Perspective-Taking and Discourse of Space:

A Review of Basic Concepts for Spatial Encoding and Decoding*

KATAOKA Kuniyoshi

Abstract

本論考の目的は，認知人類学・認知心理学における「空間認知」および「空間指示枠」研究に関する近年の発展のなかで，特に空間表現に関わる研究成果に焦点を当て，談話分析への学際的応用の道を探ることである。まずその端緒として，「認知地図」，「空間の視点取り」，「空間指示枠」という概念説明にはじまり，それらと言語人類学，認知・心理言語学，談話分析とが学際的に実を結んだ研究例を紹介する。最後に，著者自身の研究に触れ，このような新しい知見に基づくアプローチが従来の方向性と離反せずに共生するための可能性を示唆する。
キーワード：認知地図，視点取り，空間指示枠，談話分析

1. Introduction

In some schools of linguistics, psychology, and anthropology, the ubiquity and saliency of spatial concepts in human behaviors has largely been recognized as a source for various types of human cognition, and those concepts are assumed to crosscut several cognitive modalities such as language, vision, imagery, tactile perception, and motor activity. Here, narrowing the scope of investigation to language-related issues, I will briefly summarize several important issues on linguistic encoding/ decoding of spatial concepts, conducted mainly in the cognitive psychological and linguistic anthropological frameworks (e.g., Gärling & Golledge 1993; Taylor & Tversky 1996; Levinson 1996a). In some traditions within these disciplines, spatial perspectives have been viewed not as a fixed set of visual sensations, but as a notionally fluid, expandable entities evolving at the forefront of human

* Acknowledgement: This review article and some of my studies cited here are supported by Grant-in-Aid for Scientific Research (C) (2) (No. 12610566) and (C) (1) (No. 13610667). I also thank Dr. Scott Saft at University of Tsukuba for his comments and careful reading of the final manuscript.

cognitive capacity. With this thesis in mind, I will delineate widely acknowledged models of "mental/ cognitive maps," "spatial perspective," and "frames of reference" (hereafter FoRs), and explore the possibility of applying the findings from these studies to discourse-oriented analysis of spatial language in natural settings.

Another important line of research is cognitive linguistics — important in the sense that researchers have extensively investigated the semantics of adpositions (Herskovits 1986; Brugman 1988), typology of motion verbs (Talmy 1985, 1991; Slobin 1996, 1997), spatial metaphors (Lakoff 1987; Johnson 1987), and grammaticalization of spatial *grams* (Svorou 1993) as the loci for studying the interrelations between language and cognition. Currently, there is an emergent need for more discourse-oriented approaches that incorporate the findings from this camp (e.g., Rubba 1996; Haviland 1996, 2000), as well as the potential for revealing cognitive consequences of particular spatial perspectives used by indigenous people in ordinary contexts (Pederson, Danziger, Wilkins, Levinson, Kita, & Senft 1998, Levinson 1996b, 2000). Such a view, in contrast to the claim that spatial concepts originate from a distinct mental organ localized in the brain (e.g., Jackendoff 1987; Peterson, Nadel, Bloom, & Garret 1996), is largely upheld and corroborated by a phenomenological awareness that human cognition can never be clearly demarcated but is instead efficiently adapted to a novel environment owing to individuals' innate capacity for creative thought (Merleau-Ponty 1962; Varela, Thompson, & Rosch 1991). This view further stresses that such a potential may be induced by context-dependent perception, and could be maximized in cognitively challenging tasks and environments where human cognition is essentially "lived" and habitualized, i.e., in discourse (Lave 1988; Rogoff & Lave 1999).

In fact, we have recently seen more of such approaches occupying center stage in discourse analysis of indigenous space (Hanks 1990; Haviland 1993, 1996, 2000; Farnell 1995; Rubba 1996; Kataoka 1998b, 2001). Now, a growing number of researchers have come to recognize that spatial concepts and imagery are heavily utilized in speech (and in discourse, in general), serving as a guiding principle for investigating spatial orientations, arrangements, and calculations. Below, after briefly reviewing some space-related programs in cognitive psychology, I will focus on two frameworks for spatial perception and representation: i) "spatial perspective-taking" and ii) "frames of reference (hereafter FoRs)" , and critically assess the importance of these notions in studies of spatial discourse. Finally, I will point out some interdisciplinary approaches that will contribute to such studies of space.

2. Spatial Perspective-Taking

2.1. Spatial Perspectives in Monologue and Dialogue

In linguistics and cognitive psychology, there have been numerous studies conducted by using spatial description tasks of rooms, buildings, roads, natural environments, etc. One of the most conspicuous parameters in conceiving a spatial environment is assumed to be the distinction between *egocentric* (i.e., from the viewer's) and *allocentric* (i.e., outside the viewer's) perspectives, with degrees of integration between them. For example, Linde & Labov's (1975) linguistic study found, concerning the description of room arrangement in an apartment, that over 95% of the subjects took an imaginary "tour" perspective, identifying their perspectives with those of visitors or investigators of the

environment — the remaining 5% employing a more detached "map" perspective such that the room is imaginatively viewed from above. Other studies on room/route descriptions also identified similar, but to some extent task-specific, organizations of space (e.g., Levelt 1982, 1984; Klein 1982, 1983; Ehrich & Koster 1983, Shanon 1984). For example, Levelt's studies (1982, 1984, 1996) of the "linealization" process explicated that speakers who are verbally negotiating a path through a spatial network which consists of lines and nodes tended to use more of a "deictic" point of view (or Linde & Labov's "map" perspective). Besides, in that rigidly structured space, the subjects used the same perspective consistently based on non-linguistic principles, which exclusively relate to the image of spatial configuration.

In contrast to Levelt's findings, Bryant, Tversky & Franklin (1992) and Taylor & Tversky (1992a, 1992b, 1996) obtained essentially variable results in spatial description tasks. Taylor & Tversky (1992a, 1992b) detected what seemed like an architect's 3D model in the subjects' descriptions of the scenes, viewed from either a "route" or bird's-eye-view-like "survey" perspective. Bryant et al (1992: 97) also argue that "reader's mental models of described scenes can incorporate either an internal or an external point of view, depending on the narrative perspective .... (F)or the internal spatial framework, the scaffolding is formed from the observer's body axes and for the external framework from a set of axes projected from the observer."

Methodologically, these studies made use of monologues and/or descriptions of objects from the speaker's perspectives but did not consider the negotiation of meaning between the speaker and the interlocutor (s). Although speakers' monologues grounded on "imaginary addressees" were also collected in some of the studies above, this methodology may raise a serious question regarding its validity in, and applicability to, the real world. In fact, it has been found that actual conversation is quite different from monologues, requiring the discourse participants to negotiate the meaning and resort to a different type of "grounding" of perspective. This aspect of conversation/interaction is repeatedly emphasized by Clark & Schaefer (1989), Schober (1993, 1995), and G. Brown (1995).

For example, Schober (1993, 1995) particularly worked on this interactional aspect of spatial discourse and found that perspective-taking in conversation is an especially complicated affair, taking into account not only the speaker's but also the addressee's points of view in such a way as to minimize effort for both participants (or in his case, "the director" and "the matcher" in object description-matching tasks). Also, G. Brown (1995), based on the analysis of a "map task" among interlocutors, emphasized the role of listeners in constructing a collaborative interpretation. Tversky, Lee, & Mainwaring (1999) also maintained that people quite frequently change perspective depending on the degree of cognitive load required to achieve a certain communicative task. Besides, the use of multiple frames of reference is not restricted to the dyadic/interactional context. Even for spatial judgments in experimental settings, Carlson (1999) found that individuals relied on multiple frames of reference in judging the fit between physical environments and spatial expressions, and that multiple frames were automatically and initially activated. These studies suggest that mental representations of space may not constitute a uniform perspective throughout a spatial description task. That is, constant use of a single perspective throughout a stretch of event seems to be an untenable construct even in a communicatively restricted environment.

2.2. Mental Maps and Spatial Imagery

There are other long-standing traditions in spatial cognition studies within cognitive and environmental psychology: investigation of how "mental (or cognitive) maps" and spatial imagery are constructed, maintained, skewed, and represented (see Tversky 1992, Kitchin 1994, 1996 and Kosslyn 1994 for reviews). The notion of "mental/cognitive maps" was first proposed by Tolman (1948) about the innate hippocampal capacity for "cognizing" the spatial orientation, and later extended by Lynch (1960), who essentially emphasized the discreteness of spatial concepts in terms of five components of urban space: *paths, edges, districts, nodes*, and *landmarks* (see also Downs & Stea 1973 and Gärling & Golledge 1993 for historical and recent developments). Subsequently, a mental/cognitive map was typically defined as "an internalized reflection and reconstruction of space in thought (Hart and Moore 1973: 248)," and characterized by "a series of psychological transformations by which an individual acquires, stores, recalls, and decodes information about the relative locations and attributes of the phenomena in his [sic] everyday spatial environment (Downs and Stea 1973: 7)."

A current view of a psychological cognitive map is basically of two kinds; a *hierarchy* (a tree-like elaboration of spatial concept: Hirtle & Jonides 1985, McNamara 1986) or a *network* (a series of interconnected links and nodes: Thorndyke 1981). However, a cognitive map does not necessarily represent actual geographic information, but is rather distorted in some way according to various features such as "distance," "change of reference points," "number of turns and nodes," "amount of information remembered," and "amount of clutter" (Tversky 1992; McNamara 1992). Tversky (1992) characterizes the types of distortion as *rotation* and *alignment*, both of which represent mental manipulation of actual geographic relationships. For example, in her experiments most of the subjects incorrectly indicated that Stanford is slightly west of Berkeley, probably mentally *rotating* the Bay Area as running North to South, rather than at an angle. Also, North and South America are likely to be aligned upright, although in fact South America is more to the east (north-south *alignment*). Likewise, people tend to align the US with Europe on the same level, although, in fact, Europe is much further north of the US (east-west *alignment*). In any case, it seems to be the case that cognitive maps represent a cognitively distorted, non-Euclidean image of perceived distance and relations between places.

Notions of cognitive maps above also relate to mental imagery studies such that not only how spatial relations are *structured* but also the ways they are *stored* in the mind are crucial aspects of spatial representation. This aspect of spatial concepts was elaborated by Kosslyn (1990, 1994) and Pylyshyn (1981; cf. Block 1981) in a series of the "Imagery Debate." For more than the last quarter century the Imagery Debate has focused on, roughly speaking, whether imagery is *depictive* or *propositional* (Block 1981; Kosslyn 1990). Many studies have used scanned visual images, assuming that if imageries were depictively represented, the retrieval of the scanned image for objects should be delayed when they are located far from the stimulated origin owing to the longer distance to be covered for retrieval (Kosslyn 1990; see also Bower & Morrow 1990). If it is propositional and stored as an idea, we expect no reason for the retrieval to affect its processing time (Pylyshyn 1981). Based on the depictive model, it is usually maintained that there exists in people's minds the rich and detailed properties of an image that they create. However, these fields are too vast to treat adequately in this short article, so I will limit the scope of the current review only to "frames of reference (FoRs)" and "perspective-taking."

2.3. Three Types of the Frame of Reference (FoR) in the Coordinate System

Here, I will delineate the functional typology of space proposed by Levinson (1996a), which classifies the whole *static* spatial arrays in the following way (Figure1).[1] Note that this is a typological grid for "linguistic," not perceptual, encoding/decoding of space. This system is currently gaining a lot of attention from linguists and psychologists, and becoming one of the standard systems for the study of spatial reference. (See Kataoka [to appear] for a more detailed account of this model.)

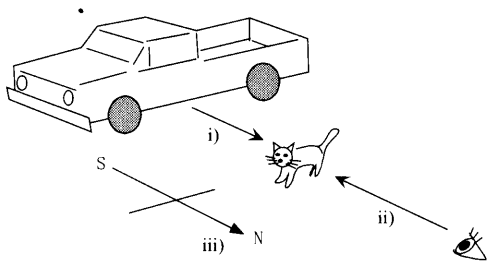

Figure 1. "The cat is _____ the truck."

i) Intrinsic
"The cat is to the left of the truck."
(The cat is at the place contiguous with the intrinsic left part of the truck: the coordinate system based on the "truck.")

ii) Relative
"The cat is in front of the truck."
(The cat is on the hither side of the truck from the standpoint of the speaker and located between the truck and the speaker : the coordinate system based on the "speaker.")

iii) Absolute
"The cat is to the north of the truck."
(The coordinate system based on cardinal directions or conventional absolute directions.)

What Levinson calls a coordinate system represents a configuration where some kind of *angular* specification is given, and is comprised of three types of frames of reference: *intrinsic, relative*, and *absolute*. Now, let us look more closely at each type of coordinate system by using the sentences in Figure 1 i) to iii). First, the sentence i) "The cat is to the left of the truck" correctly describes the scene. The coordinate system employed here is called the *intrinsic* FoR, because the cat's position is identified in terms of the truck's intrinsic orientations — i.e., front, back, left, and right, derived from its default direction of motion[2]. In this FoR, the spatial relation is "binary," or relating two objects/entities in the immediate context (*cat* and *truck*).

For the sentence i), however, another (and perhaps more likely?) interpretation is possible when the cat is in the truck's intrinsic front — i.e., to the left of the truck seen from the speaker. This ambiguity comes from another frame of reference applied to the spatial array, *relative* FoR.

A relative FoR is an equivalent concept to what is called "deictic reference." In this FoR, the cat and the truck are related by the implicit spatial configurations vis-a-vis the speaker. It is thus a "ternary" relation among cat, truck, and Speaker. Since the FoR employed here is the speaker's, the spatial relation is determined through his/her location in the scene. Thus, Figure 1 can be "relatively" described with the sentence ii), "The cat is in front of the truck."

In the Absolute system, the referring practice is more simple because this frame of reference only

1) It seems that the non-coordinate system in Levinson's spatial array is roughly equivalent to the first and second stages of Piaget's developmental sequence of children's spatial conception, and his coordinate system, to his third stage: Euclidean space (see Piaget 1956).

2) However, we need to heed the use of the term "intrinsic" here. It can refer to two types of frame of reference because we can talk about the moving agent's intrinsic frame of reference (Levelt 1996) or that of an object

requires as an anchor absolute directions such as NSEW, "where the sun rises/sets," "uphill/downhill," "upstream/downstream," or any orientations based on the fixed and stable geographic features[3]. The relation is always "binary" between these absolute orientations and the referent. Accordingly, in Figure 1, an English speaker could describe the cat's position with the sentence iii), "The cat is to the north of the truck," although such an expression is highly marked and requires a special context.

2.4. Three Types of Spatial Perspective-Taking

As briefly mentioned above, the notion of spatial perspective is itself fluid, and there is immense terminological inconsistency observed in related studies. Taylor & Tversky (1996) pointed out that there are several positions concerning what is assumed to be the "default" FoR in spatial perspective-taking. Miller & Johnson-Laird (1976) propose that it is *intrinsic*; Carlson-Radvansky & Logan (1997) found a skewed preference of the *object-centered* (or *intrinsic*) FoR, which is obviously at odds with Carlson-Radvansky & Irwin's (1993, 1994) findings right below.[4] Garnham (1989) strongly claims that it is *extrinsic*; Carlson-Radvansky & Irwin (1993, 1994) also admit that the *environmental (extrinsic)* FoR should be dominant, though admitting other possibilities in selecting the anchor frame; Levelt (1984, 1996) and Frederici & Levelt (1990) maintain that the *egocentric* perspective is the default FoR (at least in the non-gravity environment). In either case, the common understanding is now that coordinate terms represent grades of goodness/badness in judging spatial relations of entities in focus (Hayward & Tarr 1995; Logan & Sadler 1996). Given this, the selection of the default frame of reference seems to be highly a contextual and/or task-specific issue, depending on the most pressing cognitive needs to interpret the environment in the most cogent manner.[5]

This is basically what Taylor & Tversky found in a series of experiments (1992a, 1992b, 1996; see also Tversky 1996). As briefly mentioned above, they acknowledged two context-sensitive perspectives

(Levinson 1996b). Here I follow Levinson (1996a, 1996b), and call only the one representing binary relationship *intrinsic*. For example, "the ball is behind me" is *intrinsic* because it is based on the speaker's perspective, and only two objects are related by the expression: *the ball* is the referent, and *me* is the relatum. On the other hand, "the ball is behind the tree" is *relative* because the sentence requires three objects to be related: *the ball* is the referent, *the tree*, relatum, and *the speaker*, the viewer.

3) Levinson' s notion of "absolute" space is distinct from Newtonian absolute space, the concept which is more widely acknowledged. Newton's concept is abstractly based on the astronomical location of the universal center of gravity as the reference point. Apparently, the absolute directions based on this universal center constitute vertical orientations and may or may not coincide with the "absolute" directions defined by the Earth' s geomagnetic orientations (compass directions) or indigenously established absolute directions on the horizontal plane (see Jammer 1993: Ch 4).

4) Carlson-Radvansky & Logan (1997) attribute this incongruency to the display characteristics. In Carlson-Radvansky & Irwin (1993, 1994), they displayed multiple objects and a horizon line, whereas in Carlson-Radvansky & Logan (1997), they only showed the reference and located objects without a horizon line, which, they assume, could have de-emphasized the "environmental" association and caused less gravity-orientation (here identified with viewer/environment-centered frame of reference). Further, this phenomenon may also be cross-linguistically variable.

5) Although gravitational orientation is a key factor for constructing the coordinate system, it does not exclude the possibility that other frames of reference are computed as well. In fact, they were shown to compete with the environmental reference frame for lexical assignment, but failed to be prototypically selected, as attested by the response times to spatial cues (Carlson-Radvansky & Irwin 1994, Carlson 1999).

in spatial descriptions: a *route* perspective and a *survey* perspective. A *route* perspective (Figure 2) is characterized by a mental tour of the environment with the changing perspectives of the investigator/ explorer (e.g., as typically seen in Linde & Labov 1975, Klein 1982, 1983; Grenoble 1995). Klein (1982, 1983) also noticed the constantly shifting *origo* for "route communication" activities between the information giver and the receiver, who imaginatively travel through the environment together and report the procession live. The perspective-taking in a *route* tour is thus *intrinsic* to the moving entity, including the speaker-navigator.

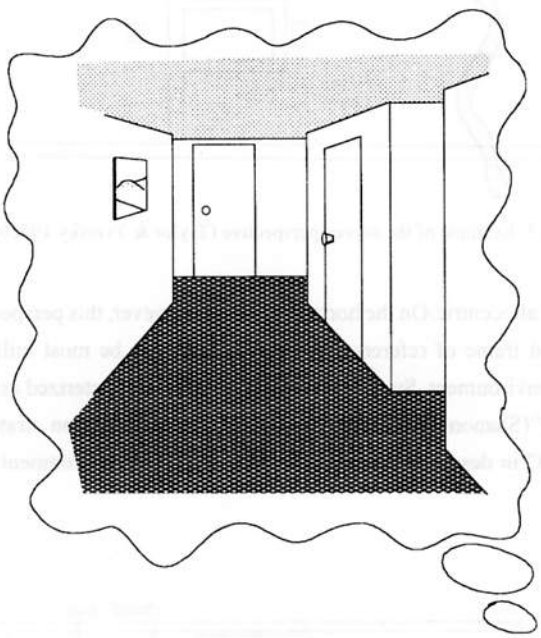

Figure 2. Example of the *route* or imaginary *tour* perspective (e.g., Linde & Labov 1975; see also Klein 1982, 1983)

A *survey* type (Figure 3) is different from a *route* tour in that it is more like a bird's eye view of the environment, relating landmarks and nodes from a higher-order point of view. The *survey* perspective has a fixed and stable view-point, often evoking a survey on a map. Thus, the *origo* is not with the traveling agent but with the narrator/viewer of the environment. Its perspective may often be dual (especially for descriptions of the vertical dimension), merging the narrator's *relative* frame of reference and the environment's *absolute* frame of reference. So far, the spatial perspectives shown in Figure 2 and 3 have typically been termed in cognitive psychology as "egocentric" and "allocentric" perspectives. This distinction between *route* and *survey* perspectives is generally corroborated by previous studies on spatial memory which revealed that memories of small-scale layouts were orientation dependent but that memories of large-scale layouts were orientation independent.

In addition to the *route* and *survey* perspectives, Taylor & Tversky (1996) further differentiate one more intermediate level, the *gaze* perspective (Figure 4). The *gaze* perspective is characteristic of the scanning of an environment from a single fixed point of view. It is similar to the *survey* perspective in

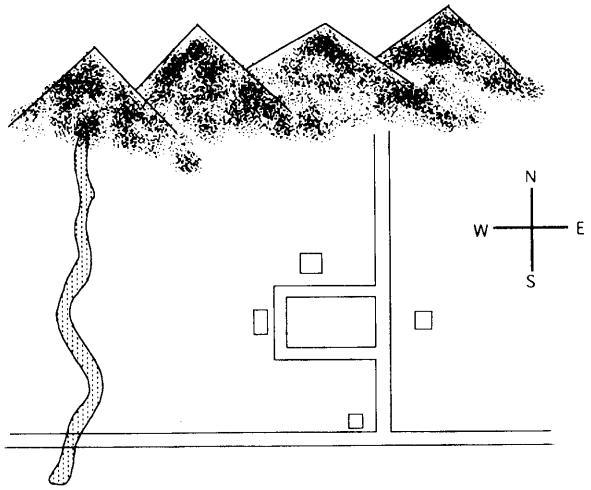

Figure 3. Example of the *survey* perspective (Taylor & Tversky 1992b, 1996)

this respect, and thus is allocentric. On the horizontal plane, however, this perspective is often associated with the viewer's fixed frame of reference and can presumably be most utilized for responses to a request to describe an environment. Such descriptions are often characterized as highly hierarchical and "higher-to-lower-order"(Shanon 1984) and show particular linearization strategies such as "parallel line" and "round about" in describing familiar objects in a given environment (e.g., Ehrich & Koster 1983).

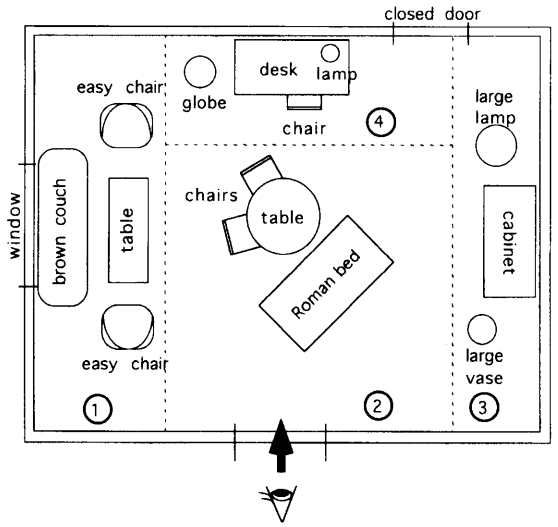

Figure 4. Example of the *gaze* perspective (Ehrich & Koster 1983)

These three spatial perspectives are now assumed by Taylor & Tversky (1996) to be compatible with the referential frameworks of space proposed by Levinson (1996a). Following Levinson, I will call these systems "frames of reference (FoRs)" or "coordinate systems," and briefly delineate how they are integrated into Tversky's model.

2.5. Integration

Utilizing Levinson' s set of FoRs, Taylor & Tversky (1996) summarized the common features between their perspective-taking model and Levinson's coordinate system as follows (if we regard the moving agent's "route/tour" perspective as equivalent to the "intrinsic" FoR of a referent). Table 1 is a summary of each type of perspective given in Taylor & Tversky (1996), and is elaborated by corresponding notions observed in related studies.

All these findings indicate that spatial representation concerns one or more aspects of *intrinsic*, *relative*, and *absolute* FoRs. Also, variable use of FoRs (or shifting perspectives) is assumed to be a pan-human phenomenon, and is (arguably) derived from the egocentric FoR on the horizontal dimension as the default condition (e.g., Shepard & Hurwitz 1984; Landau & Jackendoff 1993). In tasks for encoding spatial information, Tversky and her colleagues (Bryant, Tversky, & Franklin 1992; Taylor & Tversky 1992a, 1992b, Tversky 1996) found that environments with multiple routes and landmarks on multiple size scales tended to encourage the subjects to take a more *survey* perspective, while environments with single routes/landmarks on a single size scale tended to encourage more *route* descriptions.

In retrieving spatial memory, it is usually acknowledged that map-based knowledge (roughly equivalent to the *survey* perspective) is most efficiently accessed in a fixed orientation, whereas spatial knowledge based on navigation (equivalent to the *route* perspective) can be accessed more flexibly from different points of view (e.g., Sholl 1999). However, this map-based perspective which accommodates the knowledge of external environments is equally an egocentric perspective of the speaker's own on a larger scale. Accordingly, an *egocentric* perspective is a much more complex FoR, which may be subcategorized into eye-centered, head-centered, and body-centered FoRs (see Sholl 1999)

Furthermore, a question still remains concerning the conditions under which humans would dare to defy the default system most facilitative in actual environments. For example, Tversky et al. (1999) point out several factors influencing people to switch perspective during interaction/discourse. Even the subjects in experimental settings dared to change their FoRs during the exposition of spatial relations despite presumably a higher cognitive cost in shifting perspectives. Therefore, in both actual environments and simulated experiments, it is not necessarily the case that the cognitive load is the only determining factor. Simply put, people change perspective if it is more facilitative for communicative tasks at hand than not changing it. They finally suggest that, like Carlson (1999) and others (e.g., Graziano & Gross 1994), people will start to perceive and process space in terms of multiple perspectives simultaneously, and perhaps such factors as cognitive load, salience of referent object, ease of reference terms, and the "near" bias come into play to offer the most effective perspective for the task at hand.

Carlson-Radvansky & Irwin 1993, Carlson-Radvansky & Logan 1997, and Carlson 1999) have also been testing the availability of other FoRs in non-canonical settings (e. g., in a setting where the gravitational *above* and an object's intrinsic *above* are incompatible), and found that multiple FoRs are

Table 1. Three perspectives, FoRs, and related properties

Cognitive psychology	**EGOCENTRIC**	**ALLOCENTRIC**	
TAYLOR & TVERSKY'S PERSP.-TAKING	**ROUTE (OR TOUR/WALKING)**	**GAZE**	**SURVEY**
LEVINSON'S FoRS	**INTRINSIC (to "traveling" addressee)**	**RELATIVE (to viewer / speaker)**	**ABSOLUTE**
PERSPECTIVE	within, changing	outside (on the eye level), horizontal, fixed	outside (from above), vertical, fixed
RELATIONS	relate objects with respect to the addressee	relate objects with respect to one another	relate objects in terms of absolute directions
CAN BE SEEN IN ONE VIEW?	No: large-scale space (Mark & Frank 1989)	Yes: small-scale space (Mark & Frank 1989)	Yes: small-scale space (Mark & Frank 1989)
SINGLE ORIGO?	No	Yes	Yes
DESCRIPTIVE TYPE	exploration/navigation	gaze/attention shift	bird's eye view
TERMS OF REF.	LRFB	LRFB	NSEW (UP/DOWN)
MAJOR STUDIES	Linde & Labov's "(imaginary) tour" 1975 Levelt's "Intrinsic" 1996; or "speaker-oriented" 1982 Ullmer-Ehrich's "walking tour" 1982 Klein's "shifted origo" 1982, 1983 (Shanon 1984?) Grenoble 1995 Taylor & Tversky 1992, 1996, Tversky, Lee, & Mainwaring 1999	Linde & Labov's "map" 1975 Levelt's "Deictic" 1996 Ullmer-Ehrich's "gaze tour" 1982 Klein's "deictic" 1982, 1983 Also, Ehrich & Koster 1983 Shanon 1984 Grenoble 1995 Taylor & Tversky 1996	Haviland 1993 Brown & Levinson 1993, Pederson et al. 1998 Taylor & Tversky 1992, 1996, Tversky, Lee, & Mainwaring 1999
SP.'S PREVIOUS VISUAL INPUT	Necessary	Not necessarily	Not necessarily
REFERENT	person	object or person	object
VERB TYPES	active	stative	stative
REPRESENTATION TYPE OF KNOWLEDGE	procedural (Taylor & Tversky 1996)[6] procedural (route) knowledge.- (Golledge 1991)[7] procedural (Mark 1987)	declarative (landmark) knowledge. - (Golledge 1991) often topological? (Mark 1987)	declarative (Taylor & Tversky 1996) configurational (survey) knowledge - (Golledge 1991) often metrical? (Mark 1987)

6) Taylor & Tversky explicitly identify declarative knowledge with their survey perspective, but their definition is limited to a survey perspective confined to a single viewpoint. The fully developed notion is widely called *configurational* knowledge, often with Piagetian developmental connotation.

7) What Golledge (1991) defines as *configurational* (survey) knowledge does not have to assure visibility of reference point from the origin of reference. It is hypothesized that reference points are not necessarily incorporated in the overall schema but can be inferred from the relations to other objects.

automatic and initially active. Carlson (1999) summarizes her findings based on her previous study (Carlson-Radvansky & Irwin 1994) concering the response times for a speeded sentence/picture verification tasks, claiming that the possible FoRs for various objects whose axes are incongruent with a canonical orientation are initially activated, followed by a selection process that is facilitated by the inhibition of non-selected FoR(s) in the given context. This activation is automatic but eventually mediated by competing FoR(s), such that, for an assignment of a vertical term *above*, the use of relative FoR was obtained only when absolute/intrinsic FoRs were rendered unavailable. Given these results, she proposed the Multiple Frame Activation Hypothesis that all the FoRs are active and involved online in the computation of assigning a direction to spatial reference terms.

2.6. Assessment of Current Spatial Models

There is an increasing awareness that those studies which identify possible FoRs in human spatial perspectives are just the threshold into a more complicated phenomena in spatial cognition — a more dynamic, fluid, in-situ, and usage-based perspective-taking in actual discourse. So far, there has been no such models of FoRs as to exactly pin down the complex vicissitudes of FoR shifts. Precisely speaking, the spatial frameworks posited by Tversky and Levinson would be adequately applied to *static* entities on the *horizontal* plane, but there is no guarantee at this moment that they should also offer the default conditions for *dynamic* entities in *vertical* or other non-canonically oriented environments. Related findings seem in fact mixed and highly context dependent.[8] Context-dependency posited in such a framework is also an eyesore for the traditional experimental methods because they inherently represent a limited sets of contexts. We need to incorporate a more natural, experiment-*in*dependent methodology to deal with various types of spatial management in actual human communication.

Accordingly, future research will have to focus more on the dynamic aspects of FoRs: why do people change perspectives in discourse and what would be the motivations for such shifts? — because people seem to do them at the risk of greater cognitive load and possible communicative inconvenience incurred by such shifts. Why (or why not) do horizontal and vertical planes converge in spatial descriptions of space? To what extent do they converge and in what context do they defy such merging? Are they purely perceptual, or wholly cognitive, or somewhere in between? Are there any motivations for such shifts derived from linguistic features or rhetorical patterns of the language used in discourse? What spatial information may or may not be compensated for by other paralinguistic properties such as gestures, facial expressions, body torques, and other kinetic/somatic modalities? These questions have not been researched sufficiently, and have not been elaborated enough to seek for definite answers.

In addition, the legitimacy of the current integrated view of Levinson's FoRs and Tversky et al's spatial perspectives is still debatable (Levinson seems not to be particularly committed to this integrated view, saying, "I don't know." : p.c.). They differ such that Levinson's *absolute* FoR is essentially *allocentric* and the speaker's view is irrelevant to the encoding and decoding of spatial relations,

8) For example, Kataoka (1998) suggested that linguistic spatial relations of some objects with intrinsic orientations (such as *car* and *human*) may be differentially named on the vertical plane in comparison to other objects without intrinsic orientations (such as *ball*). Recent experimental results (Coventry, Prat-Sala, & Richards 2001) also attest to a function-dependent view of space-term assignment and a perceptual fluctuation of applicable spatial relations.

whereas what Tversky and her colleagues assume for the *survey* perspective is a spatial frame from which the speaker *egocentrically* takes a certain point of view, being aware of the larger environmental orientations. As is already clear by now, there seems to be no model which could adequately explain the context-dependent preference for *coordinate* (e.g., FoRs) and *non-coordinate* (e.g., deictic, topological, and place names) perspectives. One may claim that they are distinct processes that defy an instant integration. Interestingly, however, deictic (non-coordinate) and coordinate (e.g., intrinsic) perspectives may quite easily merge in some situations, but not in others. Separate models would work decently as long as they deal with static objects in disseminated chunks of discourse, but there should be some spatial models that will efficiently capture the motivation and rationale for such skewed preferences.

Still, we are yet to know the implicit relationships between these spatial perspectives and other modalities of mind. The most clearly articulated assumption concerns coordination of gesture with spatial description. McNeill (1992, 2000b), Kita (1993), Armstrong, Stokoe, & Wilcox (1995), and Emmorey & Reilly (1995) advocate that they are two sides of the same coin, suggesting, however, which side will be shown more frequently is another question. That is, we still don't exactly know to what extent different modalities originate from the same source, compensating and corroborating each other in on-line articulation. For instance, Kita (1983) and McNeill (2000a) showed that, based on the typological classification of lexicalization types by Talmy (1985, 1991), English and Japanese speakers encoded spatial information and gestures to different degrees in retellings of cartoon episodes. Gestures may or may not compensate for the omission of certain verbally represented spatial elements in discourse. Gesture is one of such most palpable instances/devices inquiring into the interplay between language and cognitive processes. Also, there is the possibility that other types of somatic modalities related to language may play a fundamental role in encoding spatial information missing from the immediate articulation of spatial knowledge, not to mention culturally moderated dispositions (e.g., Levinson 1996b, Pederson et al. 1998).

These findings as well as questions imply that the spatial models constructed by the data from context-free environments like laboratory experiments need to be counter-balanced to capture the whole array of spatial management by incorporating the findings from contextually challenged and culturally habitualized modes of spatial reference.

3. Toward Studies on Spatial Discourse in Natural Settings

3.1. Diversity of Current Studies on Spatial Discourse

Here I will propose one such approach that will serve to address the questions and problems raised above: a discourse-oriented approach to spatial cognition. Although it is not free from its own problems and inadequacies in precisely pinning down what aspects of spatial cognition are investigated, an interdisciplinary project based on this approach will efficiently address the questions about dynamic and plastic perspectives and preferred FoRs by looking at cognitively challenged treatment of space in discourse.

Above the level of a single sentence uttered from a single point of view, manners of perspective taking and preference of FoRs are diverse in type and rationale. These types of less content-based, (and often)

non-propositional means of organizing discourse are claimed to be suffused with various cognitive underpinnings, and have come to be seen as important regulators of discourse. Representative studies include, for example, the *socio-centric* frames of reference in Yucatec Maya (Hanks 1990), the *action-centered* representation of space in Plains Sign Talk (Farnell 1995), a spatial narrative in Yagua (Payne 1984), interactional protocols for identifying route and location (Schegloff 1972; Psathas 1991), spatial projection in conversation (Ochs, Gonzales, & Jacoby 1996; Goodwin 2000), spatial descriptions in everyday life (Mondada 1996, Kataoka 1998b), Guugu Yimithirr gestures based on absolute FoR (Haviland 1993, 2000), mental-spaces studies on discourse construction of indigenous space (Fauconnier 1994; Rubba 1996; Johnson, Roepcke, & Kataoka 1996; Haviland 1996, 2000), and spatial mapping in American Sign Language (Emmorey & Reilly 1995; Liddell 2000), to name only a few.

For example, Hanks (1990), in his huge tome on referential practice in a contemporary Maya community, demonstrated that what seems to be simple spatial reference could be based on a deictic *figure-ground* distinction and a socially defined indexical ground which interactionally emerge from complex logics and practice of indigenous spatial knowledge. Haviland's (1993) seminal work on "absolute" gestures made by a Guugu Yimithirr speaker has shown that spontaneous gestures reveal unconscious cognitive processes habitualized by the natives' skewed use of "absolute" FoR. When such an absolute speaker made gestures in narratives, the spatial orientations of described objects were precisely anchored to the absolute directions in the particular environment. Thus, on two separate tellings of the same event in which a boat was flipped over by a strong wind, the teller kept the orientation of the boat constant — even though he faced different directions in the two retellings — and used gesture to describe how the boat rolled over from *east* to *west*. In another analysis, Haviland (1996, 2000), made explicit how "gesture spaces" may be merged through mental maps of speakers through "indexical" functions of gestures.

These findings suggest that different modalities such as language and gesture may share the same cognitive basis, and can ride into each other in complex ways. (I am currently working on Nepali conversation in order to identify the direction and location of certain places from the same kind of linguistic anthropological framework as Haviland's.)

3.2. Some Approaches to Discourse Analysis of Space

Finally, I will briefly summarize the approaches I have employed for the general purposes of the current paper. The following three lines of work have been exclusively used in a series of my discourse studies of rock climbers' description of space (Kataoka 1998a, 1998b, 2001, under review). One traditional approach available for such discourse analysis of space would be to examine the convergence and/or divergence between structural units in discourse and space. Structural units in narrative have long been a major issue in the study of narratives. Some classic notions most particularly relevant to our spatial analysis are Longacre's (1996) "change of vantage point and/or orientation." This feature also resonates with Grimes' (1975: 218) notion of *trajectory*, which he defines as "some parts of narratives (which) take place against a changing background," and "can be fitted into the propositional model as a particular kind of setting that has as its arguments a list of different places." Based on Grimes' notion of discourse space, Payne (1984) developed a model of *locational structure* by analyzing a Yagua narrative, and emphasized that the narrative world can be demarcated by locational scenes and/or scene

changes, which respectively constitute a spatially defined area of attention. Thus each scene may be defined in terms of a different spatial orientation and sequence.

Also, one of the widely acknowledged models in linguistics is formulated in Labov (1972). In Labov's model, a prototypical narrative starts with (or without) *Abstract* and/or *Orientation*, followed by a sequence of *Complication Actions, Resolution*, and (optionally) *Coda*, with *Evaluation* surfacing in any unit at any moment. Also relevant to this narrative analysis is Hymes' Verse Analysis (1981, 1996), in which he demarcates the main text according to structural units such as *Lines, Verses, Stanzas*, and *Scenes*.

Based on these models, Kataoka (2001) addressed how the differences in experiential status — *direct* or *indirect* — are related to the types of spatial perspective and verbs employed for spatial descriptions of "an immense fall" accident in rock climbing. Kataoka argued that experiential status, types of perspective-taking, and structural components of narrative are intertwined, activating and being activated by clearly visualized, and structurally distinct spatial imageries. The consequences are zooming-in/out modes of view, as typically seen in cinematic discourse. Also, the "immense fall" narrative was, despite a narrative status which usually favors an *intrinsic* (or *egocentric*) perspective, shown to be characterized by features of an *extrinsic* (or *allocentric*) perspective. He suggested that the *extrinsic* perspective is an output of the narrator's *indirect* experiential status, and input to weak agency and volitionality encoded in the narrative verbs. Kataoka also showed that such a narrative exhibits several ethnopoetic patterns described by Labov (1972) and Hymes (1981, 1996), and heavily relies on some framing devices characteristic of spatial imageries, perhaps through largely pan-human cognitive mechanisms such as "schematicity" and "granularity of view" (Langacker 1991, 1999).

Secondly, on a linguistic level, our cognitive activities are largely constructed by perceptions and interpretations of motion events. Particularly, spatial motions have now been recognized as conceptually pervasive and as the source domain for numerous types of schematic projection such as case frame structures, metaphorical expressions, and linguistic constructions (e.g., Fillmore 1982a; Lakoff 1987; Johnson 1987; Langacker 1987, 1991; Goldberg 1995). Spatial motions are basically physical events — though not necessarily given "fictive" motion expressions (Talmy 1996; Matsumoto 1996) — and thus have the origin and the goal of energy transmission, ordinarily perceived as the starting point and the ending point of motion.

For example, Langacker (1987: 166) conceptualized spatial motions as "change through time in the location of some entity," by using a formula $[m/l_0]t_0 > [m/l_1]t_1 > [m/l_2]t_2 > \ldots$, where *m* represents the movement along path $[l_0 > l_1 > l_2 \ldots]$, during the span of conceived time $[t_0 > t_1 > t_2 \ldots]$. Such motions consequently constitute certain trajectories and exhibit image-schematic orientations. Local semantic roles encoded by such movements can thus be represented by SOURCE, PATH, and GOAL (Fillmore 1982b), often with a less accurate candidate, DIRECTION (e.g., Lakoff 1987: 275). These conceptual sequences are well compatible with the systematic use of (deictic) motion verbs, as shown by Kataoka (under review) below.

Kataoka (under review) specifically looks at the use of Japanese deictic motion verbs, *iku* 'go' and *kuru* 'come' (see Fillmore 1971, 1982a, 1982b; Ohye 1975; Hasegawa 1993) from a discourse analytic perspective. Kataoka argues that these verbs encode different experiential statuses captured in the speaker's mental imageries, and that the use of those verbs is closely related to the characteristics of a

physical environment and modes of perspective taking. The consequences of these factors are reflected in his data such that these motion verbs may serve as an indexical cohesion device as well as topic boundary markers by binding the speaker's perspectives to salient anchor points in the narrated scene. Kataoka also claims that, although spatial perspectives are assumed to be freely shifted in individual mental imageries, such shifts are found to be experientially constrained in terms of the recoverable points of view. More importantly, the maintenance and shifts of experientially perspectives can be collaboratively constructed by several discourse participants.

A third line of research is psycholinguistically motivated discourse analysis. Based on typologically different language types termed by Talmy (1985, 1991) as "V(erb)-framed" and "S(atellite)-framed" languages, Slobin (1996, 1997) found different preferences for descriptive styles of space in discourse, revealing that those types have significant effects on the number of related Sat (ellites) / Adv (erbials), and on language-specific descriptive preferences. For example, Slobin (1997) claims that Speakers of V-languages (e.g., Japanese) are more likely to devote attention to describing aspects of the *static* scene which provides the physical context for a motion event (ibid.: 450)." He also suggests that the texts in V-languages generally have fewer ground elements and path segments per verb than in S-languages (e. g., English). Instead, texts in languages like Japanese tend to exhibit manner verbs alone, without expressing the ground elements of spatial motion. Most likely, these features will be highly relevant to the realizations of spatial expressions in actual discourse, and easily applicable to the linguistic and narrative approaches mentioned above.

The same kind of skewedness Slobin found between English and Spanish was also found between English and Japanese (Kataoka 1998a). For example, English speakers, manner-oriented in verbal encoding, inevitably attended to path as the major property to be elaborated in Sat/Adv, while Japanese speakers talked more about manner of motion in compensation for inherently less available manner verbs, by focusing on limb movements of an agent (here, a rock climber). Furthermore, Carroll (1997) claimed that, even between genealogically close European languages like English and German, language-specific preferences exist such that English speakers tend to take an "objective (or object-centered)" view for entities under description, while German speakers are likely to adopt a "deictic (or viewer-centered)" perspective.

These approaches are just the tip of the iceberg in terms of the ideas that will contribute to the general purpose of the interdisciplinary study of everyday space. I assume that, by focusing on the actual vicissitudes of verbal spatial management, human spatial cognition will most palpably exhort its capacity for adapting to language-specific contexts and the real world.

4. Concluding Remarks

In some of the disciplines discussed here, human perception and physio-motor capacity are being gradually recognized as reciprocally enhanced mechanisms, and may never be clearly separated from the real environment (cf. Merleau-Ponty 1962; Varela, Thompson, & Rosch 1991). "Lived" cognition in the everyday space may be more flexibly adapted to on-going processes than is currently conceived of. Discourse analysis of space will contribute to current questions in linguistic anthropology and cognitive/functional linguistics because such questions will be most efficiently addressed by i)

attending to spatial language for the everyday use of space, ii) considering ease and resistance in contextual shifts of FoRs, and iii) shedding new light on the spatial dimensions of human experience, something which is not captured in experimental settings.

The body in space is an essential building block of perception such that each spatial perspective needs to be re-considered in its own light as an experientially mediated "process," not as a pre-given, permanent "state." It is in this spatially contested area of cognition that our modes of perspective-taking crucially exhibit maximal stability and variability. If we share such a perspective of space as "process," a discourse-based analysis of space will come to present immeasurable potential for revealing the importance of space as a guiding principle for human activities.

References

Armstrong, D. F., Stokoe, W. C., & Wilcox, S. E. (1995). *Gesture and the Nature of Language*. Cambridge: Cambridge University Press.

Block, N. (1981). *Imagery*. Cambridge: MA: MIT Press.

Bower, G.H., & Morrow, D.G. (1990). Mental models in narrative comprehension. *Science*, 247(Jan), 44–48.

Brown, G. (1995). *Speakers, Listeners and Communication: Explorations in Discourse Analysis*. Cambridge: Cambridge University Press.

Brown, P., & Levinson, S.C. (1993). "Uphill" and "downhill" in Tzeltal. *Journal of Linguistic Anthropology*, 3 (1), 46–74.

Brugman, C.M. (1988). *The Story of* Over: *Polysemy, Semantics, and the Structure of the Lexicon*. New York: Garland.

Bryant, D. J., Tversky, B. & Franklin, N. (1992). Internal and external spatial frameworks for representing described scenes. *Journal of Memory and Language* 31:74–98.

Carlson, L. A. (1999). Selecting a reference frame. *Spatial Cognition and Computation* 1: 365–379.

Carlson-Radvansky, L. A., & Irwin, D. E. (1993). Frames of reference in vision and language: Where is above? *Cognition* 46:223–244.

—— (1994). Reference frame activation during spatial term assignment. *Journal of Memory and Language* 33: 646–671.

Brown, P., & Levinson, S.C. (1993). "Uphill" and "downhill" in Tzeltal. *Journal of Linguistic Anthropology* 3(1), 46–74.

Carroll,M.(1997). Changing place in English and German:Language-specific preferences in the conceptualization of spatial relations. In J. Nuyts & E. Pederson (eds.), *Language and Conceptualization* (pp. 137–161). Cambridge: Cambridge University Press.

Coventry, K.R., Prat-Sala, M., & Richards, L. (2001). The interplay between geometry and function in the comprehension of *over, under, above*, and *below*. *Journal of Memory and Language* 44: 376–398.

Clark, H.H., & Schaefer, E.F. (1989). Contributing to discourse. *Cognitive Science* 13: 259–294.

Downs, R.M., & Stea, D. (1973). *Image and Environment: Cognitive Mapping and Spatial Behavior*. Chicago: Aldine.

Ehrich, V., & Koster, C. (1983). Discourse organization and sentence form: The structure of room descriptions in Dutch. *Discourse Processes* 6: 169–195.

Emmorey. K. & Reilly, J. (1995). Language, Gesture, and Space. Hillsdale, NJ: Erlbaum.

Farnell, B. (1995). *Do You See What I Mean: Plains Indian Sign Talk and the Embodiment of Action*. Austin, TX: University of Texas Press.

Fauconnier, G. (1994). *Mental Spaces* (2nd ed.). Cambridge, UK: Cambridge University Press.

Fillmore, C.J. (1971). *Santa Cruz Lectures on Deixis*. Berkeley, CA: University of California. (Also published as *Lectures on Deixis* (1997) from CSLI Publications, Stanford, CA.)

—— (1982a). Descriptive framework for spatial deixis. In R.J. Jarvella & W. Klein (eds.), *Speech, Place, and Action* (pp. 31–59). Chichester: John Wiley.

—— (1982b). Frame semantics. In Linguistic Society of Korea (Ed.), *Linguistics in the Morning Calm* (pp. 111–138). Seoul: Hanshin.

Friederici, A.D., & Levelt, W.J.M. (1990). Spatial reference in weightlessness: Perceptual factors and mental representations. *Perception & Psychophysics*, 47(3), 253–266.

Gärling, T., & Golledge, R.G. (1993). Behavior and Environment: Psychological and Geographical Approaches. In G.E. Stelmach & P.A. Vroon (eds.), *Advances in Psychology* (pp. 483–). Amsterdam: North-Holland.

Garnham, A. (1989). A unified theory of the meaning of some spatial relational terms. *Cognition*, 31(1), 45–60.

Golledge, R.G. (1991). Cognition of physical and built environment. In T. Gärling & G.W. Evans (eds.), *Environment, Cognition, and Action: An Integrated Approach* (pp. 35–62). NY: Oxford University Press.

Goodwin, C. (1995). Seeing in depth. *Social Studies of Science* 25: 237–274.

—— (2000). Gesture, aphasia, and interaction. In D. McNeill (ed.), *Language and Gesture* (pp. 84–98). Cambridge, Cambridge University Press.

Goldberg, A.E. (1995). *Constructions*. Chicago: University of Chicago Press.

Grenoble, L.A. (1995). Spatial configurations, deixis and apartment descriptions in Russian. *Pragmatics*, 5(3), 365–385.

Graziano, M.S.A. & Gross, C.G. (1994). Mapping space with neurons. *Current Directions in Psychological Science* 3: 164–167.

Grimes, J. E. (1975). *The Thread of Discourse*. The Hague: Mouton.

Hanks, W. F. (1990). *Referential Practice: Language and Lived Space among the Maya*. Chicago, IL: University of Chicago Press.

Hart, R.A. & Moore, G.T. (1973). The development of spatial cognition: A review. In R.M. Downs & D. Stea (eds.), *Image and Environment: Cognitive Mapping and Spatial Behaviour* (pp. 246–288). Chicago: Adeline.

Hasegawa, Y. (1993). Prototype semantics: A case study of TE K-/IK- constructions in Japanese. *Language & Communication*, 13(1), 45–65.

Haviland, J.B. (1993). Anchoring, iconicity and orientation in Guugu Yimidhirr pointing gestures. *Journal of Linguistic Anthropology*, 3(1), 3–45.

—— (1996). Projections, transpositions, and relativity. In J.J. Gumperz & S.C. Levinson (eds.), *Rethinking Linguistic Relativity* (pp. 271–323). Cambridge, UK: Cambridge University Press.

—— (2000). Pointing, gesture spaces, and mental maps. In D. McNeill (ed.), *Language and Gesture*, (pp. 13–46). Cambridge: Cambridge University Press.

Hayward, W.G., & Tarr, M.J. (1995). Spatial language and spatial representation. *Cognition* 55: 39–84.

Herskovits, A. (1986). *Languages and Spatial Cognition*. Cambridge: Cambridge University Press.

Hirtle, S.C., & Jonides, J. (1985). Evidence of hierarchies in cognitive maps. *Memory and Cognition*, 13 : 208–217.

Hymes, D. (1981). *In Vain I tried to Tell You : Essays in Native American Ethnopoetics*. Philadelphia : PA : University of Pennsylvania Press.

—— (1996). *Ethnography, Linguistics, Narrative Inequality*. Bristol, PA: Taylor & Francis Inc.

Jackendoff, R. (1987). On beyond zebra: The relation of linguistic and visual information. *Cognition* 26: 89–114.

Jammer, M. (1993). *Concepts of Space: The History of Theories of Space in Physics* (3rd ed.). New York: Dover.

Johnson, M. (1987). *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason*. Chicago: The University of Chicago Press.

Johnson, D.M., Roepcke, Y., & Kataoka, K. (1997). Constructing social groups in discourse. *Pragmatics and Language Learning* 8: 37–53.

Kataoka, K. (1998a). *The Vertical Experience in English and Japanese Spatial Discourse*. Unpublished Ph.D. Dissertation, The University of Arizona.

—— (1998b). Gravity or levity: Vertical space in Japanese rock climbing instructions. *Journal of Linguistic Anthropology* 8 (2): 222–248.

—— (2001). Narrative construction of imaginary vertical space: "An immense fall" story in rock climbing. In *Proceedings of the First Seoul International Conference on Discourse and Cognitive Linguistics* (pp. 101–114). Seoul: Yonsei University.

—— (to appear). Linguistic Anthropological Research on Spatial Cognition in European and Non-European Settings. *Gengo To Bunka* 'Language and Culture.' Aichi University.

—— (under review). Co-Construction of a Mental Map: Rock Climbers' Use of Deictic Motion Verbs in Spatial Discourse.

Kita, S. (1993). *Language and Thought Interface: A Study of Spontaneous Gestures and Japanese Mimetics.* Unpublished Ph.D. Dissertation, University of Chicago.

Kitchin, R.M. (1994). Cognitive maps: What are they and why study them? *Journal of Environmental Psychology* 14(1): 1–19.

—— (1996). Increasing the integrity of cognitive mapping research : Appraising conceptual schemata of environment-behaviour interaction. *Progress in Human Geography, 20* (1), 56–84.

Klein, W. (1982). Local deixis in route directions. In R.J. Jarvella & W. Klein (eds.), *Speech, Place, and Action* (pp. 161–182). Chichester: John Wiley.

—— (1983). Deixis and spatial orientation in route directions. In H.L. Pick Jr. (ed.), *Spatial Orientation: Theory, Research, and Application* (pp. 283–311). New York: Plenum Press.

Kosslyn, S.M. (1990). Mental imagery. In D.N. Osherson, S.M. Kosslyn, & J.M. Hollerbach (eds.), *An Invitation to Cognitive Science Vol. 2: Visual Cognition and Action* (pp. 73–97). Cambridge, MA: MIT Press.

—— (1994). *Image and Brain: The Resolution of the Imagery Debate.* Cambridge, MA: MIT Press.

Lakoff, G. (1987). Women, Fire, and Dangerous Things. Chicago, IL: University of Chicago Press.

Landau, B., & Jackendoff, R. (1993). "What" and "where" in spatial language and spatial cognition. *Behavioral and Brain Sciences* 16: 217–265.

Langacker, R.W. (1987). *Foundations of Cognitive Grammar, Vol.1.* Stanford, CA: Stanford University Press.

—— (1991). *Concept, Image, and Symbol: The Cognitive Basis of Grammar.* Berlin: Mouton.

—— (1999). *Grammar and Conceptualization.* Berlin: Mouton.

Lave, J. (1988). *Cognition in Practice.* Cambridge: Cambridge University Press.

Levelt, W.J.M. (1982). Cognitive styles in the use of spatial direction terms. In R.J. Jarvella & W. Klein (eds.), *Speech, Place, and Action* (pp. 251–268). Chichester: Wiley.

—— (1984). Some perceptual limitations on talking about space. In. A.J. van Doorn, W.A. van der Grind, & J.J. Koenderink (eds.), *Limits in Perception* (pp. 323–358). Utrecht: VNU Science Press.

—— (1996). Perspective taking and ellipsis in spatial descriptions. In P. Bloom, M.A. Peterson, L. Nadel, & M. F. Garrett (eds.), *Language and Space* (pp. 77–107). Cambridge, MA: MIT Press.

Levinson, S.C. (1996a). Language and space. In W.H. Durham, E.V. Daniel, & B.B. Schieffelin (eds.), *Annual Review of Anthropology, Vol. 25* (pp. 353–382). Palo Alto, CA: Annual Reviews.

—— (1996b). Frames of reference and Molyneux's question : Crosslinguistic evidence. In P. Bloom, M.A. Peterson, L. Nadel, & M.F. Garrett (eds.), *Language and Space* (pp. 109–169). Cambridge, MA: MIT Press.

—— (2000). Covariation between spatial language and cognition, and its implications for language learning. In M. Bowerman, & S. C. Levinson, (eds.), *Language Development and Conceptual Development* (pp. 566–588). Cambridge: Cambridge University Press.

Linde, C., & Labov, W. (1975). Spatial networks as a site for the study of language and thought. *Language, 51*, 924–939.

Liddell, S.K. (2000). Blended spaces and deixis in sign language discourse. In D. McNeill (ed.), *Language and Gesture*, (pp. 331–357). Cambridge: Cambridge University Press.

Logan, G.D., & Sadler, D.D. (1996). A computational analysis of the apprehension of spatial relations. In P. Bloom, M.A. Peterson, L. Nadel, & M.F. Garrett (eds.), *Language and Space* (pp. 493–529). Cambridge, MA: MIT Press.

Longacre, R.E. (1996). *The Grammar of Discourse* (2 ed.). New York: Plenum Press.

Lynch, K. (1960). *The Image of the City*. Cambridge, MA: MIT Press.

Mark, D.M. (1987). On giving and receiving directions : Cartographic and cognitive issues. *Auto Carto* 8 : 562–571.

Mark, D.M., & Frank, A.U. (1989). Concepts of space and spatial language. *Auto Carto, 9*, 538–556.

McNamara, T.P. (1986). Mental representations of spatial relations. *Cognitive Psychology* 18: 87–121.

—— (1992). Spatial representation. *Geoforum* 23(2): 139–150.

McNeill, D. (1992). *Hand and Mind: What Gestures Reveal about Thought.* Chicago: University of Chicago Press.

—— (ed.) (2000). *Language and Gesture*. Cambridge: Cambridge University Press.

Merleau-Ponty, M. (1962). *Phenomenology of Perception* (C. Smith, Trans.). London: Routledge.

Miller, G. A., & Johnson-Laird, P. N. (1976). *Language and Perception*. Cambridge, MA: Harvard University Press.

Mondada, L. (1996). How space structures discourse. In M. Putz, & R. Dirven (eds.), *The Construal of Space in Language and Thought* (pp. 571–597). Berlin: Mouton.

Ochs, E., Gonzales, P., & Jacoby, S. (1996). "When I come down I'm in a domain state": Grammar and graphic representation in the interpretive activity of physicists. In E. Ochs, E.A. Schegloff, & S.A. Thompson (eds.), *Interaction and Grammar* (pp. 328–369). Cambridge, UK: Cambridge University Press.

Ohye, S. (1975). *Nichi-Eigo no Hikaku Kenkyuu: Shukansei o Megutte*. Tokyo: Nan'undoo.

Payne, T.E. (1984). Locational relations in Yagua narrative. In D.C. Derbyshire (ed.), *Work Papers of the Summer Institute of Linguistics: University of North Dakota Session, Vol. 28* (pp. 157–192), Huntington Beach, CA: SIL Inc.

Pederson, E., Danziger, E., Wilkins, D., Levinson S., Kita, S., & Senft, G. (1998) Semantic typology and spatial conceptualization. *Language* 74(3): 557–589.

Peterson, M.A., Nadel, L., Bloom, P., & Garret, M.F. (1996). Space and language. In P. Bloom, M.A. Peterson, L. Nadel, & M.F. Garrett (eds.), *Language and Space* (pp. 553–577). Cambridge, MA: MIT Press.

Piaget, J. & Inhelder, B. (1956). *The Child's Concept of Space*. NY: Norton.

Psathas, G. (1991). The structure of direction-giving in interaction. In D. Boden & D.H. Zimmerman (eds.), *Talk and Social Structure: Studies in Ethnomethodology and Conversation Analysis* (pp. 195–216). Cambridge, UK: Polity Press.

Pylyshyn, Z. (1981). The imagery debate: Analog media versus tacit knowledge. In N. Block (ed.), *Imagery* (pp. 151–206). Cambridge: MA: MIT Press.

Rogoff, B. & Lave, J. (1999 [1984]). *Everyday Cognition: Development in Social Context*. Cambridge, MA: Harvard University Press.

Rubba, J. (1996). Alternate grounds in the interpretation of deictic expressions. In G. Fauconnier & E. Sweetser (eds.), *Spaces, Worlds, and Grammar* (pp. 227–261). Chicago: IL: The University of Chicago Press.

Schegloff, E.A. (1972). Notes on a conversational practice: Formulating place. In D. Sudnow (ed.), *Studies in Social Interaction* (pp. 75–119). New York: The Free Press.

Schober, M.F. (1993). Spatial perspective-taking in conversation. *Cognition* 47: 1–24.

—— (1995). Speakers, addressees, and frames of reference: Whose effort is minimized in conversations about locations? *Discourse Processes* 20: 219–247.

Shanon, B. (1984). Room descriptions. *Discourse Processes* 7: 225–255.

Sholl, M.J. (1999). Egocentric frames of reference used for the retrieval of survey knowledge learned by map and navigation. *Spatial Cognition and Computation* 1(4): 475–494.

Slobin, D.I. (1996). Two ways to travel : Verbs of motion in English and Spanish. In M. Shibatani & S.A. Thompson (eds.), *Grammatical constructions : Their Form and Meaning* (pp. 195–219). Oxford, UK : Clarendon Press.

—— (1997b). Mind, code, and text. In J. Bybee, J. Haiman, & S.A. Thompson (eds.), *Essays on Language Function and Language Type* (pp. 437–467). Amsterdam: John Benjamins.

Svorou, S. (1994). *Grammar of Space*. Amsterdam: John Benjamins.

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (ed.), *Language Typology and Syntactic Description, Vol. 3* (pp. 57–149). Cambridge: Cambridge University Press.

—— (1991). Path to realization: A typology of event conflation. *BLS, 17*, 480–519.

—— (1996). Fictive motion in language and "ception". In P. Bloom, M.A. Peterson, L. Nadel, & M.F. Garrett (eds.), *Language and Space* (pp. 211–276). Cambridge, MA: MIT Press.

Taylor, H. A., & Tversky, B. (1992a). Descriptions and depictions of environments. *Memory and Cognition* 20: 483–496.

—— (1992b). Spatial mental models derived from survey and route descriptions. *Journal of Memory and Language* 31:261–292.

—— (1996). Perspective in spatial descriptions. *Journal of Memory and Language* 35:371–391.

Thorndyke, P.W. (1981). Distance estimation from cognitive maps. *Cognitive Psychology* 13: 526–550.

Tolman, E.C. (1948). Cognitive maps in rats and men. *Psychological Review* 55(4): 189–208.

Tversky, B. (1992). Distortions in cognitive maps. *Geoforum* 23(2): 131–138.

—— (1996). Spatial perspective in descriptions. In P. Bloom, M.A. Peterson, L. Nadel, & M.F. Garrett (eds.), *Language and Space* (pp. 463–491). Cambridge, MA: MIT Press.

Tversky, B., Lee, P. & Mainwaring, S. (1999). Why do speakers mix perspectives? *Spatial Cognition and Computation* 1: 399–412.

Ullmer-Ehrich, V. (1982). The structure of living space descriptions. In R.J. Jarvella & W. Klein (eds.), *Speech, Place, and Action* (pp. 219–249). Chichester: John Wiley.

Vandeloise, C. (1991). *Spatial Prepositions: A Case Study from French*. Chicago: The University of Chicago Press.

Varela, F. J., Thompson, E., & Rosch, E. (1991). *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge, MA: MIT Press.