Spatial frames of reference in Yucatec: Referential promiscuity and task-specificity

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Abstract
A referential communication task conducted with five pairs of native speakers of Yucatec Maya produced evidence of "referential promiscuity", defined by the unrestricted availability of spatial frames of reference (FoRs) and the lack of a default perspective. Speakers switched freely between FoRs and often combined multiple types in single descriptions. In contrast, a recall memory experiment conducted with 18 speakers revealed a strong bias towards responses consistent with the use of geocentric, as opposed to egocentric, FoRs. It is argued that referential promiscuity makes FoR selection more task-specific, preventing the linguistic conditioning of spatial reference in internal cognition that has been predicted for populations with more constrained linguistic usage.

Keywords: Spatial reference frames; Yucatec Maya; linguistic relativity

1. Introduction: Referential promiscuity[2]

The aim of this article is to explore a style of use of spatial frames of reference (FoRs) that has so far attracted little attention in the literature: what I call *referential promiscuity*, a style characterized by the unrestricted availability of all major types of FoRs and the absence of a default perspective. The article documents referential promiscuity in Yucatec Mayan discourse and also examines how Yucatec speakers memorize spatial configurations, with an eye towards the question whether referential promiscuity extends into internal cognition (or, put differently,

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[2] Key to abbreviations in interlinear glosses: 1/2/3 – 1st/2nd/3rd person; A – cross-reference set A (actor, possessor); B – cross-reference set B (undergoer, theme of stative predicatioins); CAUS – causative derivation; CL – (numeral/possessive) classifier; D1 – proximal deictic particle; D2 – distal/anaphoric particle; D3 – text-deictic particle; D4 – place-anaphoric particle; DADV – demonstrative adverb base; DET – adnominal demonstrative/determiner base; DIM – diminutive; DIS – dispositional stative derivation; EXFOC – extra-focal status inflection; EXIST – locative/existential predicator; F – feminine/endearing prefix; HESIT – hesitation; IMPF – imperfective aspect; IN – inanimate (classifier); INC – incompletive status inflection; INCH – inchoative derivation; MIDDLE – middle voice; PERF – perfect aspect derived stative form; PL – plural; PREP – generic preposition; RED – reduplication; REL – relational/nominalizing derivation; RES – resultative derivation; SG – singular; TOP – topic (= D3).

how referential promiscuity in linguistic practice is supported and sustained in internal cognition).

Spatial frames of reference are cognitive coordinate systems that partition space into distinct regions. These regions may serve as search domains for the interpretation of spatial relators in language and cognition. People compute FoRs in order to define and interpret linguistic and cognitive representations of the location and orientation of entities and of their direction of motion. Various different types of FoRs have been distinguished by psychologists, linguists, and anthropologists. In crosslinguistic and crosscultural research on FoRs, the ternary classification of FoRs proposed by Levinson (1996, 2003) has proven useful in that it groups frames together which are generally used by members of the same populations and distinguishes frames whose use in particular populations is not mutually entailed. The three Levinsonian types are the *relative*, *absolute*, and *intrinsic* types. How these terms are used in the present study is outlined in section 3. For now, the following approximations will have to do:

- Relative FoRs are projected from the body of the observer and depend on the orientation of the observer. Example: 'The ball is in front of the chair', in the sense that it is in a region projected from that part of the chair that reflects the observer's front.
- Absolute FoRs are abstracted from some environmental gradient or feature and provide bearings treated as fixed throughout the totality of space. Example: 'The ball is north of the chair'.
- Intrinsic FoRs include object-centered frames. These are projected from the reference entity – the *ground* – of spatial descriptions and depend on the orientation of the latter. Example: 'The ball is in front of the chair', in the sense that it is in the region projected from the inherent front part of the chair. A number of further types, including landmark-based ('The ball is seaward of the chair') and geomorphic frames ('The ball is downriver from the chair'), are analogized to object-centered frames and therefore subsumed under the intrinsic type as well.

I define 'referential promiscuity' in terms of two properties of FoR use which are individually necessary and whose conjunction is a sufficient condition of referential promiscuity:

- The unrestricted availability, in at least a subset of the speakers, of all major types of FoRs in manipulable space (see below)
- The absence of a default perspective for reference to manipulable space.

The research presented in Pederson *et al.* (1998), Levinson (2003), Majid *et al.* (2004), Levinson & Wilkins (2006), *inter alia*, has demonstrated a great deal of crosslinguistic variation in which types of FoRs are used in reference to spatial configurations in a horizontal plane at a *manipulable* scale, i.e., as scale at which they can easily be manipulated by people. Unrestricted availability has been documented in this literature for the Bantu language Kgalagadi of Botswana, the Kwa language Ewe of Ghana and Togo (cf. Ameka & Essegbey 2006), and Yucatec, the Mayan language of the Mexican Yucatan – the language the present study focuses on (cf. Bohnemeyer & Stolz 2006). As opposed to all other languages studied so far, these three languages have been reported to employ all three Levinsonian types in manipulable space. There are three distinct conceivable distributional scenarios for this unrestricted availability: (i)

populations in which all speakers use all three types of FoRs; (ii) populations in which some, but not all speakers, use all three types; (iii) populations in which all three types are used, but not by the same speakers. In Pederson *et al.* (1998), these three cases are lumped as 'mixed'. I wish to restrict the term 'referential promiscuity' to the first two scenarios – that is, to cases where there are individual speakers that use all three types. There are to my knowledge no attested examples of (i), although I would be surprised if no such examples exist. Examples of (iii) have been documented for Hindi (Mishra *et al.* 2003) and Tamil (e.g., Pederson *et al*. 1998). In both instances, the variation is governed by the contrast between rural and urban dwelling. The speech communities of Ewe and Yucatec both instantiate scenario (ii). In both instances, there is a gender effect: absolute FoRs are more likely to be employed in the horizontal by male speakers than by female speakers. This seems to be a consequence of the use of absolute FoRs being related to predominantly male occupational activities and other practices predominantly in the male domain. Thus it is mostly only male speakers that employ all three types of FoRs. A distinct case is documented in Wassman & Dasen (1998): Balinese is another example of a predominantly absolute language with intrinsic FoRs used as a secondary strategy. There is, however, some relative use as well, which the authors attribute to influence from Indonesian; it is mostly restricted to bilingual speakers. Should the use of relative frames expand in monolingual speakers in the future (and there continue to be monolingual speakers of Balinese), Balinese might become another example of a referentially promiscuous language.

The notion of a 'default perspective' applies to two types of speech communities: speakers of predominantly relative (Dutch, German, English, Japanese) and predominantly absolute languages (Hai//om (Khoisan, Namibia), Longgu (Oceanic, Solomons), Tseltal (Mayan, Mexico), and many Australian languages). These use either the relative or the absolute type of FoR as a default perspective, with intrinsic reference as a backup option (except, apparently, for the Guugu Yimithirr, who are claimed to use exclusively absolute frames). There are also languages whose speakers have been reported to use exclusively intrinsic FoRs: Kilivila (Oceanic, Papua New Guinea) and Mopan (Mayan, Belize and Guatemala)). The monolithic label 'intrinsic' in this case hides a great deal of variation between different strategies all of which fall under the Levinsonian intrinsic type (see section 3). The key factor that separates the relative and absolute types from the various Levinsonian intrinsic strategies is that only the relative and absolute types can be generalized in the sense that the *anchor* – the entity or environmental feature that serves as the model of the FoR[3] - stays the same (more or less) across speech situations, discourse contexts, and referents. Of course, in the relative type, the anchor moves through space and changes orientation all the time - but it still remains the same anchor, as far as a single speaker is concerned. The relative and absolute types can be turned into habitual default perspectives in a way the intrinsic types cannot. The intrinsic frames are *localized* - they only work for particular speech situations, particular contexts, and with particular grounds. One has to keep switching strategies if one cannot rely on a relative or absolute default - hence the greater variability in strategies in populations that do not have a relative or absolute default. The relative and absolute types are general-purpose solutions, whereas the intrinsic types are special-purpose solutions.

[3] The term is borrowed from Danziger (2010), who in turn derives it from Levinson's (1996, 2003) 'anchor point'. Cf. section 3 for more.

Yucatec speakers differ from speakers of intrinsic-only languages in that they do make use of relative and absolute frames (in the horizontal). At the same time, they contrast with speakers of predominantly relative or absolute languages in that they do not use relative or absolute FoRs as default perspectives. Table 1 summarizes the typology of referential practice types proposed here,[4] casting it in terms of two binary features, the presence vs. absence of a default perspective in the community and the presence vs. absence of a restriction to localized frame types, i.e., types whose anchor needs to be chosen anew from speech context to speech context.

Table 1. FoR biases across languages

		Default perspective		
		+		-
Restriction to localized FoRs	+	* (by hypothesis impossible)		intrinsic-only languages (Kilivila, Mopan)
	-	predominantly relative languages (Dutch, English, German, Japanese)	predominantly absolute languages (Hai//om, Longgu, Tseltal, many Australian languages)	referentially promiscuous languages (Ewe, Kgalagadi, Yucatec)

By hypothesis, processing pressures push or pull the languages towards one type or another. There is a processing price attached to not having a default perspective: the need to recalibrate spatial reference to a new anchor from context to context. Maintaining a generalized spatial perspective likewise comes at a price: in the case of relative FoRs, the cost of having to deal with divergent egocentric perspectives in interaction, and in the case of absolute FoRs, the cost of keeping track of one's bearings at all times. Speakers of referentially promiscuous languages may ease the processing burden imposed on them by their style of spatial orientation somewhat by not being as consistent "dead-reckoners" as their predominantly absolute cousins (see Levinson 2003: 216-243) and avoiding the use of relative FoRs in interactions where the interlocutors' orientation is incongruous. At the same time, they might still get just enough leverage out of having relative and absolute frames at their disposal so as to compensate for the greater processing demands imposed by these strategies vis-à-vis speakers of intrinsic-only languages.

I hypothesize that there are two further correlates of referential promiscuity, whose occurrence in the right circumstances may be caused by it, but which may also occur independently of it:

- All speakers frequently switch between different types of FoRs in the same discourse context

[4] This typology of referential practice types should not be confused with the typological classification of FoRs. In terms of the latter, there are three major types of FoRs: intrinsic, relative, and absolute. In terms of the former, there are four distinct types of speech communities, as per Table 1, typed in terms of their practices of using spatial FoRs.

- All speakers regularly combine multiple FoRs in single spatial descriptions, apparently capitalizing on this multiplicity of perspectives to "zero in" on the spatial representations they intend to convey.

These two properties are logically independent of referential promiscuity and may occur in other speech communities as well. However, my hypothesis is that referentially promiscuous speech communities have a greater propensity for variation than non-promiscuous communities due to the lack of a default FoR type. The evidence in support of this hypothesis is examined in section 4 and possible alternatives are discussed. However, the hypothesis can ultimately neither be verified nor falsified here. A proper test of the hypothesis requires micro-level comparisons of referential practice in Yucatec, other languages for which unrestricted use has been reported, such as Ewe, and languages for which a restriction is attested, i.e., in which one or two of the Levinsonian types are not used at all in reference to manipulable space. The present article hopes to lay the groundwork for such future research. I predict that speakers of intrinsic-only languages show a similar propensity for switching between and combining different strategies as do speakers of Yucatec – except unlike Yucatec speakers they do not include relative and absolute frames in their strategy mixes. Scattered reports from the available descriptions of intrinsic-only languages support this prediction.

Spatial FoRs have attracted much attention over the last two decades. This attention has been fueled above all by the demonstration, in Levinson (1996, 2003), Pederson *et al.* (1998), and Wassman & Dasen (1998), *inter alia*, of a robust alignment between FoR use in discourse (and gesture, and other forms of observable behavior) and internal cognition, the latter as manifest in recall memory, spatial inferences, and dead reckoning skills. This alignment is believed to be the result of the lack of inter-translatability across frames. Consider the three utterances in (1): while all three may be true in the same situation, none entails either of the other two.

(1) a. The ball is in front of the chair
b. The ball is left of the chair
c. The ball is east of the chair

Consequently, if one observes a spatial configuration and intends to later report it in a particular language, and that language prefers a particular type of FoR for this purpose and excludes another type, one must memorize the configuration in the type prescribed by the language in order to be able to carry out one's intention. Levinson, Pederson, and colleagues have argued that language (along with gesture and other observable cultural practices) is the "driving force" in this alignment, the independent variable that determines the selection of frames in internal cognition. Their reasoning is that there is a greater amount of variation across than within speech communities in the use of FoRs. The members of each community must be able to converge on a particular pattern of FoR use and, absent telepathy, this convergence is possible only by allowing observable behavior – language in particular – to be the guide. Li & Gleitman (2002) proposed an alternative interpretation according to which the linguistic and nonlinguistic biases observable in a given population are the result of cultural factors, in particular, literacy and education, a community's adaption to its natural environment, and also community size and cohesion. Of course, the existence of such cultural determinants – if their existence is confirmed, which so far

has not been the case (cf. Majid *et al.* 2004) – would not undermine the role of language and other observable practices as necessary mediators between community patterns and the behavior of the individual. But Li & Gleitman tried to show that cognitive biases towards or against particular types of frames are shallow and easily malleable. Thus, their argument seems to be that even if there is some sort of "Whorfian" influence of language on internal cognition at work here, it is merely a relatively shallow one. It is not the case, on this account, that people are caused by their native languages to be fundamentally different spatial thinkers (cf. also Li *et al.* 2005 and, for a response to Li & Gleitman, Levinson *et al.* 2002). Thus, *if* one assumes that Li & Gleitman are correct about the cultural determinants of FoR selection, then much of the debate may come down to what exactly it means for a cognitive bias to be "shallow" and "malleable" vs. "deep" and for two populations to be "fundamentally different" spatial thinkers.

The research reported in this article was undertaken as part of my NSF-funded project *Spatial language and cognition in Mesoamerica* (MesoSpace). It is the goal of this project to advance the Levinson-Gleitman debate. Intrinsic-only languages and referentially promiscuous languages have so far been ignored in this debate. The "Whorfian" prediction for the former is a cognitive bias for intrinsic frames, which is difficult to test (see section 3). Since referentially promiscuous languages do not *per se* favor or disfavor the use of particular types of frames, a strong alignment between usage patterns in discourse and cognition is not predicted for such languages. Indeed, the results of a recall memory experiment reported in section 5 suggest a possible mismatch: a response type consistent with absolute and intrinsic coding occurred much more frequently than one consistent with relative and intrinsic coding. Only a partial alignment is observed: relative FoRs, which play merely a minor role linguistically, also appear to play only a minor role in recall memory. This is in line with a central hypothesis of the MesoSpace project, which predicts that the pervasive use of *meronyms* (object part terms) with geometric meanings in spatial descriptions disfavors the use of relative FoRs.

Le Guen (2006) observes the same apparent mismatch in FoR usage patterns between Yucatec discourse and the performance of Yucatec speakers in recall memory experiments. Le Guen (in press) shows that in a task in which participants are asked to describe the location of a particular business with respect to a local landmark in a nearby town, their linguistic representations are mostly underspecified while their gestural representations are predominantly absolutely oriented, preserving the relative position of shop and landmark in an absolute FoR. Le Guen concludes that Yucatec speakers prefer absolute FoRs in cognition, but this bias is externally expressed and mediated by gesture (and other cultural practices) only and not in discourse. I discuss this proposal in section 6.1. Even if referentially promiscuous languages such as Yucatec do not impose an overall constraint on FoR selection in internal cognition, speakers must still mentally encode, during utterance production, any individual scene in precisely the FoR their intended utterance employs. Thus, if Yucatec speakers are absolute thinkers, as Le Guen suggests, it seems strange that they are not also absolute talkers. I argue instead in section 6.2 that the use of absolute strategies among Yucatec speakers, including in the recall memory experiments reported in Le Guen (2006) and in this article and in the gestures documented in Le Guen (in press), is task-specific. Yucatec speakers are referentially promiscuous in language and internal cognition alike.

The article is organized as follows: section 2 presents some information about Yucatec and its speakers. In section 3, I introduce the tools and tasks used to collect the data for this study and discuss how I coded the data. Section 4 summarizes the findings regarding FoRs in discourse

and section 5 reports the results of the recall memory study. Section 6 provides discussion and section 7 concludes.

2. Yucatec and its speakers

Yucatec is a language of the Yucatecan branch of the Mayan language family.[5] It is spoken across much of the Yucatan Peninsula, in the Mexican states of Campeche, Quintana Roo, and Yucatán and the northwestern districts of Cayo, Corozal, and Orange Walk of Belize. Dialect differentiation is low; all contemporary varieties are readily mutually intelligible.

Yucatec is a polysynthetic, strictly head-marking language. Verbs cross-reference their arguments, stative predicates their themes, and nominals their adnominal possessors. The dependents in question are realized by two series of bound pronominal indices which may be coindexed with syntactically optional nominals in the clause. The 'set-A' series of bound pronouns cross-references actors of transitive verbs and adnominal possessors, the 'set-B' series transitive undergoers and themes of stative predicates. Yucatec can be characterized as a mildly "omni-predicative" (Launay 1994) language. It is omni-predicative to the extent that all content words *can* head predicates, but is only *mildly* omni-predicative in the sense that heading predicates may not be the most common syntactic function of these words (cf. Bohnemeyer 2002: 153-166). Verbal arguments follow the verb. However, topical arguments are generally only realized by the bound pronominal markers; if these are accompanied by co-indexed nominals, these nominals are typically left-dislocated.

Given the topic of frames of reference use, especially in the context of the Levinson-Gleitman debate (see section1), it may be useful to know a little more about the speakers of the language and the land they inhabit. The 2000 Mexican census registered 800,291 speakers age 5 or older (PerfilMayaweb 2005). The available 2005 census data put the number of speakers age 5 or older at 759,000 (PHLI 2009). Unless a change in the census methodology was involved, this signifies an alarming drop and in fact the first decrease in the number of speakers in recent history. The Ethnologue places an additional 6,000 speakers in Belize as of 2006 (Lewis 2009).

The likelihood of finding Yucatec, as opposed to Spanish, used as the language of everyday interaction in a public setting increases roughly proportionally with geographic distance from the large urban centers. This is above all true in the center of the northern half of the peninsula, in an area roughly demarcated by a parallelogram whose corners are defined by the cities of Mérida, Campeche, Felipe Carrillo Puerto, and Playa del Carmen. In rural areas, Spanish is mostly restricted to interactions with people who do not speak Maya, most print media and those broadcast media with a wider reach, and to settings such as school, church, and much of the public administration (outside the smaller communities) and services. Unsurprisingly, the concentration of monolingual speakers is also largest in small rural places. In the 15-59 range, women are roughly twice as likely to be monolingual than men.

The 2005 census puts the literacy rate among Yucatec speakers age 15 or older in Mexico at 77.6%, based on the census question 'Can (NAME) read and write a message? (Yes/No)'. The

[5] Yucatec is the sole language called *Maya* by its speakers. Scholars have extended this term to the language family and invented the technical term *Yucatec* as a distinguisher for the language that gave origin to the family name. The Mexican government and public media continue to refer to the language as *Maya*.

result should be understood as primarily capturing literacy in Spanish. There have long been bilingual education efforts in primary school. Until the 1990s, these were limited in their scope by the lack of teaching materials and teacher preparation. They were intended to be transitional. The current situation is described in Pfeiler & Zámišová (2006). Yucatec is dropped from the classroom after the first few grades and beyond that point there is no training in reading or writing in it.

Except for the south, the Yucatan peninsula has a flat limestone karst topography without any rivers, but with thousands of natural sinkholes (*cenotes*) providing access to an aquifer. Elevations vary only minimally; the only salient hills occur in the *Puuc* region in the tri-state area. Much of the peninsula is covered in dense tropical jungles. The predominant mode of farming across much of the center of the peninsula is slash-and-burn horticulture. This form of production is typically complemented by logging, hunting, apiculture, and the collection of *chicle*, the natural gum traditionally used in chewing gum. Arable land is largely restricted to the south. The northern coastal area has large henequen plantations and also some cattle ranching.

3. Data collection, methods, coding

The research reported on here was conducted in the summer of 2008 in Yaxley, a village of 589 inhabitants age five or older in 2005[6] in the municipal district of Felipe Carrillo Puerto in the center of the state of Quintana Roo, Mexico. According to census data, there were 521 speakers of an indigenous language (age five or older) among the inhabitants in 2005 – almost all of these were presumably speakers of Yucatec, the only language indigenous to the area. 127 of these were monolinguals - 24.4%, almost five times the figure for the language community as a whole.

To study the use of spatial frames of reference (FoRs) in linguistic representations of easily manipulable space, the MesoSpace team (cf. section 1) developed the *Ball & Chair (B&C)* pictures (Bohnemeyer 2008b; O'Meara, Perez Baez, & Bohnemeyer, this issue). These comprise four sets of photographs. Each set includes 12 photos. The photos feature a ball and a chair in different spatial configurations. Examples are provided in section 4. These stimuli are designed for use in a picture-to-picture matching referential communication task. The goal is to induce speakers to distinguish the pictures that make up a set from one another by making the spatial configurations they show explicit. A trial involves two speakers seated side by side, facing in the same direction, with identical copies of the same set of pictures spread out on a table in front of them in different orders. A screen between the two speakers prevents visual attention sharing. One speaker – the 'director' – picks up the pictures one by one in any order they choose and describes them so their fellow participant – the 'matcher' – can find them in their copy of the set. The matcher is free to ask clarification questions and the director is expected to answer these. Conversation between the two continues until the matcher proposes a match. At this point, both participants hold up the photos for the researcher, who notes down ID numbers printed on the backs of the photographs. Both players then put the pictures back on the table, and only the director gets to reduce the set of live contrasts by placing a coin on the picture they just described. When all twelve pictures of a set have been matched, the researcher removes the screen and reconstructs the proposed matches one by one, encouraging the participants to evaluate their correctness and discuss possible sources of errors. Then the researcher puts the

[6] http://galileo.inegi.gob.mx/CubexConnector/validaDatos.do?geograficaE=230020287.

next set of pictures on the table. I had the two participants switch roles at this point. The procedure continues until the four sets have been matched.

I conducted the B&C task with five pairs of Yucatec speakers in the summer of 2008. The participants were five men in their 30s through 60s and five women in their teens through 40s. All were born in Yaxley and all except two still reside there. The two exceptions, a married couple, live in the municipal capital of Felipe Carrillo Puerto. All 10 speakers are bilingual and literate. All learned Yucatec as their first language and did not speak much Spanish before entering school. While Yaxley is a community in which Yucatec dominates everyday interactions, the married couple lives and works in linguistically more mixed settings. The married couple did the task together; two of the other four dyads were all-male and the other two all-female. All participants were tested in a room I had rented in Yaxley, sitting side by side facing due north at a table whose longest axis was oriented in east-west direction. This layout was chosen to ensure that no type of reference frame would be favored or disfavored by it. Naturally, FoRs whose main axes roughly align with those of the stimulus configuration to be represented are used more readily than those whose axes are off those of the stimulus configuration. Yucatec has cardinal direction terms based mainly on the virtual locations of sunset and sunrise on the horizon (see sections 4 and 6.1). The setup chosen made 'left'/'right' and 'east'/'west' equally applicable to the short edges of the photos (which were in a standard commercial 4x6" format).

The sessions were video recorded and subsequently directly coded in ELAN by me with the help of native speaker consultants whose task it was to check and correct my representations of what I heard the speakers saying on the tape and to provide judgments as to whether a given description is true of a given picture under a particular interpretation, i.e., especially assuming a particular FoR. Spatial descriptions were coded for six categories of information:

- Disposition of the chair ('standing', 'lying on side', 'leaning on the floor upside down')
- Orientation of the chair in the horizontal
- Location of the chair in the picture
- Disposition of the ball ('supported from underneath' vs. 'suspended (on an invisible string)'
- Location of the ball vis-à-vis the chair
- Location of the ball in the picture ('on the floor', 'on the chair', 'in the air (suspended on an invisible string)')

Only descriptions of the orientation of the chair and the location of the ball vis-à-vis the chair are included in the analysis presented in section 4. All descriptions were coded under the assumption that they are true of the configuration represented. They were assigned FoRs of a type that would make them true as long as the consultant agreed that that interpretation was possible. In case a description appeared to be true of a given scene under multiple alternative possible interpretations, it was coded for the type of FoR previous research had identified as the more frequent one. Descriptions that could not be given a truthful interpretation which the native speaker consultant would accept were treated as errors and omitted from coding. Only descriptions offered by the 'director' of a given trial were coded. The clarification questions of the matcher were not included, since they cannot be considered (to be intended as) truthful

representations of the stimulus picture in question. Similarly, negative descriptions of the matcher ('The ball is not on the chair') were excluded from coding and analysis.

Coding of FoR choices was based on a fine-grained classification that allows for multiple alternative analyses of the data given different sets of assumptions about the classification of particular types of strategies. A useful notion in introducing the categories of this fine-grained coding schema is that of the anchor already mentioned in section 1. The anchor of a FoR is an entity, or a feature of an entity, that serves as the basis for the definition of one or more axes of the FoR. FoRs can be understood as complex relations between the anchor and their origin (as coordinate systems). The origin is the ground or reference entity in locative and motion descriptions and the *figure* or theme – the entity whose orientation, location, or motion a spatial description is about – in orientation descriptions. This allows us to distinguish the following types of frames (see O'Meara, Pérez Báez, & Bohnemeyer, this issue, for further information):

- *Relative*: The anchor is the body of the observer (often, the speaker and/or addressee). The ground is a distinct entity. The axes of the FoR are *projected* (i.e., in geometric terms, transposed) from those of the body of the observer onto the ground. Examples: In locative descriptions: 'The ball is left/in front of the chair', in the observer-dependent sense of 'left of' and 'in front of'. In orientation descriptions: 'The chair is facing left'.
- *Absolute*: The anchor is some entity or feature of the environment. One or more axes of the FoR are *abstracted* from this entity/feature such that the directions in which they point are exactly the same regardless of the actual location of the ground, or the observer, vis-à-vis the anchor. Examples: 'The ball is east of the chair'/'The chair is facing east', in case the direction denoted by 'east' does not change over the course of the year as the virtual position of the sunrise on the horizon changes; 'The ball is uphill of the chair'/'The chair is facing uphill', in case the direction denoted by 'uphill' remains the same regardless of which side of the mountain (range) the ground (or the observer) is on.
- *Object-centered*: The anchor is the ground, which is an entity distinct from the body of the observer. The axes of the FoR are *projected* from those of the ground (i.e., simply extended outward beyond the outer surfaces of the ground into space). Example: 'The ball is left/in front of the chair', in the observer-independent sense of 'left of' and 'in front of'.
- *Direct*: The anchor is the ground, which is the body of the observer. The axes of the FoR are either *projected* from those of the body of the observer (by simply extending them outward into space, e.g., 'The ball is left/in front of me/you/us') or defined as vectors pointing toward the body of the observer (e.g., 'The chair is facing me/you/us'; 'The ball is toward me/you/us from the chair'; 'The ball is on my/your/our side of the chair').
- *Landmark-based*: The anchor is some (natural or human-made) entity or feature of the environment. One or more axes of the FoR are defined as vectors pointing toward this entity or feature. Examples: In locative descriptions: 'The ball is seaward of the chair'; 'The ball is toward the door from the chair'. In orientation descriptions: 'The chair is facing seaward'; 'The chair is turned toward the door/facing the door'.
- *Geomorphic*: The anchor is some entity or feature of the environment. One or more axes of the FoR are *projected* from an axis or gradient of this entity/feature onto the ground.

Examples: ‘The ball is upriver/downhill of the chair’; ‘The chair is facing upriver/downhill’.

The ‘object-centered’ type is the traditional (pre-Levinson 1996), narrow intrinsic type. As mentioned in section 1, Levinson (1996, 2003) extends the label ‘intrinsic’ to cover not only the object-centered, but also the direct, landmark-based, and geomorphic types. This grouping is primarily typologically motivated: the strategies Levinson groups together as ‘intrinsic’ often co-occur in the same languages and are on the whole much less restricted in their distribution compared to the relative and absolute types. However, other researchers – in particular, Li & Gleitman (2002) and Li *et al.* (2005), but also, e.g., Wassman & Dasen (1998) – group relative and direct FoRs together as ‘egocentric’ and absolute, landmark-based, and geomorphic as ‘geocentric’. (The Levinsonian absolute is assumed to evolve out of landmark-based or geomorphic systems by way of abstraction, a type of metaphorical semantic/conceptual transfer.) The egocentric-intrinsic-geocentric classification has the advantage of mapping more neatly (compared to the Levinson classification) onto the response types of standard experimental tests on FoR use in internal cognition (see below). But it has the disadvantage of cutting across the category boundaries the typological distribution of FoR use turns out to be sensitive to. Thus, lumping relative and direct FoRs ignores the fact that, whereas there is no attested case of a language that lacks direct FoRs, by now quite a few examples have been established of languages that lack relative FoRs.[7] Similarly, the landmark-based type is a strong candidate for a universal, whereas the absolute type is clearly lacking in many languages. Moreover, as mentioned in section 1, relative and absolute FoRs can be maintained across speech situations and discourse contexts in a way that object-centered, direct, landmark-based, and geomorphic frames cannot – the latter are all localized to particular situations.[8] Be that as it may, the fine-grained coding schema used in this study makes it possible to analyze the data both according to the relative-intrinsic-absolute Levinson classification and according to the egocentric-intrinsic-geocentric classification.

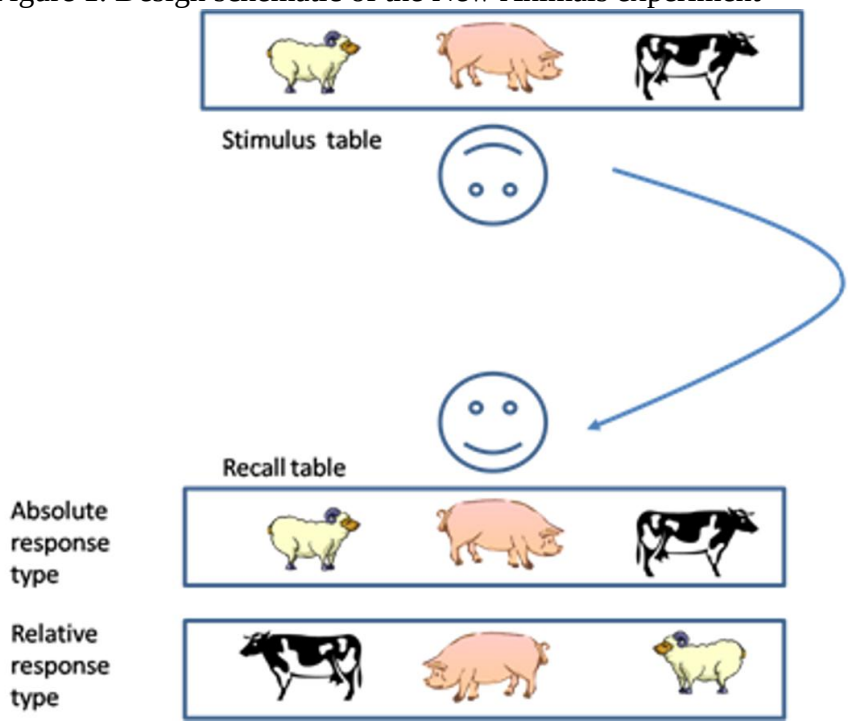
The Earth’s field of gravity serves as the anchor of an absolute FoR that is apparently accessible for the interpretation of vertical spatial relations in all languages. Since its use is not typologically restricted in the way that of other absolute types of FoRs is, it was coded separately under the label *vertical*. An eighth coding choice, in addition to the seven types of FoRs distinguished above, is that of *topological* locative descriptions in the sense of Piaget & Inhelder (1956). The interpretation of these does not depend on FoRs. They involve non-perspectival figure-ground relations such as containment, contact, proximity, and distance. In research on

[7] Per the references in section 1, languages that lack relative FoRs include Arrernte; Guugu Yimithirr; Hai//om; Jaminjung; Kilivila; Longgu; Mopan; Tenejapa Tseltal (but see Polian & Bohnemeyer, this issue); and Warrwa.

[8] It may not be obvious that there is a difference between relative and direct FoRs in this respect. One could of course say that the direct perspective stays with the observer in the same way the relative does. However, the direct type always comes with the restriction that the ground must be the body of the observer. Thus if the task is understood to define place and orientation functions with respect to arbitrary grounds, then the direct type is not a general-purpose solution, unlike the relative type.

spatial FoRs, topological and intrinsic descriptions are often lumped together. Here, too, the fine-grained coding schema makes it possible to analyze the data in this fashion should one so desire. To study the use of FoRs in recall memory across populations, the MesoSpace team has been relying on an experimental procedure closely modeled after the Animals In A Row (AIAR) design of Levinson (1996) and Pederson *et al.* (1998). Participants commit arrays of toy animals to memory and reproduce them having turned 180 degrees to another table. Figure 1 presents a schematic of the design. If the participant memorizes the array correctly in absolute, landmark-based, or geomorphic terms, they should produce the absolute response type. If the participant memorizes the array correctly in relative or direct terms, they should produce the relative response type. If they memorize the array correctly in object-centered terms, encoding the orientation and location in the array of each animal purely with respect to the other animals, both the absolute and the relative response type are consistent with their memory, as are responses identical with either except for not preserving the orientation of the main axis of the array. (Contrary to what Figure 1 suggests, the relative sizes of tables and toy animals did not exclude any orientation of the array.)

Figure 1. Design schematic of the New Animals experiment



The task was administered as follows: Participants were first familiarized with a set of four toy figures of farm animals: a horse, a cow, a pig, and a sheep.[9] Culturally appropriate

[9] The figures must be symmetrical with respect to the animals' front-back axes. If they are not, absolute coders face a conundrum: it is impossible for them to simultaneously preserve the visual appearance of the array and the order and orientation of the animals in their FoR of choice, an absolute system. In pilots with asymmetrical figures, absolute coders have commented that the task seemed impossible to solve.

interpretations of the figures are negotiated with each participant in preparation of the experiment. This is followed by a practice trial. The participant is shown an array of three of the four animals. They are asked to memorize the array and then "make it again" on the other table. When they indicate that they have memorized the array, the researcher removes it and asks the participant to wait for 30 seconds before they turn around and walk over to the recall table. They are then handed all four toy animals. The identity of the animals is made a part of the memory task in order to mask the interest in the orientation of the array. Two types of manipulations are treated as errors in this protocol: the selection of a wrong animal and a change in the order of the animals. If the participant commits either kind of error, they are shown the original array again on the stimulus table and given an opportunity to detect the difference. If they do not, it is pointed out to them. A new practice trial is then conducted with a different stimulus array. Once a trial has produced no error of either kind, the test trials commence. There are six test trials, as opposed to five in the original Animals-In-A-Row design in Levinson (1996) and Pederson *et al.* (1998), and unlike the latter, the arrays of animals they involve are prescribed as part of the protocol. The outcome of each trial is noted down on a coding sheet and the sessions are also videotaped.

I ran the task with 18 native speakers of Yucatec: nine men in their teens to 60s and nine women in their teens to 40s. 8 of these speakers also participated in the Ball & Chair task; all of these completed the New Animals task first. I subsequently excluded the results of two of the men from the analysis because they produced errors (wrong animal or wrong order) in three trials or more. The experiment was conducted in the same room in which the B&C task was recorded. The stimulus arrays were presented in rough north-south orientation.[10]

4. Results: Frames of reference in Yucatec discourse

The results of the Ball & Chair (B&C) task are presented in this section. Subsection 4.1 focuses on frames of reference (FoRs) in locative descriptions, subsection 4.2 on orientation descriptions. Since the B&C pictures feature exclusively static spatial configurations, the use of FoRs in motion descriptions is ignored here. Subsection 4.3 specifically addresses the evidence for referential promiscuity.

4.1 Frames of reference in locative descriptions

This section focuses on descriptions of the B&C pictures that encode the location of the ball vis-à-vis the chair. The structure of Yucatec locative predications is schematically represented in (2) and exemplified in (3) (*CR.B* stands for the set-B cross-reference markers; cf. section 2):[11]

(2) $[(\text{PREP=})\text{PRED-CR.B}_{\text{figure}} \quad (\text{NP}_{\text{figure}}) \quad (\text{XP}_{\text{ground}})(\text{=D4})]_{\text{S}}$

[10] East-west alignment would have been preferable in an ideal world, since the east-west axis seems to be the one cardinal direction terms are applied to most confidently in Yucatec; cf. section 4. However, I decided to go with north-south alignment in order to maximize the distance between the two tables given the layout of the room.

[11] For further details on the structure of Yucatec locative descriptions, see Bohnemeyer & Stolz (2006) and Bohnemeyer & Brown (2007).

(3) Ti'=yàan le=pàal t-u=bak'=o'
PREP=EXIST(B3SG) DET=child PREP-A3=bone=D2
'There the boy was in (lit. at) [the deer's] antlers'

Much more commonly, the nominal describing the figure – the boy in (3) – is left-dislocated to mark it as topic (cf. Bohnemeyer 2009):

(4) Le=lùuch=o' ti=yàan y=óok'ol le=mèesa=o'
DET=gourd=D2 PREP=EXIST(B3SG) A3=on DET=table=D2
'The cup (lit. gourd), there it is on the table'

That the figure is cross-referenced on the head of the locative predicate by the set-B markers becomes apparent in 1st and 2nd-person:

(5) Tu'x yàan-ech, chan=áak?
where EXIST-B2SG DIM=turtle
'Where are you, little turtle?' (Romero Castillo 1964: 308)

Examples (3) and (4) have the 'generic' (see below) preposition *ti'* apparently cliticized to the head of the locative predicate,[12] whereas this preposed, "absolute" (in the sense of occurring without a complement) *ti'* is missing in (5). As far as I can tell, pre-predicate *ti'* is in complementary distribution with anything that appears in the focus position between the left-detached (i.e., 'topic') position and the head of the predicate. In (5), this position is occupied by the indefinite place adverb *tu'x* 'where'; in (8) below, the demonstrative base *te'l* fills it and thus suppresses *ti'*.

The head of a locative predicate can never be phonologically empty, and it is not possible to use the *ground phrase* – the constituent of the locative predicate that describes the place at which the figure is located; in (3), *tu=bak'o'* 'at its antlers' – itself as the locative predicate (the figure is not cross-referenced on the ground phrase). The *PRED* slot in (2) can be filled by expressions of three types:

- the stative locative/existential predicator *yàan*, as in (3)-(5)
- a derived stative form of one of upwards of 150 'dispositional' roots, as in (6)-(9)
- a derived stative form of some other verb, as in (10).

(6) Ti'=wa'l-akbal ich le=xàak=o'
PREP=stand-DIS(B3SG) in DET=basket=D2
'There [the bottle] is standing inside the basket'

[12] Either *ti'* is a clitic - then it is presumably incorporated in the verbal complex in the context at issue here. Or it functions as an adverb that does in fact appear in focus position. Evidence for the latter analysis comes from motion descriptions, which do - very rarely - feature *ti'* in this function (in this case it is possible to tell that *ti'* is not incorporated into the verbal complex b/c it precedes the AM marker). The question is, is that the same *ti'*? The motion *ti'* appears to be more clearly used as an anaphoric place adverb.

(7) Ti'=wa'l-un-wa'l-o'b te=lu'm=o'
PREP=RED-DIS.PL-stand-B3PL PREP:DET=ground=D2
'There [the bottles] are standing one by one on the ground'

(8) Te'l kul-ukbal u=pèek'-il t-u=pàach le=nah=o'
there sit-DIS.RES(B3SG) A3=dog-REL PREP-A3=back DET=house=D2
'There the dog is sitting outside the house'

(9) ...ti'=pek-kunt-a'n y=óok'ol=i'
PREP=lie=INCH.CAUS-RES(B3SG) A3=on=D4
'...there [the rope] is lain on top of [the table]'

(10) Le=máak=o' chen u=ts'a'-mah u=anìiyo
DET=person=D2 only A3=put-PERF(B3SG) A3=ring
t-uy=àal u=k'ab bèey=a'
PREP-A3=offspring A3=hand thus=D1
'The man, he's just put the ring on his finger'

Dispositionals are a special class of roots in Mayan languages. They lexicalize stage-level spatial properties that may be thought of as describing the manner[13] in which an entity is located somewhere, including modes of support and suspension ('lying', 'sitting', 'hanging', 'leaning', 'on all fours', etc.), blockage of motion in the horizontal ('be stuck to', 'be wedged between two things'), and non-inherent configurations of parts with respect to one another ('be curled up', 'be spread out', 'be twisted', etc.). The derived stative forms illustrated in (6)-(8) occur exclusively with dispositional roots in Yucatec.

There are five types of expressions that can constitute a Yucatec ground phrase:

- a demonstrative adverb ('The ball is over there')
- the indefinite place adverb *tu'x* 'where' (as in (5))
- a place-denoting adverbial clause ('The ball is where you left it')
- a noun phrase (NP/DP) such as *yóok'ol le=mèesa* 'on the table' in (4) and *yóok'ol* 'on top of it' in (9)
- a prepositional phrase (PP), as in all other examples cited so far

There are two prepositions that can head a Yucatec ground phrase: the containment preposition *ich* 'in' illustrated in (6) and the "generic" preposition *ti'* illustrated in (3), (7)-(8), and (10) (in all cases, shortened to *t-*). *Ti'* is a "generic" preposition in the sense that it has little or no discernible semantic content. It comes close to being an all-purpose solution to turning an NP/DP

[13] The notion of 'manner of location' appears to be a more familiar concept for speakers of Mayan languages than for speakers of European languages. In Yucatec, for example, it is quite idiomatic to ask 'How is it (in such-and-such a place)', expecting answers like 'It's hanging', 'It's folded up', 'It's in a pile', etc. Cf. Bohnemeyer & Brown (2007) and Belloro *et al.* (2008).

into a PP in Yucatec. The range of functions of such PPs includes locations, goals, sources, recipients, donors, benefactives, malefactives, and judgers, and it also occurs as the base of complex prepositions that express for example causes and oblique agents.

Neither of the two prepositions is interpreted in a FoR when it occurs by itself. If the preposition combines with the nominal that describes the ground entity directly, as in (3), (6)-(7), and (10), the resulting ground phrase can only be interpreted topologically (see section 3). A *projective* ground phrase – i.e., one that requires a FoR for its interpretation – must involve a *meronym* in Yucatec. Meronyms are object part descriptors such as body part terms. In Yucatec, meronyms are lexicalized as relational nouns. These are inalienably possessed (see Lehmann 1998). Yucatec meronyms fall into three subsets: terms for volumes, surfaces, and curvature extremes such as edges and points; see Table 2:

Table 2. Yucatec meronym classes

volumes	**surfaces**	**extremes**
ho'l = pòol 'head'	*àanal* 'bottom'	*pùunta* 'tip'
chùun 'trunk'	*ichil* 'inside'	*tu'k'* 'corner'
it' 'anus'	*no'h* 'right'	*xùul* 'end'
kàal 'neck'	*óok'ol* 'top'	
k'ab 'hand/arm'	*pàach* 'back'	
nak' 'belly'	*táan* 'front'	
òok 'foot/leg'	*tséel* 'side'	
xbak'et 'buttocks'	*ts'íik* 'left'	
xikin 'ear'		
...		

Volume terms are body part terms, whereas surface and extreme meronyms have abstract geometric meanings. Surface and extreme meronyms form small, closed sets, whereas the set of volume meronyms is large and possibly not sharply delimited. With the exception of *pàach* 'back', only surface meronyms can be possessors of other meronyms.

Àanal 'bottom', *ichil* 'inside', and *óok'ol* 'top' may head the ground phrase without the "support" of the generic preposition *ti'*. This is illustrated for *óok'ol* in (4) and (10) and for *àanal* in (11) below. The other meronyms occur either as complements of *ti'*, possessed in their turn by the ground-denoting nominal – this is illustrated for *pàach* 'back' in (8) and (12) and for *tséel* 'side' in (12) – or as derived adverbials formed with the suffix *–il* and modified by a PP headed by *ti'*.

It is only surface meronyms that may be interpreted 'projectively', in spatial FoRs.[14] All surface meronyms have projective interpretations except for *ichil* 'inside'. *Àanal* 'bottom' and

[14] There is one – rare – exception. Consider the equivalent propositions 'The ball is behind the chair', interpreted in an object-centered FoR, and 'The ball is toward the back of the chair'. Expressions of both propositions require the meronym 'back' in Yucatec. However, the second type of representation can be extended to non-surface parts, as in, for example, 'The ball is toward one leg of the chair'. This proposition, too, should be considered object-centered, but its expression in Yucatec does not involve a surface meronym.

óok'ol 'top' prefer absolute FoRs, but also occur with object-centered FoRs – even where this violates the 'Principle of Canonical Orientation' of Levelt (1984, 1996). An example is (11), produced as a description of the picture in Figure 2:

(11) Le=bòola=o', **y=àanal** te'l tu'x k-u=kutal
DET=ball=D2 A3=under DADV where IMPF-A3=sit:INCH.DIS
máak=o' , kóoh-ol tu=chan ba'l-il (...)
person=D2 hit\MIDDLE-INC PREP:A3=DIM thing-REL
'The ball, **under** there where a person sits, (it's) touching (the chair's) thing (...)'

Figure 2. Ball & Chair 1.6

The Principle of Canonical Orientation states that the use of object-centered FoRs with a given ground requires that ground to be in canonical vertical orientation from the perspective of the observer. As (11) shows, this principle is not an absolute constraint in Yucatec. However, it still holds as a tendency, in the sense that all speakers prefer absolute uses of vertical terms over intrinsic ones.[15]

The remaining surface meronyms of Table 2, *no'h* 'right', *pàach* 'back', *táan* 'front', *tséel* 'side', and *ts'íik* 'left', occur with topological, object-centered, direct, and relative interpretations. Relative uses of *no'h* 'right' and *ts'íik* 'left' are as frequent as intrinsic or topological uses, whereas intrinsic uses strongly dominate with the other terms; see Figure 4. Example (12) shows a relative use of *tséel* 'side', followed by an object-centered use of *pàach* 'back', with respect to the picture in Figure 3:

(12) Ti'=pek-kun-a'n
PREP=lie.as.if.dropped-CAUS-RES(B3SG)
'There lies'

[15] That this principle is no more than a strong tendency even in English was implicitly demonstrated in a series of experiments reported in Carlson-Radvansky & Irwin (1993, 1994). However, "disaligned" intrinsic uses of vertical terms appear to be more common in Yucatec than in English. 20% of the Yucatec descriptions of those 10 B&C pictures that afford disaligned intrinsic descriptions feature intrinsic FoRs, compared to 4% of the English descriptions collected from five pairs of University at Buffalo undergraduate students in a pilot (see below).

hun-p'éel chan=bòola=i' **tu=tséel**=e'.
one-CL.IN DIM=ball=D4 PREP:A3=side=D3
'a little ball, **on its side**.'

Tu=tséel=i', bwèeno, **tu=pàach**
PREP:A3=side=D4 well PREP:A3=back
'On its side, well, **behind**'

te'l tu'x k-u=nak-tal máak=o'
DADV where IMPF-A3=lean-INCH.DIS person=D2
'the seat (lit. where a person leans against)'

Figure 3. Ball & Chair 2.11

According to Bohnemeyer & Stolz (2006), relative uses are restricted to grounds not supporting object-centered FoRs because they lack an inherent front-back axis. As (12) and Figure 4 below demonstrate, this was an overstatement. It was based on elicited speaker judgments. A more accurate statement would be that 'front', 'back', and 'side' terms are used preferentially intrinsically (in the sense of Levinson 1996; cf. section 3), but permit also relative uses even with grounds that support intrinsic frames, and that 'left' and 'right' are used relatively and intrinsically with about equal frequency.[16]

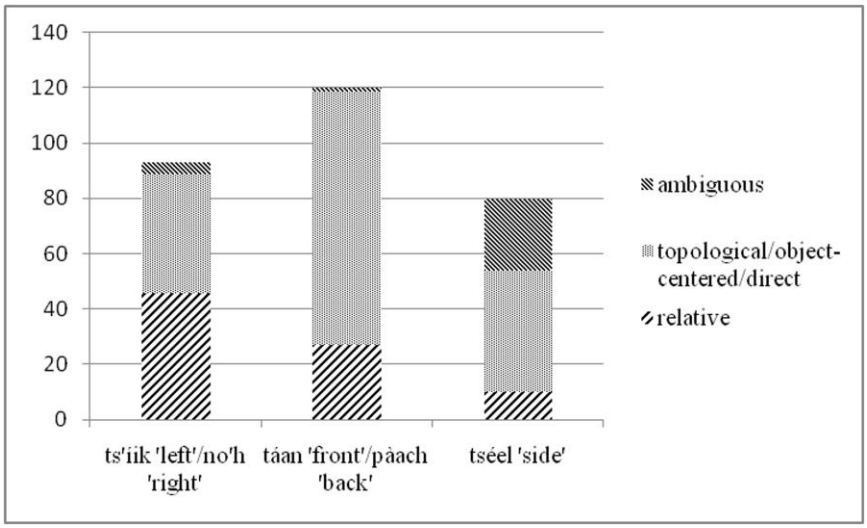
Yucatec has solar-based cardinal direction terms: the nouns *chik'in* 'west', *lak'in* 'east', *nohol* 'south', and *xaman* 'north'. *Chik'in* and *lak'in* etymologically refer to the sunset and

[16] The numbers in Figure 4 must be taken with a grain of salt, as the Ball & Chair pictures are not properly counterbalanced for the contrasts they show. Of the 48 pictures, 13 feature intrinsic front-back relations (i.e., the ball is located at the chair's intrinsic front or back), 11 relative front-back relations (i.e., the ball is in front of or behind the chair from the perspective of the viewer), 15 intrinsic lateral relations, and 21 relative lateral relations. What one can confidently take to be meaningful about Figure 4 is the contrast between the 'left'/'right' and 'side' figures (represented by the outer bars), as the terms in question are applicable to the same pictures, and the proportion of non-relative to relative uses of the 'front'/'back' terms, as the latter is much larger than the proportion of the number of items featuring the relevant relations. Propositions coded as ambiguous in Figure 4 are true of the relevant stimulus picture under both a relative and an intrinsic interpretation.

sunrise, respectively (< *k'ìin* 'sun'). Many speakers are aware of this etymological connection. In contrast, the terms for 'north' and 'south' are more opaque. This may explain why speakers tend to have more reliable intuitions about which directions are designated by *chik'in* and *lak'in* than about the precise directions labeled by the other two terms. Asked how one determines where north and south are if unsure, I was given the following instruction: point your right arm toward where the sun rises and your left arm toward where it sets and look straight ahead – you are now facing due north and your back is turned toward the south. Yucatec speakers are aware that the virtual location of the sunrise and sunset on the horizon changes a bit over the course of the year and that the procedure just described should be performed on the days of the equinoxes to get an exact measurement. However, I have not encountered uses that require an amount of precision that would call for the exact measurement. I nevertheless assume that Yucatec speakers understand their cardinal terms as abstract absolute terms rather than as concrete landmark-based terms (see section 3). No geomorphic FoRs are used in the community where the present study was conducted. I take this primarily as a reflection of the absence of suitable environmental gradients – no rivers, no mountains, no prevailing winds, etc. The same should largely be true of the Yucatec language community as a whole, although local exceptions may exist.

As (13), a description of Figure 5, illustrates, Yucatec speakers – unlike English or Spanish speakers - use cardinal direction terms in the domain of easily manipulable space. However, it was exclusively the two all-male dyads who used the cardinal terms. This is consistent with observations in Bohnemeyer & Stolz (2006), Le Guen (2006), and Le Guen (in press) to the effect that the use of the cardinal direction terms is largely restricted to male speakers. However, using cardinal direction terms is apparently not a 'genderlect' phenomenon. By no means do all male speakers use the terms, and it does not appear to be the case that the use of the terms is perceived as an expression of masculinity. I tentatively conclude that the gender bias in the use of cardinal direction terms is an artifact of occupational biases. Cardinal directions are tied to a number of cultural practices, all of which appear to be primarily in the male domain. For instance, the four edges of the *milpa*, the tropical garden where people plant their corn, beans, squash, chili, and so on, are supposed to be aligned with the cardinal directions, as are the walls of a traditional house. Food offerings are likewise arranged cardinally on the altar.

Figure 4. Instances of relative vs. non-relative uses of horizontal surface meronyms in the Yucatec B&C data



(13) Te'l **chik'in**=o' náats' te=lu'm=o'
there west=D2 near(B3SG) PREP:DET=earth=D2
ti'=pek-ekbal hun-p'éel chan= bòola=i'.
PREP=lie.as.if.dropped-DIS(B3SG) one-CL.IN DIM=ball=D4
'There **in the west**, close by on the ground, there is lying a little ball.'

Figure 5. Ball & Chair 3.12

The left-dislocated ground phrase 'In the part in our direction the way we are sitting like this' in example (14), a description of the picture in Figure 6, instantiates the direct type of FoRs: the bodies of speaker and addressee serve as both anchor and ground.

(14) **Te=pàarte t-ak=tòoh-il-o'n bèey he'x kul-ik-o'n**
PREP:DET=part PREP-A1PL=straight-REL-B1PL thus how sit-EXFOC-B1PL
bèey=a', ti'=pek-a'n te=lu'mo' hun-p'éel bòola
thus=D1, PREP-lie.as.if.dropped-RES(B3SG) PREP=earth=D2 one-CL.IN ball
'In the part in our direction the way we are sitting like this, there is a ball lying on the ground'

Among locative descriptions locating the ball vis-à-vis the chair, direct frames played only a minor role, occurring with only 8.2% of descriptions. Even much less frequently than that did the landmark-based type occur: there were only six descriptions that featured it, and all of these were produced by the same pair of speakers. An example is (15), a description of the scene in Figure 6:

(15) Ba'l=e', **tu=tòoh-il** **le=kàancha**=o',
thing=TOP PREP:A3=straight-REL DET=court=D2
ti'=yàan le=bòola tu=pachk'ab-il=o'
PREP=EXIST(B3SG) DET=ball PREP:A3=back:hand-REL=D2
'But **towards the [volleyball] court**, there's the ball behind [the chair]'

Figure 6. Ball & Chair 4.2

Descriptions that employ a FoR anchored to the Earth's field of gravity to interpret vertical relations are illustrated in (4) and (9) above. Finally, (3), (6)-(7), and (10) are examples of topological descriptions.

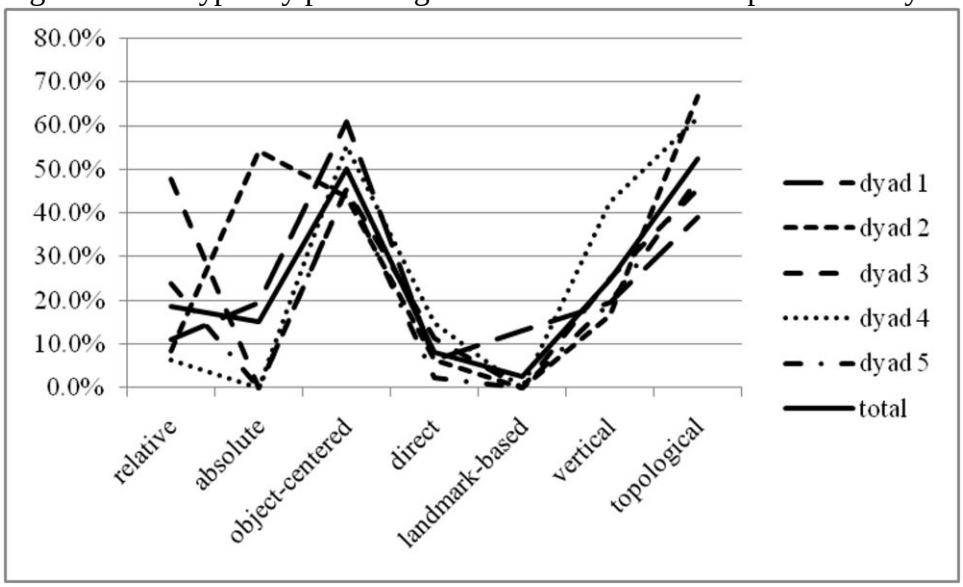
Figure 7 summarizes the distribution of strategies in the descriptions of the location of the ball with respect to the chair. The chart shows that both overall and for each dyad individually, the object-centered type is by far the most frequently used type of FoR in Yucatec locative descriptions. Overall, the five dyads of speakers are rather similar to one another in their choices. This holds with three exceptions:

- Only the first two dyads use cardinal direction terms. As mentioned above, these are the two all-male dyads. Dyad 2 uses cardinal terms with particularly high frequency.[17]
- Dyad 3 uses relative frames with markedly higher frequency than the other four dyads. These are the two participants who live in a larger urban community in which Spanish plays a much larger role. It is impossible to tell on the basis of this one pair of speakers whether this is coincidence or whether there is a causal relation here.

[17] A reviewer wonders whether the use of picture stimuli might have suppressed the use of absolute FoRs. I have collected data with another referential communication task involving motion paths defined with respect to toy town models. Although I have not analyzed these quantitatively, the use of absolute FoRs was certainly not more prominent during this task.

- Dyad 4 makes considerably more frequent use of vertical descriptions than the other participants. These two speakers used vertical locative descriptions to convey meanings that other speakers preferred to express dispositionally. They would, for example, say 'The ball is sideways above the chair' instead of 'The ball is hanging on the side of the chair'.

Figure 7. FoR types by percentage of B&C locative descriptions and dyad of speakers



The distribution in Figure 7 supports, for Yucatec, a central hypothesis of the MesoSpace project (see section 1): the idea that speakers of languages that make pervasive use of geometric meronyms in their spatial descriptions favor, in terms of Levinson's (1996, 2003) classification, absolute and/or intrinsic over relative FoRs. The rationale behind this prediction is the following: meronyms in such languages favor object-centered and direct interpretations, because speakers are accustomed to applying meronyms to objects on the basis of their geometric properties, whereas relative interpretations force speakers to ignore the geometry of the ground. So speakers go either with meronyms under object-centered or direct interpretations or with absolute, landmark-based, or geomorphic descriptions, as the latter do not require meronyms.

Examples (12) and (15) illustrate one of the hypothetical correlates of referential promiscuity mentioned in section 1: the combination of multiple FoRs in a single description. An evaluation of the role of referential promiscuity in locative descriptions is provided in section 4.3. First, however, the use of FoRs in orientation descriptions is briefly addressed.

4.2 Frames of reference in orientation descriptions

The most common way of expressing the orientation of an object in Yucatec involves a stative middle voice form of the verb *sut* 'turn' with the figure as theme and a ground phrase expressing the direction. This is the strategy realized in the four examples quoted below. For the task of orienting the chair, the Yucatec speakers used cardinal direction terms and relative FoRs in 25.4% and 17.5% of their descriptions, respectively. Examples (16), a description of the configuration in Figure 8, and (17), a representation of the scene in Figure 9, illustrate:

(16) (…) le=pàarte tu'x k-u=kutal máak=o',
DET=part where IMPF-A3=sit:INCH.INC person=D2
chik'in súut-ul (…)
west turn\MIDDLE-INC(B3SG)
'(…) the part where one sits, it's turned **west** (…)'

Figure 8. Ball & Chair 3.9

(17) (…)u=ho'l le=sìiya=o', estéen,
A3=head DET=chair=D2 HESIT
x-no'h súut-ul
F-right(B3SG) turn\MIDDLE-INC(B3SG)
'(…) the backrest (lit. head) of the chair, it's turned **right**'

Figure 9. Ball & Chair 1.12

Orientation descriptions cannot be object-centered in the same way locative descriptions can. In orientation descriptions, as illustrated in (16)-(17), the FoR is centered on the figure of the description. It is impossible to project such a coordinate system from the figure's own geometry – in analogy to how object-centered frames are projected from the geometry of the ground – since it is impossible to orient an entity with respect to itself. Orientation necessarily requires an extrinsic viewpoint. However, the Levinsonian intrinsic FoR is still represented in orientation descriptions by direct and landmark-based systems. These indeed make up the lion's share of orientation descriptions in the Yucatec B&C corpus. 75.1% of the orientation descriptions express direct propositions and 10.1% landmark-based ones. The two strategies are illustrated in

(18), a description of the picture reproduced in Figure 10, and (19), a representation of the scene in Figure 11, respectively.

(18) Tu'x k-u=nak-tal máak=o',
where (B3SG) IMPF-A3=lean.against-INCH.DIS person=D2
estée **ta=frèente** súut-ul
HESIT PREP:A2=front turn\MIDDLE-INC(B3SG)
'The back (lit. where one leans against), uh, it's turned **towards your front**.'

Figure 10. Ball & Chair 2.5

(19) (…) u=frèente le=sìiya=o', ti'= súut-ul
A3=front DET=chair=D2 PREP= turn\MIDDLE-INC(B3SG)
tu=tòoh-il **le=kàancha**=o'
PREP:A3=straight-REL DET=court=D2
'(…) the front of the chair, it's turned **toward the volleyball court.**'

Figure 11. Ball & Chair 4.1

4.3 Referential promiscuity

It has been shown above that Yucatec speakers have all types of FoRs distinguished in section 3 at their disposal, with the exception (at least in the community in which the present study was realized) of geomorphic frames. As mentioned above, the absence of geomorphic frames is presumably simply a consequence of the lack of topographic gradients suitable as anchors of such systems and does not indicate a principled restriction. It has also been established that neither the absolute nor the relative type can be said to constitute a default perspective for

Yucatec speakers as a community (while there are both individual speakers who appear to use predominately absolute FoRs and speakers who appear to use predominately relative FoRs). As per the definition in section 1, these two properties together qualify Yucatec speakers as referentially promiscuous. The intrinsic type dominates in both locative descriptions (half of which are object-centered) and orientation descriptions (three quarters of which are direct). However, as argued in section 1, the intrinsic type cannot constitute a default perspective since it is by necessity localized.

Examples (12) and (15) above illustrate one of the hypothetical additional symptoms of referential promiscuity: the pervasive combination of multiple FoRs in a single spatial description. In (12), a relative FoR is paired with an object-centered one; in (15), the combination is landmark-based plus object-centered. Example (20), a description of Figure 12, shows a combination of an object-centered, a relative, and an absolute FoR:

(20) T-u=**tséel**, te=x-**ts'íik** te-estée-le=**chik'in**=o',
PREP-A3=side PREP:DET=F-left PREP:DET-HESIT-DET=west=D2
hun-p'éel bòola yàan=i', ch'uy-k'ah-a'n (…)
one-CL.IN ball EXIST(B3SG)=D4 hang-MIDDLE-RES(B3SG)
'**On the (chair's) side**, **on the left in the, uh, the west**, there is a ball, it is suspended (…)'

Figure 12. Ball & Chair 2.2

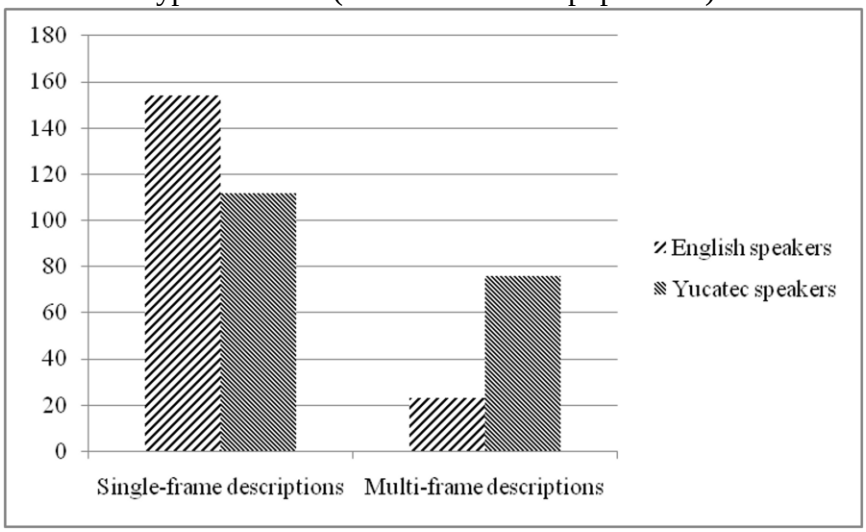
Figure 13 compares the frequencies of descriptions that occurred with at most one type of FoR vs. multiple types in the Yucatec B&C corpus and in one collected with five dyads of University at Buffalo undergraduate students recorded as a pilot in the spring of 2008.[18,19] The difference is striking – multi-frame descriptions were produced almost four times as often by the Yucatec speakers compared to the English speakers. Orientation descriptions split almost exactly the same way as locative descriptions: 28.6% featured multiple FoRs, compared to 32.9% of orientation descriptions.

[18] 9 of the 10 participants of this English pilot were native speakers. However, one was a native speaker of Spanish who started learning English at age 6.

[19] Ambiguous propositions, which are true of a given stimulus picture in multiple different FoRs, and topological propositions are excluded from the breakdown in Figure 13.

It is conceivable that the higher frequency of multi-frame descriptions by the Yucatec speakers is to some extent due to them being less accustomed to the task of producing detailed and highly precise spatial descriptions without sharing a visual field. The English-speaking participants might be more familiar with this task because of their greater familiarity with communication across a distance, be it orally, by phone, or in writing. Indeed, two other referential communication tasks on spatial orientation I have conducted with Yucatec speakers (including the Men & Tree task, whose results are reported in Bohnemeyer & Stolz 2006) have produced comparable evidence of variation. In contrast, several local history narratives and one living space description I collected, where the spatial referents are not present during the recording, but the interlocutors share a visual field and are able to rely on gestures, confirm variability in terms of types used – and thus referential promiscuity – but not in terms of perspective shifts and multi-frame descriptions. This is not unexpected on the view that these properties are merely indirectly related to referential promiscuity, as causal effects produced by referential promiscuity under certain circumstances. To determine whether the perspective shifts and multi-frame descriptions produced by the Yucatec participants in response to the B&C task have anything to do with referential promiscuity at all or are purely an artifact of the task, one needs to compare the performance of the Yucatec speakers to that of speakers of non-promiscuous languages with a similar background in terms of familiarity with the task of communication without visual attention sharing. Such a comparison remains to be carried out, at least in quantitative terms. However, Gabriela Pérez Báez (personal communication) points out that speakers of Isthmus Zapotec overwhelmingly produced single-frame descriptions during the B&C task. There is little reason to suspect that Zapotec speakers from Juchitán, Oaxaca, are significantly more accustomed to remote communication than are Yucatec speakers. The key variable that appears to distinguish the two populations is the reliance on a default perspective by the Zapotec speakers – they predominantly use absolute FoRs. This supports the view that the variability observed in the Yucatec data in terms of perspective shifts and multi-frame descriptions is indeed a product of referential promiscuity.

Figure 13. English and Yucatec B&C locative descriptions employing single vs. with multiple types of FoRs (N = 240 for each population)



5. Results: Frames of reference in recall memory

Before taking a look at the results of the New Animals recall memory experiment, it is worth recapitulating the predictions for a referentially promiscuous language such as Yucatec. New Animals is modeled after the Animals In A Row task (see section 3), which was designed to test the hypothesis that speakers of languages with a strong bias toward relative or absolute frames of reference (FoRs) at the exclusion of the other type tend to memorize spatial configurations in the type of FoR their native languages favor for describing them. The basis for this prediction is the failure of spatial representations to translate across FoRs coupled with unavailability (at least in first approximation) of the relative or absolute type. This rationale does not apply to Yucatec: both the relative and the absolute type of FoRs are available to Yucatec speakers. As pointed out in section 4.1, the use of absolute frames in the horizontal is largely restricted to male speakers. However, there is a many-to-one relationship between reference frames and response types (see section 3): the absolute response type is produced not only by memorizing the array in absolute terms, but also by using a landmark-based or geomorphic FoR, and the relative response type is produced both by coding the array of animals in memory relatively and by coding it directly. And object-centered FoRs, which in the Ball & Chair task proved the most frequent type in locative descriptions, are compatible with both types of responses (and also with responses that shift the orientation of the main axis of the array of animals).

It is clear, then, that there are no predictions for the outcome of this experiment among Yucatec speakers. I did not run the task in order to test the alignment hypothesis, but for purely exploratory purposes, to get some preliminary data on how speakers of referentially promiscuous languages memorize spatial information.

Table 3 assigns to the participants, broken down by age (with an arbitrary cut-off point at 30) and gender, predominant response types. At least three trials have to instantiate a particular type in order for that type to qualify as the predominant type for the participant. No participants produced three relative and three absolute responses (except for 'unidirectional' coders – see below). 'Mixed' means there was no dominant type.[20] 'Unidirectional' coders maintained a fixed orientation of the recall array across trials, i.e., did not apparently encode the orientation of the stimulus array at all.[21]

[20] Of the two participants in this category, one produced two absolute responses, one relative response, one nonaligned one (see below), and two wrong-order trials. The other produced two absolute responses, one relative response, two non-aligned ones, and one wrong-animal error.

[21] The overall distribution of responses across the four response types is significant ($\chi^2 = 8.5$, df = 3, $p < .04$). There are no significant differences by age ($\chi^2 = 2.252$, df = 3, $p > .5$) or gender ($\chi^2 = 2.229$, df = 3, $p > .5$).

Table 3
Cross-tabulation of participants (N = 16) by age group, gender, and predominant response type

Age group	Gender	Predominant response type				Total
		"absolute"	"relative"	unidirectional	mixed	
< 30	male	1	1	0	0	2
	female	3	0	0	1	4
≥ 30	male	3	0	2	0	5
	female	2	1	1	1	5
Total		9 (56.3%)	2 (12.5%)	3 (18.8%)	2 (12.5%)	16

Table 4 below presents a breakdown of the results in terms of individual trials. Here, unidirectional responders' responses are treated as absolute or relative since the unidirectional pattern does not manifest itself at the trial level. Non-aligned responses pattern with the relative type in terms of the animals' facing direction and with the absolute in terms of the representation of their order, or vice versa (both of these variants occurred five times).

Two aspects of the distribution represented in these tables are noteworthy:

- the much greater frequency of absolute compared to relative responses (by a factor of three in terms of trials and by one of four in terms of participants)
- the relatively high frequency of responses that fit neither the absolute nor the relative type.

Table 4
Breakdown by trial

Age group	Gender	Responses in individual trials					Total
		"absolute"	"relative"	non-aligned	wrong order	wrong animal	
< 30	male (N=2)	7	5	0	0	0	12
	female(N=4)	17	1	3	2	1	24
≥ 30	male (N=5)	17	4	4	3	2	30
	female (N=5)	14	8	3	5	0	30
Total		55 (57.3%)	18 (19%)	10 (10.4%)	10 (10.4%)	3 (3.1 %)	96

The second of these features may be seen as a reflection of the salience of the object-centered frame type in Yucatec.[22] Participants who code the order of the animals in purely object-centered

[22] However, only one participant shifted the orientation of the main axis of the array, and only during one practice trial. The participant aligned the axes of stimulus and recall arrays during his test trials even though I did not correct the axis of the practice trial. I assume the reason that more participants did not change the orientation of the array was the reduction in visual similarity this causes.

terms (say, 'The horse is in front of the cow, and the cow is in front of the sheep') and ignore the facing direction are likely to produce unidirectional or nonaligned responses. The first property is in line with, but not explained by, the bias against relative FoRs predicted for languages which make use of geometric meronyms as an important resource of spatial language at the end of section 4.[23] This bias still leaves an apparent mismatch between FoR use in discourse and recall memory: if absolute, geomorphic, and landmark-based frames are uniquely responsible for absolute responses, then the combined role these frame types appear to have played in the New Animals experiment far exceeds their role in the Ball & Chair referential communication task reported on in section 4. The following section is dedicated to discussing possible explanations of this mismatch.

6. Hypothetical accounts of the discrepancy

6.1. Deep geocentric coding

Le Guen (2006) finds the same discrepancy between linguistic and cognitive uses of FoRs in Yucatec based on evidence from a battery of tasks conducted with a substantially larger population of participants (57). Le Guen interprets this mismatch to the effect that Yucatec speakers are fundamentally 'geocentric' (see section 3) thinkers, but that this bias is more strongly expressed in recall memory than in discourse. He points to the role of cardinal directions in ritual practice and horticulture (see section 4), arguing that such non-linguistic cultural practices may induce enculturation in the geocentric style of cognition in Mayan children even as the linguistic input they receive does not suggest such a bias. However, given that the relevant cultural practices are largely gender-specific (see section 3), this account predicts that it is predominantly boys, not girls, who grow up to be geocentric thinkers. And yet, in Le Guen's data as in those presented above, a gender bias in the use of spatial FoRs manifests itself only in language and precisely not in recall memory.

Le Guen (in press) considers a different semiotic medium that may facilitate a language-independent convergence on "deep" geocentric coding in the cognition of Yucatec speakers: gesture. Asked to describe the location of a particular business with respect to a nearby local landmark in a neighboring town, participants relied predominantly on geocentrically oriented gestural representations for the encoding of the spatial relations. The accompanying verbal descriptions referred to these gestures indexically ('The gas station is like THIS, and the shop is like THIS'). This account does not suffer from the gender bias problem: men and women alike produced geocentric gestural representations.

Le Guen argues that Yucatec speakers fail to reflect the bias for geocentric coding in their verbal utterances because the use of cardinal direction terms is much more restricted than that of geocentric FoRs. He assumes that spoken language and gesture form a composite semiotic system in which gesture can pick up the slack, so to speak, for spoken language. On this account,

[23] The two participants who produced predominantly relative responses to the New Animals task (see Table 3) both likely have more exposure to Spanish compared to the other participants. Both are from the (predominantly Yucatec-speaking) village where the present study was carried out; however, one now lives in a nearby town which is linguistically mixed and the other is a migrant worker in the coastal tourism industry. It is conceivable that Spanish and the cultural practices of Spanish speakers were factors influencing these two participants' performance.

Yucatec discourses really do manifest a bias for geocentric representation – but they do so gesturally, not verbally.

The observation of a preference for geocentrically anchored gestural representations of real-space configurations at a certain scale is important and certainly aligns with my own experiences. However, Le Guen's store location descriptions are on a scale at the boundary between manipulable and geographic space, and he fails to show that the preference for geocentric gestures holds for smaller scales. Moreover, the linguistic data remain unexplained and puzzling under Le Guen's proposal. Yucatec speakers frequently produced relative and direct and above all object-centered descriptions during the Ball & Chair task. At least while planning these utterances, the participants must have mentally encoded the scenes they were about to describe in relative, direct, or object-centered terms, not in geocentric ones, since representations are not equivalent or mutually translatable across these different types of FoRs (see section 1). But why were the participants thinking about the scenes in question in relative, direct, or object-centered terms if they are fundamentally geocentric thinkers, as Le Guen claims? It cannot have been language that forced them to deviate from geocentric coding! A reviewer suggests that the participants' inability to rely on gesture may have pushed them to use other frames. However, the participants did in fact gesture intensely throughout the task – their co-participants were merely unable to see these gestures. If the participants mentally encoded the stimulus configurations in geocentric terms, nothing would have prevented them from gesturally representing the configurations in geocentric terms as well. They could have then in addition provided geocentric verbal descriptions, relying, if not on cardinal direction terms, on landmark-based FoRs, which are likewise geocentric. Yet, they did so in just 2.6% of locative descriptions and 10.1% of orientation descriptions. This seems inexplicable under Le Guen's proposal.

6.2. Deep referential promiscuity

The alternative I wish to consider now is that Yucatec speakers are not fundamentally geocentric thinkers, but are cognitively just as referentially promiscuous as they are in their use of language. Under this hypothesis, the preferences for geocentric coding manifest in the New Animals task and in Le Guen's (in press) gesture data are task-specific. What might induce Yucatec speakers to prefer geocentric FoRs in the New Animals recall memory experiment and in gestural representations of real-space entities at a sufficient scale, but direct and object-centered frames in the B&C task? As discussed in section 4, three quarters of the orientation descriptions in the B&C corpus are direct, and half of the locative descriptions are object-centered. Of course, any accounts of these distributional differences have to remain hypothetical until more data become available.

An important factor that may account for the pervasive use of direct FoRs to describe the orientation of the chair in the B&C task is that speaker and addressee in this task have vantage points that are functionally identical for the purposes of the task: the participants are seated side by side, facing in the same direction, and the photographs in front of them give them the fixed angle of the camera onto configurations that are "frozen" in the image space. As mentioned in section 4.2, orientation descriptions require an extrinsic anchor. The participants' bodies are simply the closest and most convenient entities to serve in this function. Evidence in support of the conjecture that it is specifically the interchangeability of the participants' perspectives that affords the high frequency of direct descriptions is the constant switching back and forth between

1st-person singular (speaker's body as anchor), 2nd-person singular (addressee's body), and 1st-plural (speaker and addressee's bodies combined as anchor) in the direction descriptions.[24]

In contrast, both the New Animals recall experiment and Le Guen's store location descriptions involve a misalignment of perspectives – between the participant and the researcher. The store location descriptions are framed for the researcher's benefit – that is how they are solicited. In the recall experiment, the participants presumably view the researcher as the judge of the correctness of their reproductions of the arrays. In both contexts, speakers of predominantly relative languages such as English would "naturally" assume an egocentric perspective, taking it for granted that the person they interact with – the researcher – will "automatically" adjust for the subjectivity of their viewpoint. However, I see no reason to assume that this is true for Yucatec speakers as well. The relative frame type is not a default perspective for them – they in fact lack a default perspective. Instead, it seems that the habitual response to this kind of interactional context among Yucatec speakers is to assume a neutral – as far as personal viewpoints go – geocentric perspective.

Additional evidence for task-specificity comes from a comparison between Yucatec and Mopan, a close cousin from the same branch of the Mayan language family spoken in Belize. In discourse, Mopan speakers use exclusively intrinsic FoRs in the sense of Levinson (1996, 2003). This includes, aside from object-centered frames, landmark-based, direct, and, to some extent, geomorphic frames (Eve Danziger, personal communication), but of course excludes relative and absolute FoRs. Danziger (2001) reports on the results she obtained with the Animals In A Row design, the predecessor and model of New Animals (see section 3). She initially obtained results from four participants, of whom three used a unidirectional coding strategy and two changed the axis of the array of animals. Danziger then

> (…) altered the protocol, and started asking explicitly that consultants pay attention to the orientation of the animals. In the absence of any direct way of expressing this in Mopan I asked consultants, in the initial instruction, to pay attention to the identity of the animals (horse, pig, cow) and also to notice *tub'a tun-cha'an* [where they are looking] (Danziger 2001: 212).

Nine of 17 participants who performed under this modified protocol produced an absolute response pattern and three a relative one. Danziger then tried a third condition, under which she asked the participants to pay attention to 'how', instead of 'where', the animals were looking. Of 12 participants who performed under this protocol, nine produced an absolute response pattern and none a relative one.

Just as in Danziger's Mopan data, I assume that the prevalence of absolute or geocentric responses to certain tasks among Yucatec speakers is due to the speakers' interpretation of these tasks and to their contextual conditions and does not reveal a deep cultural bias towards absolute or geocentric frames of reference.

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[24] This does not yet explain the high frequency of object-centered descriptions. The bias for non-relative FoRs mentioned above is expected to play a role here. In addition, it could be that once a speaker decides to forego relative and absolute frames for orienting the chair, it becomes more efficient to not invoke these frame types for the location of the ball vis-à-vis the chair either given that the chair affords the application of object-centered frames. A correlation test between orientation and location types should clarify this issue.

7. Summary

Yucatec Maya has been presented as a referentially promiscuous language in this article. Such languages have been argued to share with languages in which exclusively intrinsic frames of reference (FoRs) are used the lack of a default type of frame, i.e., a type of frame that can be used as a general-purpose solution across contexts and speech situations. Only relative and absolute types of frames can be used as default perspectives. Referentially promiscuous languages differ from intrinsic-only languages in that their speakers (or at least some of their speakers) in fact use absolute and relative FoRs. However, they merely use them as two more strategies in addition to the several different types of strategies subsumed under the broad 'intrinsic' category of Levinson (1996, 2003).

In line with the referentially promiscuous type of the language, all types of frames of reference occur regularly in Yucatec discourse, including in the domain of manipulable space. The use of cardinal direction terms is restricted to adult males. FoR selection in Yucatec is highly variable, both across and within speakers. All speakers frequently combine multiple FoRs in a single spatial description. Object-centered and direct FoRs are the most frequent in discourse with all speakers. Even terms for relations in the vertical are regularly used intrinsically, suggesting that the Principle of Canonical Orientation is no more than a tendency in Yucatec. The relatively minor role of relative FoRs supports the hypothesis that languages in which geometric (shape-based) 'meronyms' (object part descriptors) are a pervasive resource for the expression of projective spatial relations favor intrinsic and/or absolute FoRs over relative ones.

Participants of a spatial recall memory task predominantly produced responses in line with absolute or geocentric coding. Le Guen's (2006, in press) proposal that Yucatec speakers are fundamentally geocentric thinkers and that their native language fails to properly reflect this bias has been considered, but was not adopted. An alternative account was sketched according to which the preferences observed in certain non-linguistic tasks may be the product, not of a deep cultural bias in favor of particular types of FoRs, but of task-specific effects and interactional conventions. A comparison to Danziger's (2001) observations with Mopan speakers lends support to this conjecture.

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