Language Sciences 33 (2011) 915–942

Contents lists available at SciVerse ScienceDirect

Language Sciences

journal homepage: www.elsevier.com/locate/langsci

Frames of reference and topological descriptions in Ayutla Mixe

Rodrigo Romero-Méndez *

Seminario de Lenguas Indígenas, Instituto de Investigaciones Filológicas, Universidad Nacional Autónoma de México, Circuito Mario de la Cueva, Ciudad Universitaria, D.F. 04510, Mexico

ARTICLE INFO

Keywords:
Spatial reference frames
Ayutla Mixe
Topological relations

ABSTRACT

This paper presents the first account of the use of frames of reference (FoR) in Ayutla Mixe, a Mixe-Zoque language spoken in Southern Mexico. A referential communication task was conducted with five pairs of native speakers in order to locate a figure with respect to a ground. In addition to presenting the expression of FoRs in Ayutla Mixe and their frequencies, two main issues are discussed here. One is the difference between projective and non-projective relations and the other is the difference between landmark-based and direct FoRs, particularly when the anchor is a speech act participant.

1. Introduction[1]

There are two basic ways of describing the location of a **figure**, the entity being located, with respect to a **ground**, the reference object (Talmy, 1985, p. 61): one is to use topological, i.e. non-projective relations, and the other is to use spatial frames of reference (FoRs), i.e. projective relations. In this paper I discuss FoRs and topological relations in Ayutla Mixe (AyMi), a language of the Mixe-Zoque family spoken in Southern Mexico. However, the main goal of this paper is to describe and discuss the use of FoRs in Ayutla Mixe and, secondarily, to contrast them with topological relations. This is important because, unlike other Mesoamerican languages, particularly Mayan languages (Brown and Levinson, 1993; Danziger, 1996; Levinson, 1996; Brown and Levinson, 2004; Bohnemeyer and Stolz, 2006; Brown, 2006) and two Zapotec languages (Lillehaugen, 2006; Pérez Báez, in press), to date there are no published accounts of FoRs for AyMi or any other Mixe-Zoque language.

The present study is part of a larger collaborative project, called *Spatial language and cognition in Mesoamerica* or MesoSpace (P.I. Jürgen Bohnemeyer; NSF Award No. BCS-0723694), dedicated to the investigation of spatial representation and cognition in Mesoamerican languages (for a broader description of the project, see O'Meara and Pérez Báez, 2011). Some of the results of this paper are compared to other articles in this special issue, which were also written in the context of MesoSpace.

It has been recognized that when locating a figure with respect to a ground one of the strategies we use is to take a perspective from a reference point (see, for example, Levinson, 2003). In this way, it is possible to divide the space into different

Abbreviations: 1,2,3, first, second and third person, respectively; S, subject of an intransitive verb; A, subject of a transitive verb; O, object of a monotransitive or a ditransitive verb; APPL, applicative; ADJN, adjunct; CAUS, causative; CMPLZ, complementizer; DEIC (.P/.M./D), adverbial demonstrative, proximal, medial, and distal, respectively; DEM(.P/.M/.D/.C), adnominal or pronominal demonstrative, proximal, medial, and distal, respectively; DEP, neutral dependent aspect-mood; DIR, directional; DISC, discursive marker; INCL, inclusive; INCH, inchoative morpheme; INDEP, neutral independent aspect; INV, inverse; LOC, locative; M.DEM, manner adverbial demonstrative; NOM, nominalizer; ORD, ordinal; PERF, perfect aspect; PERD, perdurative; POSS, possessive prefix; Q, polar question clitic; SG, singular.

* Tel.: +52 55 5622 7489.
E-mail address: rrmz@unam.mx

[1] *NB:* In many cases a fine grain morphological analysis is not relevant. In such cases, I will use "+" to indicate a formal boundary that I am not analyzing.

0388-0001/$ - see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.langsci.2011.06.006

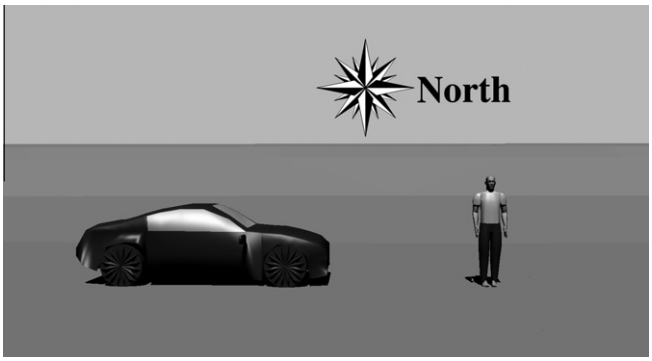

Fig. 1. Projective description.

sectors, and a coordinate system or frame of reference emerges. So, for example, if someone says that *A cat is to the left of the car*, one possible interpretation comes from the speaker projecting an angle from her body onto the car, and based on that the addressee can determine the direction in which the cat is from the car. As will become clearer in a moment, one of the main characteristics of a coordinate system is that the truth conditions are dependent on one of three things: the configuration of the ground, the speaker's perspective, or the configuration of the whole scene (although see Danziger, 2010). Levinson and other scholars have pointed out (Pederson et al., 1998; Levinson, 2003; Levinson and Wilkins, 2006; among others) that using terms such as 'right' and 'left' is not the only option; one could also say that a person is in front of the car when one is facing the side of the car, as in Fig. 1. In fact, it is also known that not all cultures and languages take the same perspectival viewpoint (or at least not all of them or not preferentially). Thus, while in English it is common to say that the person is to the left of the car, speakers of Arrernte (Wilkins, 2006) or Warlpiri (Laughren, 1978, p. 2), in Australia, would say that the person is to the north of the car, as in Fig. 1.

In the traditional Levinsonian FoR classification (Pederson et al., 1998; Levinson, 2003), there are three frames of reference: intrinsic, relative and absolute. In an **intrinsic** FoR the angular system is based on a projection from the ground's features, such as 'back' in 'The cat is to the back of the car'. A **relative** FoR is based on projection from the observer's body and depends on the speaker's perspective, as in 'The cat is to the left of the car'. An **absolute** FoR consists of fixed angles abstracted away from environmental features, such as a mountain slope, the direction of the winds or cardinal coordinates. For example, 'The cat is north of the car' involves an absolute FoR. In absolute and intrinsic FoRs, the speaker's perspective is not involved. In this study, and in the MesoSpace project in general, we are using a more fine-grained classification of FoRs, which is defined shortly. For the time being, suffice it to say that some of the FoRs which are considered in the MesoSpace classification are included in the FoR class that Levinson calls "intrinsic" (for a more detailed comparison across different classifications see Bohnemeyer, 2011 and O'Meara and Pérez Báez, 2011).

Danziger (2010) proposes a four-way organization and, in addition to absolute, relative and intrinsic ("object-centered" in her terminology), she distinguishes **direct** FoRs. In these FoRs, a speech act participant (SAP) is the reference point that serves to locate the figure, without mentioning another entity. A key motivation for distinguishing more than three types of FoRs is the identification of not one but two "reference points" involved when computing perspectives, which, in some types of FoRs, correspond to the same entity. In addition to the ground object, i.e. the object with respect to which the figure is located, there is an **anchor**, which is "the zero point from which the vector is calculated that narrows the search space from Ground to Figure" (Danziger, 2010, p. 168). The idea of anchor roughly corresponds with one of Levinson's primitives necessary for the description of FoRs in general, which he calls the "anchor point" (Levinson, 1996, p. 140; Levinson, 2003, p. 39). Both the ground and anchor are different types of "grounds" in a broad sense, but only insofar as both of them are reference points.[2] The main advantage of differentiating between ground and anchor is that it allows for a more refined classification of FoRs. In a relative description such as 'The ball is to the right of the chair', the ground is the chair but the anchor is the speaker's body (Fig. 2). However, in a direct description, such as 'The ball is in front of me', the speaker's body is both the ground and the anchor (Fig. 3). As described below, in a geomorphic description such as 'The ball is toward the hill from the chair', the ground is the chair and the anchor is the hill (Fig. 4). In contrast, in an intrinsic description such as 'The ball is in front of the chair', the chair is both the ground and the anchor (Fig. 5).

In addition to locating a figure with respect to a ground and an anchor, as in 'The ball is to the left of the chair', FoRs are also used to orient a figure with respect to the anchor, as in 'The chair is facing left'. This is important as the data in this study were coded for orientation as well as location (see Section 3). Notice that the same truth conditions for FoRs apply when orienting a figure as when locating it. Both 'The ball is to the left of the chair' (from the speaker's perspective) and 'The chair is facing left' become false if the speaker rotates 180°. While all types of FoRs can be, in principle, used to locate a figure with respect to a ground, it is hard to imagine situations in which a figure is oriented intrinsically, that is, with respect to itself.

[2] The anchor can be seen as one of the types of what Talmy (2000, p. 203) calls "secondary reference object."

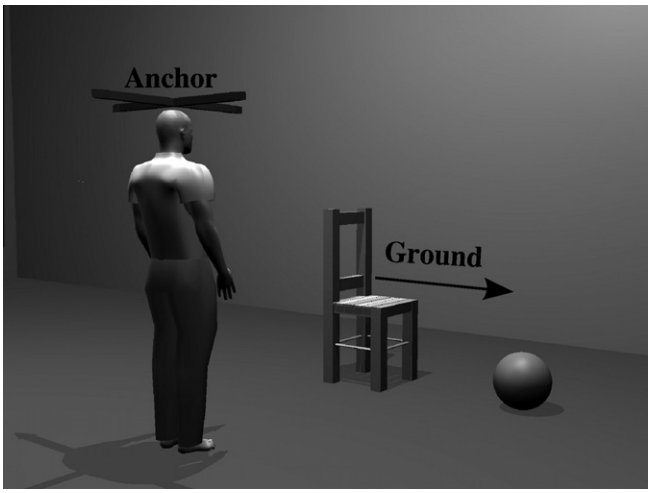

Fig. 2. Anchor and ground in a relative FoR.

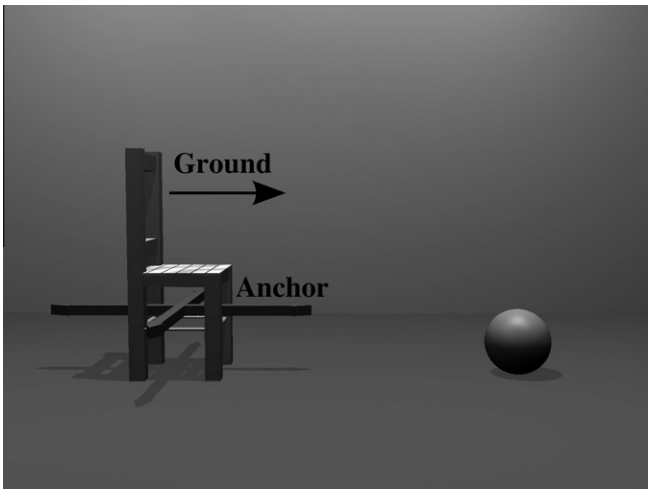

Fig. 3. Anchor and ground in a direct FoR.

The definitions of FoR types used in this paper are roughly the same as those presented in the MesoSpace FoR classification (see O'Meara and Pérez Báez, 2011), although slightly more restricted. In this paper, the FoRs used in coding and describing the AyMi data are defined as follows.

- **Relative**. The anchor is the observer's body and the ground is the entity with respect to which the figure is located, and the speaker projects her body's axes onto the ground. The truth conditions depend upon the orientation and location of the observer. Examples: 'The chair is facing left', 'The ball is to the left of the chair'.
- **Direct**. In this FoR a SAP is both the anchor and the ground. Typically, the anchor is not the whole body, but only part of it, as in 'The ball is in front of me'. Notice that there is no projection of the SAP's body onto the ground, as in a relative FoR. The truth conditions depend upon the orientation and location of the SAP.
- **Intrinsic**. The entity that serves as reference point is both the ground and the anchor. The angular system is based on salient features of the reference point, such as the front, the back or any other part. The truth conditions depend on the orientation of the reference point. Example: 'The ball is in the front of the chair'. This type of FoR is what Danziger (2010), O'Meara and Pérez Báez (2011), and Bohnemeyer (2011) call ''object-centered''.
- **Geomorphic**. The anchor is a gradient provided by a landscape feature such as a mountain or a river, and the ground is the origin of the coordinate system. The truth conditions depend on the orientation of the whole landscape feature. Example: 'The chair is facing upriver', 'The ball is toward the shore from the chair'.

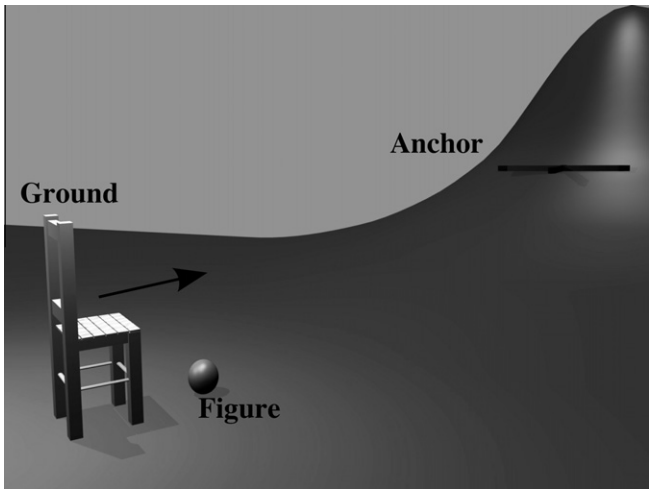

Fig. 4. Anchor and ground in a geomorphic FoR.

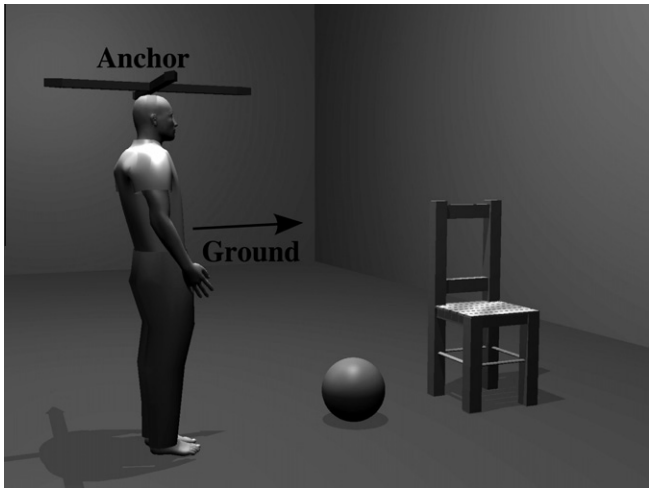

Fig. 5. Anchor and ground in an intrinsic FoR.

- **Landmark-based**. The anchor is a natural or manmade feature in the environment, such as a house, a tree, etc., or even a person. The ground is the origin of the coordinate system. The truth conditions depend on the orientation and location of the chosen landmark. Examples: 'The ball is toward the window from the chair', 'The chair is facing that guy'.
- **Absolute**. The anchor is based on angles abstracted from the environment. Again, the ground is the origin of the coordinate system. Here, the absolute system is restricted to the horizontal plane. Examples: 'The chair is facing north', 'The ball is to the south of the chair'.
- **Vertical**. This is in fact an absolute FoR but in a vertical axis aligned to the Earth's gravitational field. This FoR is classified as separate from the absolute FoR because it seems that all cultures use an absolute system in the vertical plane but not all cultures use an absolute system in the horizontal plane. Example: 'The ball is up in the air'.

The main divergence between the definitions presented above and the definitions in O'Meara and Pérez Báez (2011) is in the difference between the direct and landmark-based FoRs. Here, I adopt a definition of direct closer to Danziger (2010), where the anchor has to coincide with the ground and has to be a SAP. The definition of the direct FoR in O'Meara and Pérez Báez (2011) is rather underspecified with respect to whether the anchor has to be (part of) the ground. Also, the definition of landmark-based FoRs in O'Meara and Pérez Báez (2011) does not explicitly include cases where a person acts as the anchor. In the definition above, however, a person can indeed be the anchor in a description using a landmark-based FoR. More information on the difference between direct and landmark-based FoRs is provided in Section 4.5.

There are some points worth mentioning with respect to the assignment of the anchor and the ground in geomorphic, landmark-based and absolute FoRs (as per the MesoSpace terminology). In an absolute FoR à *la* Levinson, the ground is the origin and the anchor point is a "conceptual slope" (Levinson, 2003, p. 50). Similarly, in Danziger (2010, p. 169), the

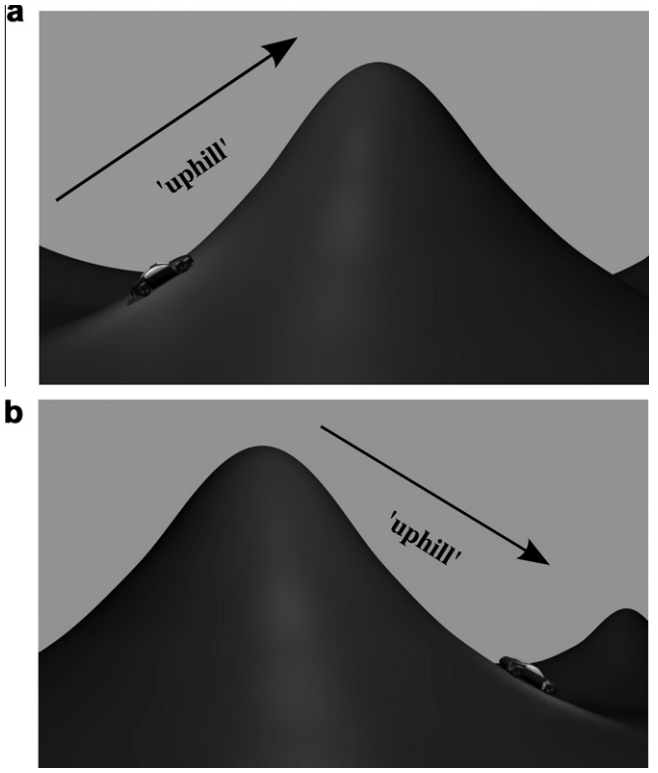

Fig. 6. Denotation of 'uphill' in an absolute system. (a) Compatible with a geomorphic and an absolute system. (b) Compatible only with an absolute system.

anchor is "located in the landscape or the cosmology surrounding the Figure-Ground scene." In Bohnemeyer (2011), there is a similar distinction, where the anchor is the "third" object, not the chair or the ball in descriptions such as *The ball is toward the door from the chair*. Notice that the ground is not the mentioned entity, i.e. the door or the river, in descriptions such as *The ball is toward the door (from the chair)* or *The ball is toward the river (from the chair)*. Rather, as stated in the FoR definitions listed above, the ground entity is in fact the origin of the coordinate system. In Danziger's (2010) classification of FoRs there are two parameters at work: whether the anchor and the ground are the same entity or not, and whether the anchor is a speech act participant or not, which consequently results in a quaternary classification, which is depicted in Figs. 2–5 above.

A geomorphic, a landmark-based and an absolute FoR can easily be misidentified. In fact, Li and Gleitman (2002) and Li et al. (2005) group these three FoRs together under the geocentric label. The main difference between an absolute FoR and the other two FoRs is that only in the first case the coordinate system is abstracted away from the environment. A geomorphic FoR is rather similar, but the coordinate system is contingent on the environmental features and no abstraction is involved in this FoR. Thus, according to Levinson (1996) a term like *ajk'ol* 'uphill' in Tseltal in example (1) is used not only when the speakers are on the "uphill" side of the slope, as in Fig. 6a, but also when they go further, to the other side of the hill, as in Fig. 6b, showing the use of an absolute FoR. In a geomorphic FoR, this would not apply and only in Fig. 6a would the term be correctly used, once speakers go beyond the tip of the hill, to the other side, they would automatically go downhill. The same problem arises for a landmark-based FoR, for there is obviously no abstraction from the surroundings. While a landmark-based FoR is presumably available for all cultures and languages, not all of them use an absolute FoR descriptions of objects in table-top space (Levinson and Wilkins, 2006; Bohnemeyer, 2011).

(1)	*waxal*	*ta*	*y-ajk'ol*	*xila*	*te*	*limite*
	standing	at	its-uphill	chair	the	bottle
	'The bottle is uphill of the chair.' (From Levinson, 1996, p. 112)					

In order to avoid further confusion, bear in mind that the term 'intrinsic' for Levinson (1996, 2003) comprises the following FoRs in the present study: direct, geomorphic, landmark-based, and intrinsic (or object-centered). The scope of the terms 'relative' and 'absolute' remain more or less the same in comparison with Levinson. On the other hand, the term 'egocentric' for Li and Gleitman (2002) and Li et al. (2005) would include relative and direct FoRs as they are defined in this study.

In addition to FoRs, it is possible to locate a figure with respect to a ground in topological terms.[3] Topological relations are those of proximity, containment, contact, and support (see Levinson and Meira, 2003 for a more detailed discussion). The main point here is that topological descriptions are perspective free. Thus, if I say *The ball is at the chair's leg*, it does not require the use of a coordinate system, i.e., it is not necessary to project an axis from the leg in order to understand the sentence.

This article is organized as follows: Section 2 presents some information regarding general grammatical characteristics of AyMi as well as sociolinguistic and geographical information concerning the language, its speakers and where AyMi is spoken. In Section 3 the data collection, methods and coding are explained, with particular attention to expressions that are vague with respect to at least two interpretations. The results on FoR preferences in AyMi are presented in Section 4; in addition, a discussion of some problematic issues with respect to FoRs is also presented in Sections 4.3, 4.4, 4.5. The results with respect to the use of topological descriptions for the localization of a figure with respect to a ground are discussed in Section 5. Section 6 summarizes the main points covered in the article.

2. The language

Ayutla Mixe is a language of the Mixe branch of the Mixe-Zoque linguistic family. Mixe languages are spoken in the state of Oaxaca, in Southern Mexico, as shown in Fig. 7. Strictly speaking, the Mixe branch of the family also includes Olutec and Sayultec, also known as Oluta Popoluca and Sayula Popoluca, which are spoken in the state of Veracruz, also in Southern Mexico (Clark, 1962, 1981; Wichmann, 1993; Clark, 1995; Zavala Maldonado, 2000; *inter alia*), as well as Tapachultec, now an extinct language that was spoken in the state of Chiapas. However, the Oaxacan Mixe languages form a close cluster of languages (Wichmann, 1995).

AyMi is spoken in the municipality of San Pedro y San Pablo Ayutla Mixe. Wichmann (1995) groups AyMi together with Tlahuitoltepec, Tamazulapam, Tepuxtepec, Tepantlali, and Mixistlán Mixe as part of South Highlands Mixe. However, I have previously argued that each community has a different linguistic system or *communolect*,[4] and it is necessary to study each of them separately. There is a dialectal continuum among all Oaxaca Mixe communolects where each variety presents some grammatical and lexical variations with respect to surrounding varieties, and the farther apart the dialects are, the more different they are.

In general, Mixe-Zoque languages are largely understudied, even in comparison with other Mesoamerican languages. Important grammatical descriptions and vocabularies of Mixe languages include Romero Méndez (2009) for Ayutla Mixe, Schoenhals and Schoenhals (1965) for Totontepec Mixe, Hoogshagen and de Hoogshagen (1993) for Coatlán Mixe, Clark (1981) for Sayultec and Zavala (2000) for Olutec. As for the Zoque branch of the family, one could mention Elson (1960), Johnson (2000), Boudreault (2009), Wonderly (1951a,b,c,d, 1952a,b), Clark (1995), Harrison and de Harrison (1984), Engel and de Engel (1987), and Wichmann (2002) for grammars and vocabularies. In recent years there has been a renewed interest in Mixe languages but most of the published works include phonological or morphological accounts (Jany, 2006; Herrera Zendejas, 2006; Reyes Gómez, 2009; Herrera Zendejas, 2010; Aguilar Gil and Arellanes Arellanes, in press, among others). Thus, it is not surprising that there are no published accounts of the use of FoRs in Mixe languages.

Ayutla Mixe is a polysynthetic language and verb stems can contain more than one verb root (in core verb serialization). Also, verb stems can have non-verb roots, in the cases of noun incorporation (both arguments and non-arguments) and adjective incorporation. Most of the morphological complexities happen in the verb, as it is a head-marking language. There is only one slot for person markers in the verb, and in monotransitive and ditransitive verbs only one argument is cross-referenced. Since it has an inverse system, the agreement is not in terms of grammatical relations but in terms of a person hierarchy, which is roughly: 1 > 2 > 3 animate > 3 inanimate (see Romero Méndez, 2009 for a full explanation). When the object is higher in the hierarchy than the subject, it is the former, not the latter, that is marked on the verb. That is why in example (2) the first person object is marked on the verb, not the third person subject. This happens in direct FoRs, as the anchor, a first person, outranks the figure, a third person, in the person hierarchy.

(2)

Nayte'n	*yë' tsënapyajt ëjts xjën'ejxp.*[a]			
nayte'n	yë'ë	tsëën-nay-pajt	ëjts	x-jën-ex-p
also	DEM.M	sit.down-PERD-LOC	1SG	1O[INV]-front-see-INDEP

'The chair is looking at me as well.' (B&C 1–4 MJ)[b]

[a] AyMi is written using the more accepted orthography for Mixe languages (see Reyes Gómez, 2005). Vowels are written as «a, e, i, o, u, ë ([ɨ]), ä ([ʌ])». All vowels can appear in seven syllabic nuclei, exemplified with «a»: «a, aa ([a]), aj ([aʰ]), aaj ([aːʰ]), a' ([aˀ]), a'a ([aˀa]), a'aj ([aˀaʰ])". Consonants are written as «p, t, k, '([ʔ]), x ([ʂ]), j ([h]), ts, m, n, l» and, marginally, «s». There is no contrast between voiced and voiceless vowels in AyMi. In the Mixe orthography the glottal stop is not written in initial position. For instance, *m'ejxp* 'you see' is written with the glottal stop but *ex* 'see!' or *ejxp* 'I see/he sees' is written without it.

[b] In the examples and figures, B&C stands for "Ball and Chair", the referential communication task, and the numbers indicate the picture numbers (see Section 3). The last two letters in the examples are a code that identifies the participants. If the example does not have B&C, it comes from a source different from the Ball and Chair elicitation task.

[3] Following Piaget and Inhelder (1956), not in mathematical terms.

[4] "Roughly, each community forms a *municipio* (or county), although some *municipios* might have more than one community. Regarding the Mixe area, I understand for 'community' a group of people who live in a defined geographical area, who interact regularly with each other (with respect to trade, religious practices, and civil duties), who form a cluster of kin relationships, and who, most importantly, have a proper identity, considering themselves different from other Mixe communities" (Romero Méndez, 2009, p. 2).

Fig. 7. Location of Ayutla Mixe. From Romero Méndez (2009, p. 4).

In Mixe languages all verbs are conjugated as independent or dependent, and there are two sets of both person prefixes and aspect-mood suffixes to do this. Despite what the terminology might suggest, inflectional dependency has nothing to do with subordination, as a matrix verb can be conjugated as dependent and verbs in subordinate clauses can be conjugated as independent. The inflectional dependency is triggered by the presence of certain words in the clause, such as aspectual or temporal particles, locative adverbials, and conjunctions, among others. Verb conjugations are marked by AM suffixes and by verb apophony (Romero Méndez, 2009). For example, a verb like *men* 'come' is conjugated in the third person as *memp* 'he comes', for neutral independent aspect, *me'mp* 'he come (subjunctive)', for irrealis independent mood, and *meen* 'he came', for perfective aspect.

Ayutla Mixe has a rich morphology for coding spatial relations, which includes locative and directional prefixes but also core verb serialization. There is a special class of bound morphemes that can either appear in the verb as prefixes or can be the head of ground-denoting phrases, as explained in Section 4.1. They are of special interest in this paper as they play an important role in expressing projective and topological descriptions.

Sociolinguistic and geographical conditions might be of relevance in the study of FoRs (see, for example Majid et al., 2004). Most of the Ayutla population consists of bilingual speakers and it is possible that there is Spanish interference in the use of relative FoRs (as discussed in Section 4.3). As of 2005, 93.7% of the population 5 years or older in Ayutla speaks Mixe, of which 23% (around 900) are monolingual speakers of Mixe. Even though those figures alone do not seem dramatic, this contrasts with the situation fifty years earlier, when 84% of the population was monolingual and only 15% was bilingual. According to the 1900 census, all people spoke Mixe in Ayutla. By 1930 around 80% of the population was monolingual, a situation that persisted until 1960. Since 1970, however, there has been a continuous decline in the number of monolingual speakers.[5]. If this tendency is not changed, AyMi will disappear within two generations. As for the geographical conditions in which AyMi is spoken, Ayutla is located in the mountains, in the southern part of the *Sierra Mixe* or Mixe Mountain Range, which constitutes part of the *Sierra Norte de Oaxaca*, and is located at 17°01′40″N and 96°04′33″W. The main town is on average 2080 m above sea level, but the entire county has parts ranging between 1000 m above sea level in the northern corner of the county to 2800 m above sea level in the east. It is important to take into consideration the geographical setting as it has been suggested that local landmark cues might influence the use of certain FoRs (Li and Gleitman, 2002). It would be of interest, therefore, to know whether across Mesoamerica, speakers of different languages spoken in similar geographical conditions also use absolute FoRs, especially in light of the extensive use of absolute FoRs in Tseltal (Levinson, 2003; although see Polian and Bohnemeyer, 2011, for a different account).

[5] Sources: Secretaría de Fomento (1906), Secretaría de Hacienda (1918), Departamento de la Estadística Nacional (1927) and Dirección General de Estadística (1930, 1948, 1950, 1963, 1971).; Instituto Nacional de Estadístca Geografía e Informática, 1984, Instituto Nacional de Estadística Geografıa e Informática, 1992, 1996, 2002, 2005.

3. Data collection, methods and coding

The research reported here was conducted in the fall of 2008, in the town of San Pedro y San Pablo Ayutla Mixes. In order to study the use of spatial frames of reference (FoRs) in table-top space, an elicitation task was developed by the MesoSpace team called the Ball and Chair (B&C) referential communication task, which consists of four sets of photographs with 12 pictures each (Bohnemeyer, 2008). The pictures show a ball and a chair in different configurations (examples are shown in Section 4). B&C is a photo-to-photo matching task that requires that two participants have a copy of the same set of pictures. The participants are seated side by side at a large table, but there is a screen between them so that they cannot see each other's pictures. Each picture set is placed in front of each of the participants in a 3×4 arrangement, in a semi-random order. One speaker, the director, picks up a picture and describes it, while the other speaker, the matcher, tries to select the same picture from within the set. The matcher can ask clarification questions. The conversation goes on until the matcher proposes a picture, and the researcher tells them whether they chose the same picture or not. If they did, a little coin was put on the director's pictures; if they did not, the game continues until the selected photo is picked. In a few cases where it was clear that they did not reach an agreement after several attempts, they were told to compare the pictures and discuss what went wrong. More information regarding the methodology followed in the context of MesoSpace is provided in O'Meara and Pérez Báez (2011).

The task was run with five pairs of speakers of different ages. Three speakers were male and seven were female, and they were in their 20s though 60s. All of them were born in Ayutla, and all of them were bilingual speakers whose first language is Mixe and whose second language is Spanish. The sessions were audio and video recorded in digital format. For the audio recording, each speaker had a microphone, while the camcorder was in front of the participants to ensure that paralinguistic information was captured.

The transcription was made in Transcriber with the assistance of a native speaker consultant. Part of the data was transcribed in Ayutla in the fall of 2008 and the rest in Mexico City throughout 2009. Spatial descriptions were coded for six categories of information:

- Disposition of the chair ('standing', 'lying on the side').
- Orientation of the chair in the horizontal vertical planes.
- Location of the chair in the picture ('on the ground', 'near the wall (in the picture)').
- Disposition of the ball.
- Location and orientation of the ball with respect to the chair.
- Location of the ball in the picture ('in the air', 'on the ground').

The orientation of the chair, the location of the chair in the picture, the location and orientation of the ball with respect to the char, and the location of the ball in the picture were coded with respect to the FoR types described in Section 1 and for topological relations. The coding of relators was done by type, not by token. In other words, for each picture, each expression was coded only once for the FoR it expresses, even if the expression was repeated multiple times. In (3) the speaker repeats twice the part-naming morpheme (see Section 4.1) *ëx* 'back' and thus the expression *ëxkë'ë − py/ − y* 'behind' was counted as only one instance of an FoR.

(3) *Mëmajtsk, tënaapy yä'ät siiya, ës yäjp* ***yëxkë'py****, pelota kyonn.*

më-majtsk	tënay-p	yä'ät	siiya	jëts	yäjp	y-**ëx**-kë'ë+py	pelota
ORD-two	[3S]stand-INDEP	DEM.P	chair	and	DEIC.P	3POSS-back-LOC	ball
y-kon-n							
3S-be.small.object-PERF;DEP							

'The second one, the chair is standing, and behind it there is a ball.'

Ku tu'uk siiy... tyan, jëts ***ëxkë'ëjy*** *pelota kyonn.*

ku	tu'uk	siiy	y-tan	jëts	**ëx**-kë'ë+y	pelota	y-kon-n
CMPLZ	one	chair	3s - stand[INCH;DEP]	and	back-LOC	ball	3S-be.small.object-PERF;DEP

'That the chair is... standing, and behind it there is a ball.' (B&C 1–7 GL)

3.1. Polysemy and vagueness

Many descriptions are ambiguous, or even vague, between two or more interpretations. This is the case in many languages, including English. Thus, if one says in English the sentence provided in (4), it is possible to interpret it in two ways: a direct interpretation in which the ball is in front with respect to the speaker, i.e. between the speaker and the chair, as in Fig. 8a, or an intrinsic interpretation in which the ball is in front with respect to the chair, as in Fig. 8b.

(4) *The ball is in front of the chair.*

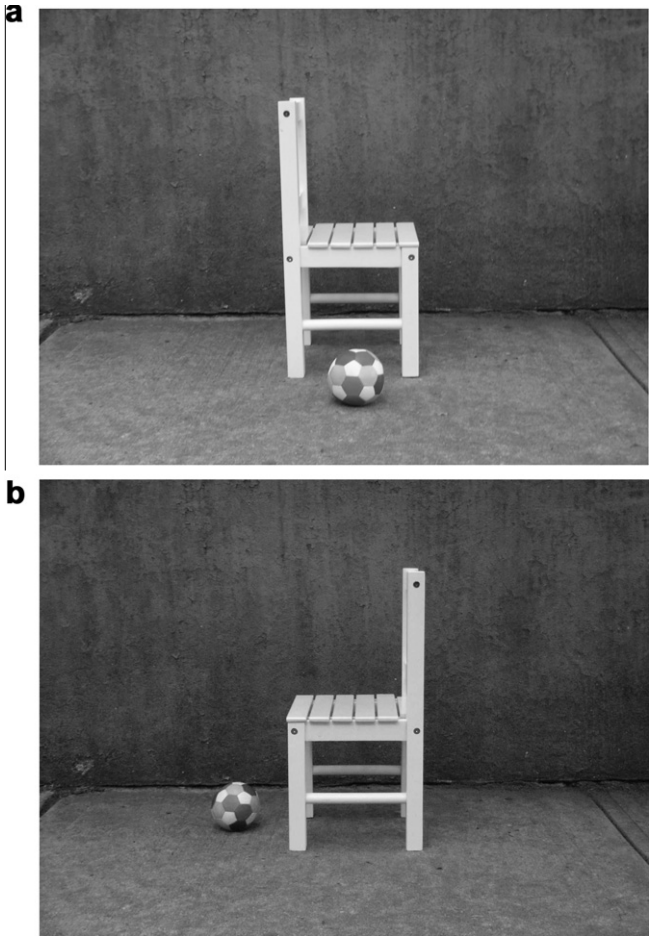

Fig. 8. Ambiguity for 'front'. (a) B&C 3–10, (b) B&C 3–12.

In example (4) the two interpretations correspond to different truth conditions and if someone describes Fig. 8a with the utterance in (4), there is no doubt she is using the expression following a direct FoR. There are other cases in which the same expression could have two interpretations and both interpretations correspond to the same (sub) set of truth conditions. In some of those cases, there is a default interpretation that can be determined independently of the B&C task, which solves the problem. This happens with expressions containing part-naming morphemes in Mixe, which can be explicitly marked for possession or not. For example, *jëntuujy* 'at the front/in front of *X*' can appear non-possessed, but it can also be possessed to indicate whose front is being referred to, as in *njëntuujy* 'at my front/in front of me'. Strictly speaking the non-possessed form is vague with respect to the possessor; however, many expressions containing part-naming morphemes in AyMi have a default interpretation. In the case of *jëntuujy* 'in front', the default interpretation is the speaker's front and not the chair's front. On the contrary, in the case of *pukë'ëjy* 'side', the default interpretation is the chair's side, not the speaker's side. All non-possessed expressions were coded according to their default interpretation.[6]

Finally, there were a few ambiguous cases where it was not possible to determine a default interpretation. Example (5), used to describe Fig. 9, can have an intrinsic or a relative interpretation, and both interpretations correspond to the same subset of truth conditions; that is, both interpretations can apply to the utterance in (5). The few cases in which two interpretations correspond to the same truth conditions where it was not possible to argue in favor of a default interpretation were coded as ambiguous. Thus, example (5) was coded as ambiguous.[7] Notice that this happened only with respect to two pictures out of 48.

[6] In these cases, additional elicitation was done by the researcher to determine the default interpretation.

[7] It might be possible to argue that, given the overwhelming proportion of intrinsic FoRs over relative FoRs in this circumstance, the default interpretation of this example is intrinsic. However, in order to avoid a bias due to the analysis, cases like (5) were still coded as ambiguous.

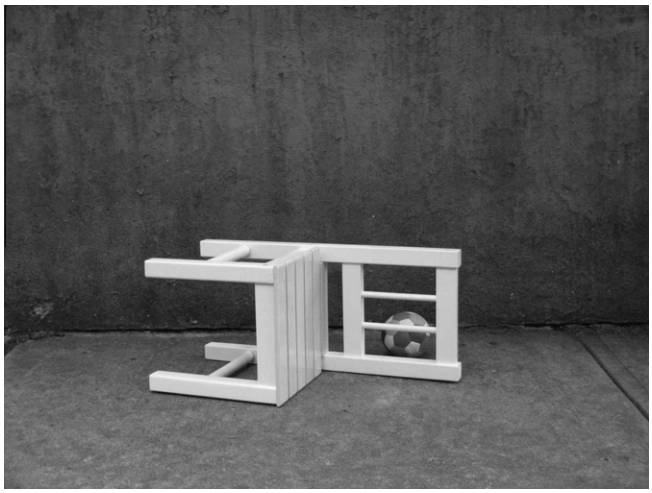

Fig. 9. Ambiguity between intrinsic and relative interpretations in picture B&C 1–4.

(5) *. . .ja' pelota jajp tmëët ëxki'py'amy.*

ja'	pelota	jajp	t-mëët	ëx-kë'ë+py-amy
DEM.D	ball	DEIC.D	3A-have[INCH.DEP]	back-LOC-DIR

'. . .it has the ball behind.' (B&C 1–4 AC)

4. Frames of reference in Ayutla Mixe

This section presents the results of the Ball and Chair elicitation task with respect to the use of FoRs; the use of topological descriptions is dealt with in more detail in Section 5. The structure of locative expressions used in FoRs is presented in Section 4.1. These locative expressions are also used in topological descriptions. Particular attention is paid to part-naming morphemes, as they are an important resource in the expression of FoRs and topological descriptions in AyMi. In Section 4.2 a summary of the preferences in the use of FoRs in AyMi is presented, excluding the use of topological descriptions. The remaining sections are dedicated to different issues with respect to relative, landmark-based and direct FoRs. In Section 4.3 I address some confusion in the denotation of 'right' and 'left' in the use of relative FoRs. Section 4.4 is devoted to some interesting characteristics of landmark-based FoRs. Finally, in Section 4.5 some parallelisms and differences between direct and landmark-based FoRs are discussed.

4.1. Locative expressions used in frames of reference and topological descriptions

There are three types of ground-denoting expressions in AyMi that can be used to express a FoR or a topological description. The most important expressions are part-naming morphemes (Romero Méndez, 2009) that appear in locative phrases involving intrinsic, direct and landmark-based FoRs, and for topological descriptions. The semantics of part-naming morphemes are, as their name indicates, parts of entities such as front, back, tip, side, etc. They are equivalent to what Bohnemeyer (2011) and O'Meara and Pérez Báez (2011) call meronyms, although given the morphosyntactic characteristics of these expressions, I call them part-naming morphemes following Levy's terminology for Papantla Totonac (1992, 1996, 1999). Part-naming morphemes are a morphologically defined class of roots in AyMi: they are the only class of morphemes that appear in locative phrases, such as *pat* 'bottom' in (6), and in a special slot in the verb, such as *këx* 'surface' in (7) (Romero Méndez, 2009).

(6) *Tapa pelot tsënapyajt pyatki'py.*

tajp=ja'a	pelot	tsëën-nay-pajt	y-pat-kë'ë+py
DEIC.D=DEM.D	ball	sit.down-PERD-NOM	3POSS-bottom-LOC

'The ball is underneath the chair.' (BPJ-16)

(7) *Ës este. . . meero jam kyëxkeny ja' pelot etkujk.*

jëts	este	meero	jam	y-këx-kon-y	ja'a	pelot	etkujk
and	DISC	exact	DEIC.D	3S-surface-be.small.object-DEP	DEM.D	ball	middle

'And hmm. . . the ball is exactly there in the middle.' (B&C 1–6 GL)

A locative phrase in AyMi consists of a ground-denoting noun, such as *tsënapyat* 'seat, chair' in (6) above, and a part-naming morpheme that is possessed, such as *pat* 'bottom' in (6), and a locative suffix. Also, the ground-denoting noun can form a compound with the part-naming morpheme, such as *wet* 'cloth' and *pat* 'bottom' in (8). In such cases, there is no possessive prefix and the default interpretation is intrinsic or topological (see Section 4.3). When the noun that denotes the ground has been mentioned before or it is known, it can be omitted, as in (9).

(8) *Tapa cuchara wetpatki'py*.

tajp=ja'a	cuchara	wet-pat-ki'py
DEIC.M=DEM.D	spoon	cloth-bottom-LOC

'The spoon is underneath the cloth.' (BPA-24)

(9) *Jëts ëxki'py jajp tu'uk eejk*.

jëts	ëx-ki'py	jajp	tu'uk	eejk
and	back-LOC	DEIC.D	one	toy

'And there is a toy behind [the chair].' (B&C 1–4 BE)

Part-naming morphemes are historically related to nouns in proto-Mixe-Zoque (see Romero Méndez, 2009 for a more detailed description of part-naming morphemes), but in the proto-language they were, presumably, independent nouns as shown in (10) for two part-naming morphemes. There are three main reasons for saying that part-naming morphemes are not nouns. One is that they have a different phonological form in comparison with their nominal counterparts. For example, in (11) the vowel in the part-naming morpheme has been reduced and the vowel quality is different from the part-denoting noun; in addition, in (11b) the glide has undergone devoicing. Also, the meaning of the part-naming morpheme and the meaning of the noun is different, as shown in (10) and (11); while the noun indeed denotes a body part, the part-naming morpheme has a more abstract meaning. However, the most important reason is that part-naming morphemes are bound morphemes that never appear without a locative suffix or without being incorporated into the noun. As a result, they cannot be heads of noun phrases.

(10) a. *ëx* 'behind', 'at the base' < proto-Mixe-Zoque ∗*jëx* 'back'[c]

b. *jën* 'in front' < proto-Old-Mixe ∗*win* 'eye'

(11) a. *a* (part-naming morpheme) 'inside' vs. *ää* (noun) 'mouth'

b. *jën* (part-naming morpheme) 'in front' vs. *ween* (noun) 'eye'

[c] Reconstructions from Wichmann (1995).

Additionally, there are two adverbs that are important for expressing topological and vertical projective relations, respectively: *etkujk* 'in the middle' and *naxpy* 'below'. As these words are used adverbially, they do not have a locative suffix. Finally, subordinate locative clauses are also used to express FoRs, as in (12), or in topological descriptions, as in (13). Locative clauses are introduced by the adverbial subordinator *mä* 'where' and have the clitic *=ë'n* at the end, which seems to indicate that the subordinate clause is an adjunct.

(12) *Te'n ja' tyeky jamtsoo'ampy*, ***mäyë' ventanë'n***...

te'n	ja'a	y-teky	jam-tsoo-ampy	mä	yë'ë	ventan=ë'n
M.DEM	DEM.D	3POSS-foot	DEIC.D-DIR-DIR	where	DEM.M	window=ADJN

'Its feet are there, toward the window...' (lit. 'Its feet are there, where the window is.') (B&C 1–4 BE)

(13) *Pelota yää* ***mä ja'tyekyë'n***.

pelota	yää	mä	ja'a	y-teky=ë'n
ball	DEIC.P	where	DEM.D	3POSS-foot-ADJN

'The ball is where its feet are.' (GL 2–12)

4.2. Frequency in the use of frames of reference in Ayutla Mixe

Ayutla Mixe speakers used the following FoRs in solving the Ball and Chair task: relative, direct, intrinsic, landmark-based, and vertical, as illustrated in examples (14)–(18), respectively, which correspond to the pictures in Fig. 10. Interestingly, geomorphic and absolute FoRs were not used at all in AyMi. Bohnemeyer (2011) suggests that Yucatec speakers do not use geomorphic FoRs because they live in an area that does not have salient landscape entities such as mountains, which could be used as the anchor of a geomorphic FoR. In Ayutla, however, there are several entities that could be used as reference points, such as the steep mountain slope where the community is located (see Section 2), the mountain peak, a sacred cave,

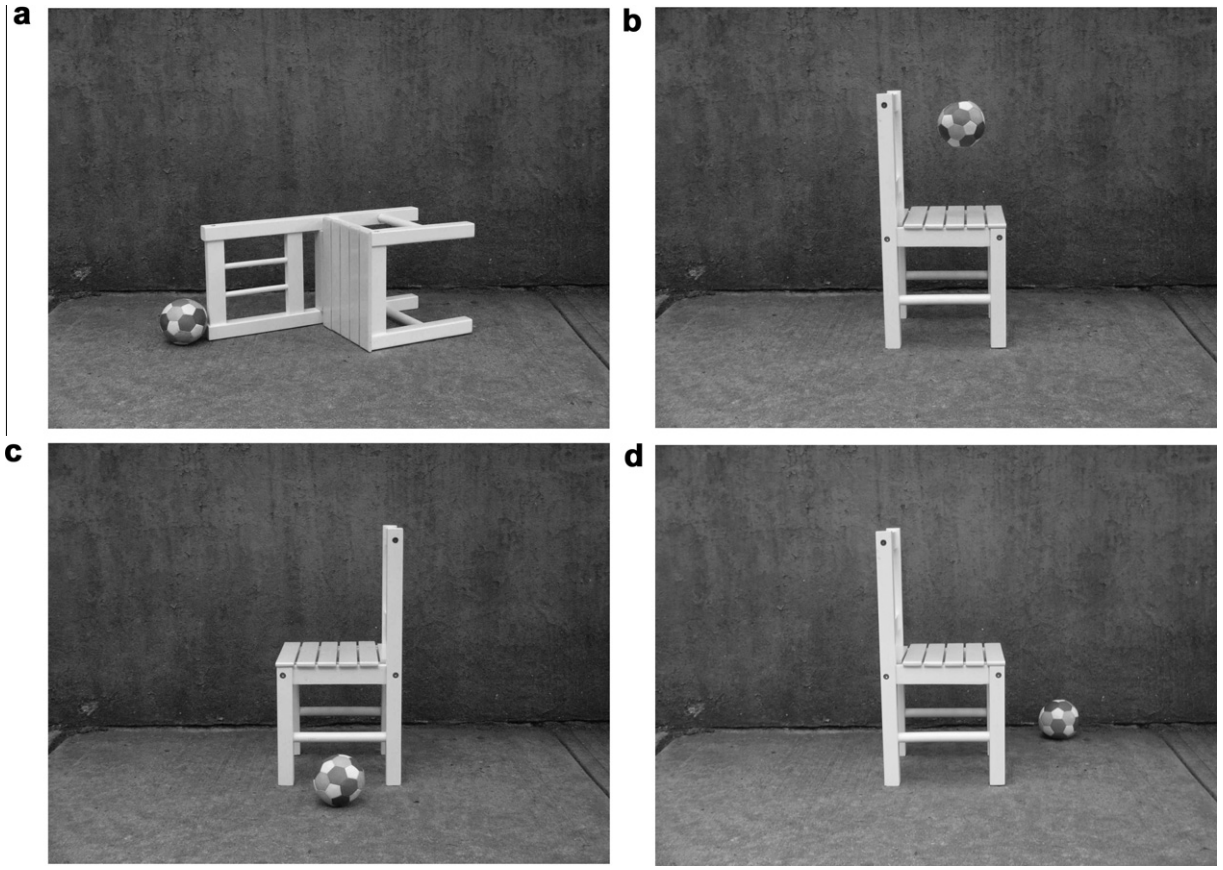

Fig. 10. B&C pictures for FoRs used in AyMi. (a) B&C 1–10, (b) B&C 3–8, (c) B&C 3–9, (d) B&C 4–8.

and so on, and yet geomorphic FoRs are not used. Perhaps, the commonality between geomorphic and absolute FoRs is that they operate at a larger scale than the other FoRs, and AyMi speakers do not use them in table-top space (although cf. Pérez Báez, 2011).

(14) *Te'n'ampy ja' akä'äny'ampyt'ixy.*

te'n=ampy	ja'a	akä'äny=ampy	t-ex-y	
M.DEM=DIR	DEM.D	left.hand=DIR	3A-see-DEP	

'Over there, [the chair] is facing left.' (B&C 1–10 GL)

(15) *Yë' mä ntatsënä'äyë'në'n, yë'ë ëjts njëntuujy...*

Yë'ë	mä	n-ta-tsëën -ay-ë'n='ë'n	yë'ë	ëjts	n-jën-tuujy
DEM.M	where	1A-APPL-sit.down-PERD-INCL=ADJN	DEM.M	1SG	1POSS-front-LOC

'The chair is in front of me...' (lit. 'That one where we sit, it is in front of me...') (B&C 1–10 MJ)

(16) *Ja' ëxki'py ja'y yaktany ja' y'eejk...*

ja'a	ëx-ki'py	ja'y	y-ak-tan-y	ja'a	y-eejk
DEM.D	back-LOC	just	3S-CAUS-stand-DEP	DEM.D	3POSS-toy

'The toy (i.e. the ball) was put behind [the chair]...' (B&C 3–9 NC)

(17) *Jam tsëënapyäjt, jam t'ixy mää yë' tëkää'n.*

jam	tsëën-nay-pajt	jam	t-ex-y	mää yë'ë	tëëjk-ää=ë'n
DEIC.D	sit.down-PERD-LOC	DEIC.D	3A-see-DEP	where DEM.D	house-mouth=ADJN

'The chair is [facing] there, it's looking toward the door.' (B&C 3–9 NC)

(18) *...jam ja' pelota naxpy.*

jam	ja'a	pelota	naxpy
DEIC.D	DEM.D	ball	low

'...the ball is low.' (B&C 4–8 GL)

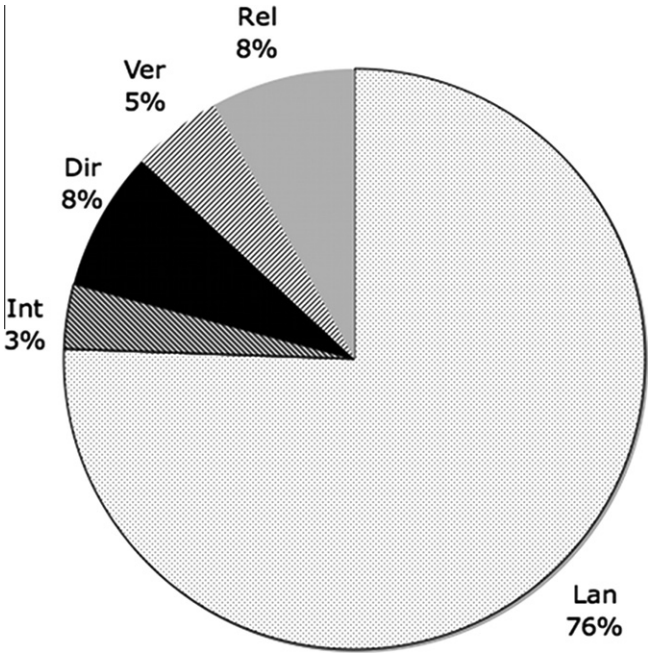

Fig. 11. FoRs in descriptions of the orientation of the chair.

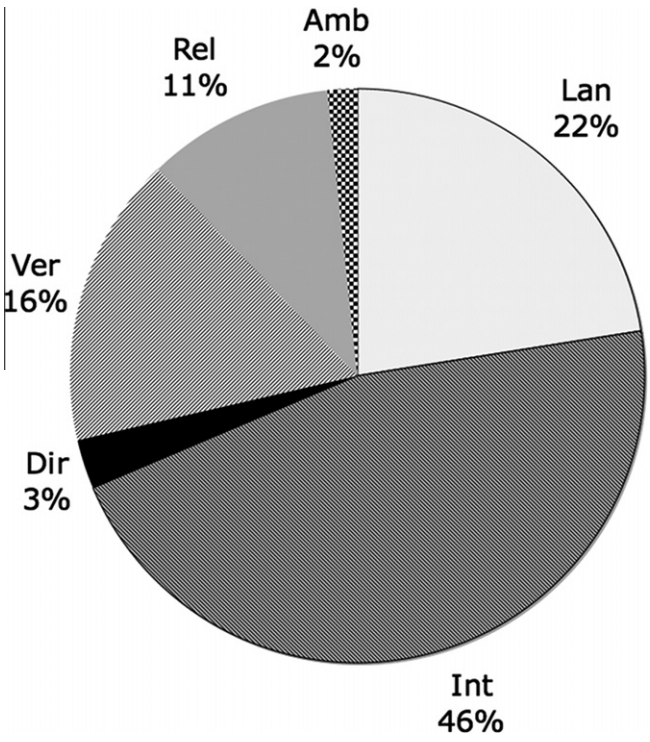

Fig. 12. FoRs in descriptions of the location of the ball with respect to the chair.

In solving the B&C task, people usually described the orientation and location of the chair, and then the location of the ball with respect to the chair. As a reminder, in orienting a figure with respect to a reference point, the figure's orientation is calculated, using FoRs, with respect to the position of the anchor, as in 'The chair is facing left'. In contrast, when a figure is located using a FoR, its position is calculated with respect to a ground and to an anchor, as in 'The ball is to the left of the chair'.

The data corresponding to these two types of descriptions are presented separately. As shown in Fig. 11, when orienting the chair with respect to an entity outside the picture (except in intrinsic FoRs), speakers used landmark-based FoRs in an overwhelmingly high proportion in comparison with other FoRs: in 76% of all cases. All other FoRs are used in less than 10% of the descriptions: relative and direct FoRs in 8% of all cases, vertical FoRs in 5%, and intrinsic FoRs in 3%. Fig. 11 shows only projective uses; topological descriptions and their use in comparison with FoRs are treated in Section 5. The few cases of intrinsic FoRs reported in Fig. 11 provide dispositional information, not the orientation of the figure. Direct FoRs here usually provide the location of the chair with respect to the speaker (such as *in front of me*) as well as orientation, as the use of *jëntuujy* 'in front' requires, at least pragmatically, that the chair is facing the speaker.

In descriptions of the location of the ball with respect to the chair, speakers used the intrinsic FoR in 46% of all descriptions – much more often than any other FoR, as shown in Fig. 12. Landmark-based FoRs were used in 22% of all cases, followed by vertical descriptions, in 16% of all cases, and relative descriptions, in 11% of all cases. Direct descriptions are marginal when locating the ball with respect to the chair, used in only 3% of all cases. 2% of all descriptions are ambiguous between relative and intrinsic FoRs. Topological descriptions were excluded here.

In the following sections I discuss some problems associated with the denotation of the terms used in relative FoRs (Section 4.3) and the use of *ad hoc* reference points in landmark-based FoRs (Section 4.4). I then turn to some issues regarding the difference between landmark-based and direct FoRs in AyMi (Section 4.5).

4.3. Relative frames of reference

Relative FoRs are not completely rare in AyMi, but a few comments are in order. First of all, it is necessary to distinguish between relative uses of terms such as *jëntuujy* 'front' and *ëxki'py* 'back', and relative uses of terms such as *akä'äny* 'left hand' and *anä'äjny* 'right hand'. This is relevant because knowing whether the terms for 'left' and 'right' have been extended to descriptions that involve a relative FoR is an empirical question, as it has been reported in the literature that there could be a mismatch between the sagittal (front-back) and coronal (right-left) planes in the relative use of such terms (Levinson, 1996; Levinson and Wilkins, 2006). For example, in Tseltal the terms for 'front'/'back' can be marginally used relatively, but this does not happen when it comes to terms for 'left'/'right' (Brown, 2006). Secondly, it would seem that even when AyMi speakers insisted on using *akä'äny* 'left hand' and *anä'äjny* 'right hand' relatively, they were not using these terms relatively on a regular basis, i.e. in everyday situations when speaking Mixe. Rather, one could hypothesize that they have learned to make that distinction in Spanish (as all consultants are bilingual), and, in the context of the task, they would find it useful to make the same distinction in Mixe. However, their use of 'left' and 'right' in AyMi was a source of confusion to the speakers themselves. There are several clues that point to such confusion. First, very often speakers did not remember which hand was 'left' and which hand was 'right', as in examples (19)–(20). Notice that the problem in these examples is not that the referents for 'right' and 'left' were mistakenly switched, but rather that there was uncertainty with respect to the denotation of the terms. In example (19), one participant has to ask for further clarification and the referent of the term *akä'äny* 'left hand' is finally determined with respect to an *ad hoc* landmark. In example (20) the person does not remember which is which and switches to using a locative adverbial demonstrative. Also, oftentimes it was necessary to ask whether the matcher understood the instructions, as in (21). In one dyad (MJ), there was some confusion with respect to the terms 'right' and 'left' early on in the task, but in the third and fourth sets, the speakers had reached an agreement with respect to the denotation of the terms and were more efficient at using them. This confusion with respect to the terms that correspond to 'right' and 'left' arose in all three dyads that used those terms. The other two dyads did use relative FoRs but not involving the terms for 'right' and 'left'.

(19) A: *Mää xëk yë'akä'äny'ampy*?
mää xëk yë'ë akä'äny=ampy
where ?? DEM.M left.hand=DIR
'Where is left?'

B: *Mä yë' tëkää'n.*
mää yë'ë tëëjk-ää=ë'n
where DEM.M house-mouth=ADJN
'Toward the door.'
(Memorizing)

A: *Anä'äjy, akä'äny . . .*
'Right, left. . .' (B&C 2–2_NC)

(20) *Pës yäätsoo'ampy yë'tsënapyajt t'ixymääts yä'ät nkë'ën.*

pës	yää-tsoo-ampy	yë'ë	tsëën-nay-pajt	t-ex-y	mää=ëjts
DISC	DEIC.P-DIR-DIR	DEM.M	sit.down -PERD-LOC	3S-see-DEP	where=1SG
yä'ät	n-kë'ë=ë'n				
DEM.P	1POSS-hand-ADJNT				

'Well, the chair is looking here where my hand is.'

¿Xë'n xka'pxyëtë?

xë'n	x-kä'px-y=jëte
how	2A-say-DEP=ANT

'How did you say?'

¿Anä'äjy'ampy o akä'ä . . . ?

anä'äjy-ampy	o akä'ä[ny]
right-DIR	or left

'Right or left. . .?'

Wa'n, yë' tsënapyajt xem t'ixy.

wa'n	yë'ë	tsëën-nay-pajt	xem	t-ex-y
DUB	DEM.M	sit.down-PERD-NOM	DEIC.D	3A-see-DEP

'Well, the chair is looking there.' (B&C 3–9 MJ)

(21) *Të xmëtëkuk mëte'epakä'äny, mä yää tëkää'n?*

të	x-mëtëkuk	mëte'ep	akä'äny	mä	yää	tëëjk-ää=ë'n
BEFORE.NOW	2A-understand[INCH.DEP]	REL	left	where	DEIC.P	house-mouth=ADJN

'Did you understand which one is left, toward the door?' (B&C 2–4 NC)

In addition, sometimes a speaker used a relative expression but, since using 'left' and 'right' was rather confusing, decided to use another type of expression, as in (22).

(22) *Te'ep ëjts ntapujnaxpy, yë' nkë'ë.*

te'ep	ëjts	n-ta-puj-näx-yp	yë'ë	n-kë'ë
REL	1SG	1SG-APPL-wash-pass-INCL;TR	DEM.M	1POSS-hand

'With the hand I wash clothes with (i.e. the right hand).' (B&C 3–3 MJ)

In sum, it would seem that not all participants in the elicitation task are entirely familiar with the denotation of the terms *akä'äny* 'left hand' and *anä'äjny* 'right hand', and that their extension to relative uses arises in the context of the B&C task along with some amount of confusion.

4.4. Landmark-based frames of reference

Landmark-based FoRs are the most frequent strategy used when orienting the chair, and of secondary frequency when locating the ball with respect to the chair. It is noteworthy that in most of these cases the anchor is an *ad hoc* entity, salient and within sight, such as the door in example (23)-(24), the kitchen in example (25), a representation of the Virgin Mary in example (26), and even the researcher in (27).

(23) *Jëts jatu'uk siiya nate'ntsyëën xem, nate'n tsyëën mä yë' tëkää'n . . .*

jëts	jatu'uk	siiya	nate'n	y-tsëën	xem	nate'n	y-tsëën
and	other	chair	as.well	3S-sit.down[INC..DEP]	DEIC.D	as.well	3S-sit.down[INC..DEP]
mä	yë'ë	tëëjk-ää=ë'n					
where	DEM.M	house-mouth=ADJN					

'And one chair is sitting there as well, sitting toward the door. . .' (lit. 'And one chair is sitting there as well, it is also sitting where the entrance of the house is.') (B&C 3–11 AC)

(24) *. . .te'n'ampy ja' tsënapyajt t'ixy mä ntëktëjkëmë'n.*

te'n=ampy	ja'a	tsëën-nay-pajt	t-ex-y	mä	n-tëëjk-tëk-ëm=ë'n
M.DEM=DIR	DEM.D	sit.down-PERD-NOM	3A-see-DEP	where	1S-house-enter-INCL=ADJN

'. . .the chair is looking at the door.' (lit. '. . .the chair is looking where we enter the house.') (B&C 4–1 MJ)

(25) *. . .ja' ku xem'ampy t'ixy mä . . . mänkä'äyëmë'n.*

ja'a	ku	xem=ampy	t-ex-y	mä	mä	n-kay-ëm=ë'n
DEM.D	CMPL	DEIC.D=DIR	3A-see-DEP	where	where	1A-eat-INCL=ADJN

'. . .but it is looking toward. . . toward the kitchen.' (lit. '. . .but it is looking where. . . where we eat.', as in the kitchen is where people eat.) (B&C 2–8 MJ)

(26) *Mä yë' täkääjtë'mt'ixy ja' tsënapyäjt.*

mä	yë'ë	täkääjtë'm	t-ex-y	ja'a	tsëën-nay-pajt
where	DEM.M	Virgin	3A-see-DEP	DEM.D	sit.down-PERD-NOM

'The chair is facing the Virgin.' (B&C 3–10 NC)

(27) *Jamtsoo'ampy mä yë' jä'äytyanë'n.*

jam=tsoo=ampy	mä	yë'ë	jä'äy	y-tan=ë'n
DEIC.D=DIR=DIR	where	DEM.D	person	3S-stand[INCH.DEP]=ADJN

'[The chair is facing] where the person is standing.' (B&C 3–3 EB)

An important issue with respect to landmark-based FoRs is that they do not use a conventional entity as the anchor, as geomorphic and absolute FoRs do, but rather speakers choose whatever suits their communicative needs at a given moment. This is particularly clear in (27), as the person in question (the researcher) was moving around and he might not be a useful anchor a moment later. In this respect, another possible explanation as to why AyMi speakers did not use geomorphic and absolute FoRs, but they did use landmark-based FoRs in table-top space (and as a reminder, in all three cases the anchor is different from the ground but it is not the speaker), is that there is no cultural agreement among AyMi speaker with respect to which entities should be taken as a reference point and, as such, it is more reliable to use entities that both the speaker and hearer can see at the moment of utterance.

4.5. Landmark-based or direct descriptions?

There are other cases, such as 'The chair is facing me', that are at the borderline between direct and landmark-based FoRs. In the present paper, all such expressions were coded as direct. In this section, I examine in more detail which cases where considered to be direct and which landmark-based, and why some instances have similarities with both direct and landmark-based FoRs.

According to Danziger (2010), in a direct FoR the anchor is (part of) the ground, and this happens in examples like 'The ball is in front of me'. A similar expression is found in AyMi, shown in example (28), where *ëjts njëntuujy* means 'in front of me', or in example (29), except that in this case *jëntuujy* 'in front' is not possessed, but given the context it is clear that it refers to the observer's front (see Section 3.1). In most cases, the anchor/ground is the first person, particularly taking into account that the default interpretation for the non-possessed form of *jëntuujy* 'in front' is with respect to the first person. There is only one case where the anchor/ground is the second person, shown in (30).

(28) *Yë' mäntatsënä'äyë'në'n, yë'ë ëjtsnjëntuujy . . .*

Yë'ë	mä	n-ta-tsëën-ay-ë'n='ë'n	yë'ë	ëjts	n-jën-tuujy
DEM.M	where	1A-APPL-sit.down-PERD-INCL=ADJN	DEM.M	1SG	1POSS-front-LOC

'The chair is in front of me. . ..' (lit. 'That one where we sit, it is in front of me. . .') (B&C 1–10 MJ)

(29) *Yää jëntuujy'ampy kyonn.*

yää	jën-tuujy-ampy	y-kon-n
DEIC.P	FRONT-LOC=DIR	3S-be.small.object-PERF;DEP

'[The ball] is in front [of me/us]' (B&C 4–3 LG)

(30) *Jës yë' eejk jaa mejts mjëntuum . . .*

jëts	yë'	eejk	jaa	mejts	m-jën-tuum
and	DEM.M	toy	DEIC.D	2SG	2POSS-front-LOC

'And the toy is in front of you.' (B&C 4–3 NC)

There are other slightly different examples where the observer's front is also mentioned. This happens when there is a 'seeing'/'looking at' verb, which usually contains the root *ex* 'see'. In some of these cases, the verb stem does not contain any reference to the speaker or addressee, but there is an expression, such as *atom jëntuum* 'at our front' in example (31), that indicates that the chair is looking at the speaker's front. In some other cases, the verb stem has

the part-naming morpheme *jën* 'front' to indicate that the 'facing' event is directed to someone's front, as shown in (32).

(31) *Este*... te'n wyejtsn, atom *njëntum myëk'ixy*.

Este	te'n	y-wets-n	atom	n-jën-tum	y-mëk + ex-y
DISC	M.DEM	3S-be-PERF;DEP	1INC.PL	1POSS-front-LOC	3S-observe-DEP

'Hmm... it [the chair] is like that, it is looking at us.' (lit. 'Hmm, it is like that, it is looking there at our front') (B&C 4–11 AC)'

(32) *Te'p yajkmëknë'kpajtp, yë'ëjts tsyäm xjën'ejxp*.

te'ep	y-ak-më-jënë'ëk-pat-p	yë'ë	ëjts	tsyäm	x-jën-ex-p
REL	3S-CAUS-BEN-lean-NOM-INC	DEM.M	1SG	DEIC.P	1O-front-see-INC

'The chair is looking at me.' (lit. 'That in which one leans, it is looking at my front.') (B&C 1–11 MJ)

Examples (31) and (32) can easily be taken as expressing a direct FoR, as the observer's front is being referred to by the part-naming morpheme *jën* 'front'. However, the mention of someone's front (or any other part) cannot be taken as the sole reason for having a direct FoR. As a reminder, these examples cannot be considered as expressing a relative FoR, because the observer's body axes are not projected onto the ground, as is the case in a relative interpretation of 'The ball is to the left of the chair'.

One important thing to say about (31) and (32) is that they serve to orient a figure with respect to a ground, not to locate it. A frequently used device for expressing the orientation of a figure in AyMi is the use of a form of the verb *ex* 'see'/'look at'. Sometimes the SAP is explicitly marked as the object of the verb, as in examples (32) and (33). In such cases, given the inverse system in AyMi (see Section 2), the first person object is obligatorily cross-referenced in the verb, not the third person object. In other instances, the SAP is an argument of a locative subordinate clause, as is exemplified in (34).

(33) ...*x'ejxë'n ku yää ntatsënä'äyë'm*.

x-ex-ë'n	ku	yää	n-ta-tsëën-äy-ë'm
1O-see-INCL	CPLM	DEIC.P	1S-APPL-sit.down-PERD-INCL

'...it [the chair] is looking at us, (it is seeing) that we are sitting.' (B&C 2–2 AC)

(34) *Ja' tsënapyajtu'nk te'n t'ixy mäëjtsë'n*.

ja'a	tsëën-ay-pajt-u'nk	te'n	t-ex-y	mä	ëjts=ë'n
DEM.D	sit.down-PERD-NOM-DIM	M.DEM	3A-see-DEP	where	1SG=ADJN

'The little chair is looking at where I am.' (B&C 3–3 DJ)

When orienting a figure, as in (31)–(34), there is only one reference point. In contrast, when locating a figure there are two reference points: the anchor and the ground. Whether these two reference points are the same entity or two different entities is one of the parameters Danziger uses to distinguish between two classes of FoRs (see Danziger, 2010 for more details). In this respect, if a speaker is locating a figure, one of the differences between direct and landmark-based FoRs is that in the former, but not in the latter, the anchor and the ground correspond to the same entity, a SAP. When orienting a figure such a criterion does not apply in order to distinguish between direct and landmark-based FoRs because there is only one reference point, and one might wonder whether examples like (31)–(34) should be considered as expressing a direct or a landmark-based FoR. However, when one compares 'The chair is facing me/you' with 'The chair is facing the door', the only difference is that in one case the reference point is a SAP and in the other, an external entity. Bearing that in mind, (31)–(34) are similar to other examples that involve a landmark-based FoR.

In terms of locating a figure with respect to a ground, cases where a SAP is the anchor also seem more similar to clear instances of landmark-based FoRs than to examples of direct FoRs. In examples like (35), the ball is said to be in the direction of the speaker. While it is true that the anchor is the first person, the location of the ball is calculated away from the chair, not away from the speaker, as happened in examples (28)–(30), which involve a direct FoR. One could think that in (35) there are different regions projected away from the (center of the) chair; one of those projections is directed toward the speaker. Analyzing the angular system used in (35) in this way, it becomes clearer that the first person is acting as a landmark. Additionally, the fact remains that in (35) the first person is the anchor but the chair is the ground.[8]

[8] To be fair, though, a similar problem could be identified in Danziger's (2010) examples. If one says *The milk is in front of me*, there has to be nothing between the speaker and the milk. As soon as there is another object between the speaker and the figure that is being located, that other object automatically becomes the reference point. "In front" is determined as the region between the speaker and any other ground; past that ground, it has to be the reference point.

(35) *Ës ja'... pelota te'n'ampy mäëjtsë'n.*

Jëts	ja'a	pelota	te'n=ampy	mä	ëjts=ë'n
and	DEM.D	ball	M.DEM=DIR	where	1SG=ADJN

'And the ball is toward me.' (lit. 'And the ball is directed like this, (toward) where I am.') (B&C 2–6 GL)

There is one remaining issue with respect to landmark-based FoRs when the anchor is a part of the body of the SAP, the front to be more precise. When orienting a figure with respect to a ground, it is necessary to assign an internal asymmetry to the figure, usually based on internal features. This happens regardless of the FoR used. If one says 'The chair is facing north', then the front is the internal reference point. Even though it would be pragmatically inadequate, in semantic terms a person could utter (34) even if she is facing away from the figure. However, in order to truthfully say (36), or any other instance where *jën* 'front' is part of the verb or the locative phrase, the SAP anchor has to be facing the chair. In other words, for these sentences to be true, the chair's front needs to be oriented toward the anchor's front as much as the anchor's front needs to be oriented toward the chair's front. In this way, a reciprocal description emerges in landmark-based FoRs when the anchor is the front of a SAP.[9] The reciprocal relation is not restricted to speech act participants, but it applies to non-speech act participants as well, as in (37), as long as the anchor is the part of a person. Examples (36) and (37) also show that in landmark-based FoRs, non-SAP humans show similar characteristics to SAP anchors.

(36) *Nayte'n yë' tsënapyajt ëjts xjën'ejxp.*

nayte'n	yë'	tsëën-nay-pajt	ëjts	x-jën-ex-p
also	DEM.M	sit.down-PERD-LOC	1SG	1O[INV]-front-see-INDEP

'The chair is looking at me as well.' (B&C 1–4 MJ)

(37) *Ah, ¿jam yë' anä'äjk ja'jyën'ijxp ja' siya?*

A	jam	yë'ë	anä'äjk	ja'	y-jën-ex-p	ja'a	siy=a?
DISC	DEIC.D	DEM.M	guys	DEM.D	3A-front-see-INDEP	DEM.D	chair=Q

'Ah, is the chair facing those guys?' (lit. 'Ah, is the chair looking at those guys' front?')

Taking into consideration the previous discussion, it might be useful to break down the landmark-based FoRs into different subcategories. Table 1 provides the frequencies for utterances involving different subtypes of landmark-based FoRs as well as the frequencies for direct FoRs. The cases of landmark-based FoRs when the anchor is a non-SAP (either a human third person or an object such as the door, the kitchen, etc.) are perhaps the clearer cases of landmark-based FoRs. The instances in Table 1 where the anchor is a SAP are classified in the present article as landmark-based as well, but similar cases might have been classified as direct in other articles in this special issue.[10] Within them, the examples of landmark-based FoR where the anchor is the front of a SAP are those that could be closer to examples like *the chair is in front of me*, that is, closer to a direct FoR.

To conclude this section, one could say that Danziger's (2010) direct FoR is a type of intrinsic FoR with respect to speech act participants. In fact, for Levinson (1996, 2003) and Pederson et al. (1998) direct FoRs (as well as landmark-based FoRs) are types of intrinsic FoRs. In the present article, in an intrinsic (or object-centered) description the anchor and the ground are the same and the anchor is a non-SAP, and thus 'The ball is in front of the chair' (with respect to the chair's front) is an instance of an utterance involving an intrinsic FoR. In contrast, in a direct description the anchor and the ground are the same but the anchor is a SAP, as in 'The ball is in front of me/you'. Following the same line of thought, one would want to say that landmark-based FoRs whose anchor is a SAP should be considered a type of direct FoR (or even a different category altogether). It has been shown here, however, that 'The chair is facing me' shares many characteristics with other clearer cases

[9] See Talmy (2000) for a discussion with respect to reciprocal relations in spatial descriptions.

[10] Since most articles in this special issue group landmark-based FoRs with a SAP as anchor together with direct FoRs, the information in Table 1 can be used for comparative purposes. If one decided that landmark-based FoRs where the anchor is a SAP are indeed cases of direct FoRs, the figures would look like those in the table below. The information in this table contrasts with the information in Figs. 11 and 12.

	Lan	Int	Dir	Rel	Ver	Amb
Orientation						
# of cases	105	9	111	21	13	0
% of cases	40.5	3.5	42.9	8.1	5.0	0
Loc of ball						
# of cases	33	120	32	28	42	4
% of cases	12.7	46.3	12.4	10.8	16.2	1.5

Table 1
Frequencies of landmark-based and direct FoRs across pictures and speakers.

Landmark-based FoRs with non-SAP as anchor	Landmark-based FoRs with SAP as anchor	Landmark-based FoRs with the front of a SAP as anchor	Direct
Orientation of the chair			
105	66	25	20
Localization of the ball			
33	20	5	7

of landmark-based FoRs. The solution to this problem is not simple, but part of the question is how important it is for a speech act participant to be the anchor or not.

5. Projective vs. non-projective descriptions

In this section a discussion with respect to the use of topological descriptions used to locate a figure with respect to a ground is provided. As shown here, topological descriptions were used almost as often as projective descriptions in the context of the Ball and Chair elicitation task, in around 50% of all cases. Topological relations are non-projective, orientation-free descriptions used to locate a figure with respect to a ground, as shown in example (38), where the locative subordinate clause expresses proximity to the legs of the chair and the word *etkujk* 'middle' further indicates the location of the ball (see Fig. 13).

(38) *Mä yë' tyeky majtskë'n, etkujkja' pejk.*

mä	yë'ë	y-teky	majtsk=ë'n	etkujk	ja'a	pejk
where	DEM.M	3POSS-foot	two=ADJN	middle	DEM.D	round

'Where its two feet are, the ball is in the middle.' (B&C 1–5 DJ)

This is not the place to properly discuss topological relations from a theoretical perspective (but see Landau and Jackendoff, 1993; Brown, 1994; Levinson, 1994; Levinson and Meira, 2003; Levinson and Wilkins, 2006; *inter alia*) or their particularities in AyMi. Suffice it to say that topological descriptions are somewhat similar to descriptions involving FoRs except that they do not involve a coordinate system anchored from a reference point, but rather relations of proximity, containment, contact, or support with respect to the ground. In Fig. 14 it is not necessary to divide the space into different "coordinates", as the mention of the contact of the figure with the ground is enough, as in 'The ball is at the back of the chair'. In contrast, in Fig. 15 it is necessary to assume a perspective from the back of the chair in order to understand 'The ball is behind the chair'. It was shown in Section 4.1 that topological relations in AyMi are expressed by part-naming morphemes and locative subordinate clauses.

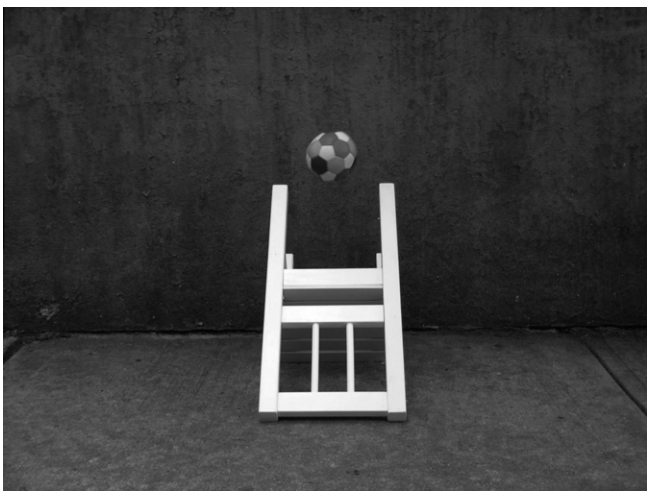

Fig. 13. Topological relation (B&C 1–5).

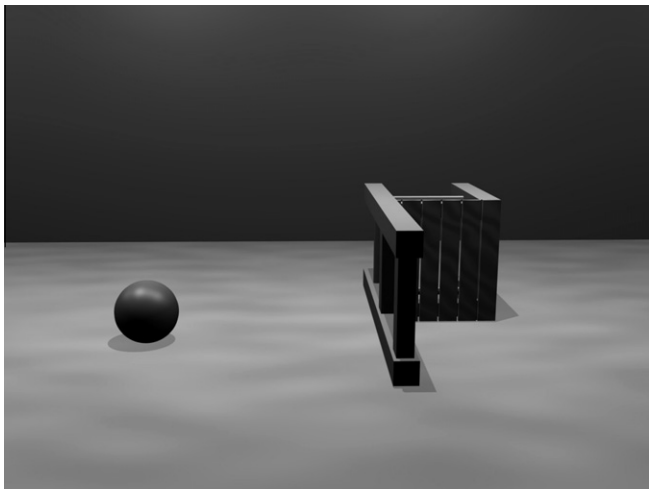

Fig. 14. Topological relation involving the ball and the back of the chair.

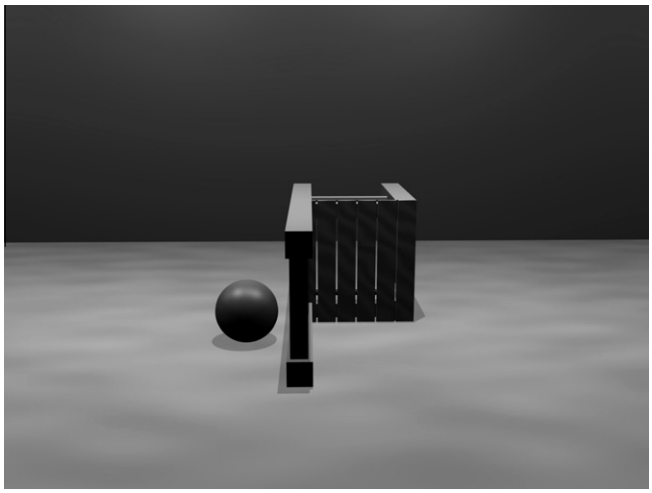

Fig. 15. Intrinsic relation involving the ball and the back of the chair.

Having an internal asymmetry does not mean that, automatically, the description ought to be projective. Locating an object with respect to a part of the object (i.e., when there is a meronymic relation, see Cruse, 1986) does not automatically mean that one is using a projective description. Borrowing one of Talmy's examples (2000, p. 198), if one says 'The mosaic is on the front of the church', it does not mean that there is an angular system projected from the church's center toward the front and extended from it. It only means that the church itself has been divided into different parts and that the mosaic has been located with respect to one of those parts (being in contact with the church's front). In contrast, in 'The building is in front of the church', the horizontal plane is divided into at least two regions, in front and not in front of the church, and the building is located in the region that is projected from the church's front. If one does not make this distinction, all topological relations with respect to parts would involve intrinsic FoRs.

Topological descriptions are important with respect to the AyMi data not just because it was one of the strategies used to solve the Ball and Chair task when locating the ball with respect to the chair, but rather because topological descriptions were used with the same frequency as projective descriptions when locating a figure with respect to a ground. This means that topological descriptions where used more often than any FoR when locating the chair with respect to a ground in the pictures or when locating the ball, either with respect to the chair or to another ground (e.g. the wall, the floor, the air) in the pictures.

Percentages of the FoRs used in AyMi were presented in Section 4.2, but data on the frequency of use of topological descriptions were omitted. Table 2 presents the data divided into two groups of columns: orientation of the chair and

Table 2
Use of FoRs and topological descriptions for the orientation and location of the chair across pictures and speakers.

	Orientation of the chair					Location of the chair in the picture	
	Lan	Int	Dir	Ver	Rel	Top	Lan
# FoR	196	9	20	13	21	20	7
% FoR Total	68.5%	3.1%	6.9%	4.5%	7.3%	7.0%	2.4%

Lan: landmark-based FoRs; Int: intrinsic FoRs; Dir: direct FoRs; Ver: vertical; rel: relative FoRs; Top: topological relation.

location in the picture. Orientation of the chair refers to the location of the chair with respect to an anchor external to the picture, except for intrinsic FoRs, as the anchor is the chair itself. Again, here the use of an intrinsic FoR only provided dispositional information. Also, the direct FoR involved the location of the chair (in front of the speaker or hearer) as well as its direction, because the chair was facing the speaker. Location in the picture refers to cases where the reference point (either the anchor in a projective relation or the ground in a topological relation) is in the picture itself, as in (39). While there are no topological descriptions that were used to orient the chair, they play a minor role in locating the chair with respect to the picture, for example with respect to the ground, as in (39).

(39) *Ëë, atëkak, näjxkëjx.*
ëë atëkak nääjx-këjx
AFF lying.on.its.side ground-surface\LOC
'Yes, [the chair is] lying down, on the ground.' (B&C 2–6 BE)

Tables 3 and 4 are also divided into two groups of data: those in which the anchor or the ground is external to the picture (again, except in intrinsic FoRs) and those in which it is part of the picture. As shown in Table 3, topological descriptions play a very important role in describing the location of the ball with respect to the chair ("Location of the ball with respect to the chair") and with respect to other features within the picture, such as the ground or the wall ("Location of the ball in picture" in Table 3). When considering only the location of the ball with respect to the chair, it turns out that almost half of all descriptions, 48.8%, are topological ones. Considering all cases where topological descriptions are used, 40% correspond to the location of the ball with respect to the chair and 17.8% to the location of the ball in the picture. This means that, when people locate the ball either with respect to the chair or to something else within the picture, they use predominantly topological descriptions, in 57.8% of all cases. As a reminder, these data are representative of the use of FoRs as type per picture, across all pictures and across all speakers (see Section 3).

Table 3
Use of FoRs and topological descriptions for the location of the ball across pictures and speakers.

	Location of ball with respect to the chair							Location of the ball in the picture	
	Lan	Int	Top	Dir	Ver	Rel	Amb	Top	Lan
# FoR	58	120	247	7	42	28	4	110	2
% FoR with respect to chair	11.5%	23.7%	48.8%	1.4%	8.3%	5.5%	0.8%		
% FoR with respect to chair and picture	9.4%	19.4%	40%	1.1%	6.8%	4.5%	0.6%	17.8%	0.3%

Lan: landmark-based FoRs; Int: intrinsic FoRs; Dir: direct FoRs; Ver: vertical; rel: relative FoRs; Amb: ambiguous for more than one FoR; Top: topological relation.

Table 4
Number of pictures containing at least one instance of an FoR and topological descriptions.

	Location of ball with respect to chair							Location of the ball in the picture	
	Lan	Int	Top	Dir	Ver	Rel	Amb	Top	Lan
# pictures with at least one instance of an FoR	47	110	141	7	40	26	4	92	2
% with respect to all pictures	19.6%	45.8%	58.8%	2.9%	16.7%	10.8%	1.7%	38.8%	0.8%

Lan: landmark-based FoRs; Int: intrinsic FoRs; Dir: direct FoRs; Ver: vertical; rel: relative FoRs; Amb: ambiguous for more than one FoR; Top: topological relation.

Fig. 16. B&C 3–12, näjxkëjxy 'on the ground'.

In addition, let us consider how many descriptions of pictures include at least one instance of each FoR and of a topological description, which is shown in Table 4. When considering the location of the ball with respect to the chair, topological descriptions were used in more pictures than any FoR, in 58.8% of all pictures; descriptions containing at least one intrinsic FoR, the most frequent type of FoR, were used in 45.8% of all pictures. In addition, 38.8% of all pictures had a topological description when the ball was being located with respect to other grounds in the picture, such as when the ball was on the ground or in the middle of the air; in contrast, landmark-based FoRs were used in only 0.8% of the pictures in those cases. Even though these data do not appear in Table 4, when considering how speakers located the ball in general, either with respect to the chair or with respect to another ground, topological descriptions were used in 196 out of 240 pictures, in 81.5% of all pictures; projective descriptions (or FoRs) were used in 175 out of 240 pictures, in 72.9% of all pictures. In other words, altogether, topological descriptions were used in more pictures than projective descriptions for the localization of the ball.

The obvious question is why topological descriptions are, by far, more often used than any FoR in AyMi in solving the B&C task. There are at least three possible explanations. With respect to the use of topological descriptions when locating the ball with respect to a salient feature of the picture, the most likely explanation is that the design of the task played an important role. There are two types of configurations that are frequently described using topological relations: that in which the figure is on the ground, as in (39) above or in (40), and that in which the ball is in the air, as in (41). AyMi speakers seemed to pay special attention to the intersection of the floor with the wall in the picture, which was very frequently referred to using the relator *wemp* 'corner, intersection', as shown in (42) (see Figs. 16–18).

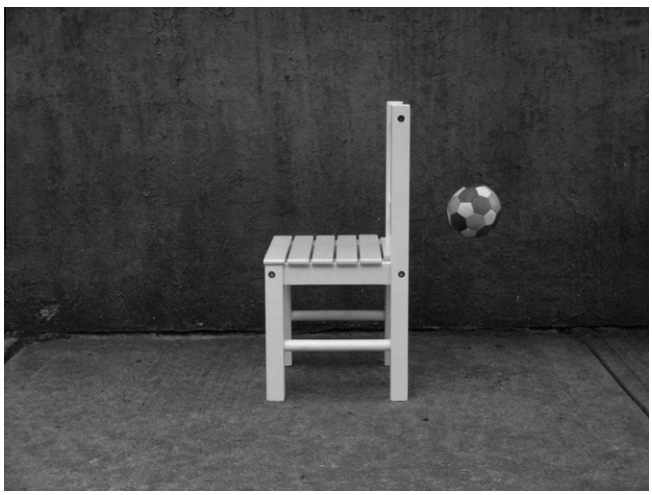

Fig. 17. B&C 2–3, pojojtp 'in the air'.

(40) *Ja' eejk näjxkëjxy kyäjpn.*

ja'a	eejk	nääjx-këx-y	y-käp-n
DEM.D	toy	ground-surface-LOC	3S-be-PERF;DEP

'The toy (i.e. the ball) is on the ground.' (B&C 3–12 NC)

(41) *. . .jam, ja' pelota tu'uk* ***pojojtp****etkujk.*

jam	ja'a	pelota	tu'uk	poj-jojt-p	etkujk
DEIC.D	DEM.D	ball	one	air-inside -LOC	middle

'. . . there, there is a ball in the air, in the middle.' (B&C 2–3 GL)

(42) *Ës yë' eejk nate'n petswyemja'y ku näjxkëjxy kyonn . . .*

jëts	yë'ë	eejk	nate'n	petsy-wemp	ja'y ku	nääjx-këx-y	y-kon-n
and	DEM.M	toy	also	wall-PLACE	but	ground-SURFACE-LOC	3S-be-PERF;DEP

'And the toy (i.e. the ball) is at the intersection of the wall [with the ground] but on the ground.' (B&C 4–8 NC)

Cases like those in examples (40)–(42) appear under the heading "Location of the ball in the picture" in Tables 2–4. Describing the figure (the chair or the ball) as being on the ground or in the air is perhaps inevitable given the design of the task. However, reference to the intersection of the wall and the floor as a reference point indicates that the numbers are not merely a byproduct of the task, as this spatial feature was not a salient ground in other languages in the MesoSpace project, as the ground or the air might be. Rather, it tells us that AyMi speakers, when locating a figure with respect to a ground in table-top space, are indeed paying attention to whichever ground can be used in a topological relation.

When locating the ball with respect to the chair (Tables 3 and 4), it is clear that AyMi speakers have a preference for non-projective relations. Here, there are other sources of topological descriptions. One is when the ball is at the base of the chair, at the intersection formed by its legs and the floor, as in (43). Another configuration where a topological description is used is when the ball is at the tip of the back of the chair, as in (44) or (45). One could wonder in these cases whether the use of *këpäjk* 'head' is used projectively or not. Notice that locating a figure, the ball in this case, with respect to a part of the ground does not constitute, in itself, a projective use of the part (see Figs. 19 and 20).

(43) *Jajp tu'uk pelota. . . pya'ääjy . . .*

jajp	tu'uk	pelota	y-pa'-ääjy
DEIC.D	ONE	ball	3POSS-edge-LOC

'One ball is there. . . at its base [of the chair]. . .' (B&C 1–7 AC)

(44) *Jëts jam jyëp'äm, jama' pelotakyonn.*

jëts	jam	y-jëëp-'äm	jam	ja'a	pelota	y-kon-n.
and	DEIC.D	3S-tip-LOC there	DEM.D	ball	3S-be.small.object-PERF.DEP	

'And it is at the tip [of the seat], the ball is there.' (B&C 1–10 GL)

(45) *Ës këpäjkppëjkta'akyja'.*

jëts	këpääjk-p	pëktä'äk-y	ja'a
and	head-LOC	[3S]put-DEP	DEM.D

'And [the ball] was placed at the top [of the back of the seat]' (B&C 1–10 BE)

There are perhaps two other possible explanations for the large use of topological descriptions. One has to do with the fact that, strictly speaking, most descriptions can be understood projectively or topologically. Thus, *ëxki'py* in example (46) can be understood as 'at the back', producing a topological description, or 'behind', creating a projective description. In the second case, it could be interpreted as an intrinsic FoR or as a relative FoR. To ensure a projective interpretation, it is necessary to use the directional *-ampy*, as in (47). Notice, however, that the use of the directional is optional and thus its omission does not entail that the relator must be understood topologically.

(46) *Ës ëxki'py jajp tu'uk eejk.*

jets	ëx-ki'py	jajp	tu'uk	eejk
and	back-LOC	DEIC.D	one	toy

'And there is a toy (i.e. the ball) at the back/behind [of the chair].' (B&C 1–4_BE)

(47) *. . .ëxki'py'ampy jajp ja' eejk.*

ëx-ki'py=ampy	jajp	ja'a	eejk
back-LOC=DIR	DEIC.D	DEM.D	toy

'. . .the toy (i.e. the ball) is behind/∗at the back.'

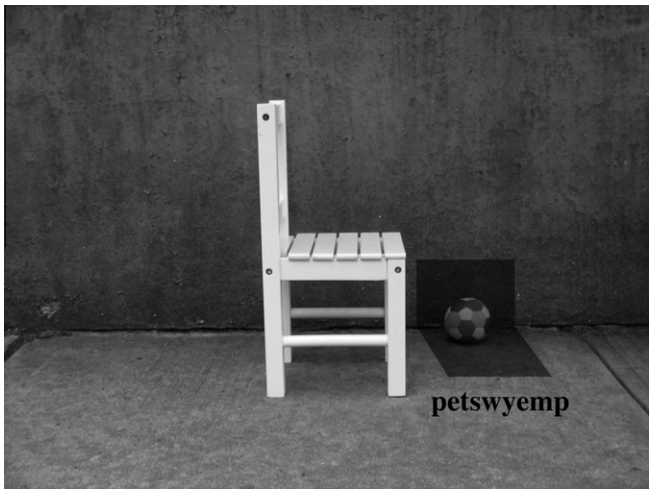

Fig. 18. Petswyemp 'at the corner'.

Fig. 19. B&C 1–7, pa'ääjy 'at the base'.

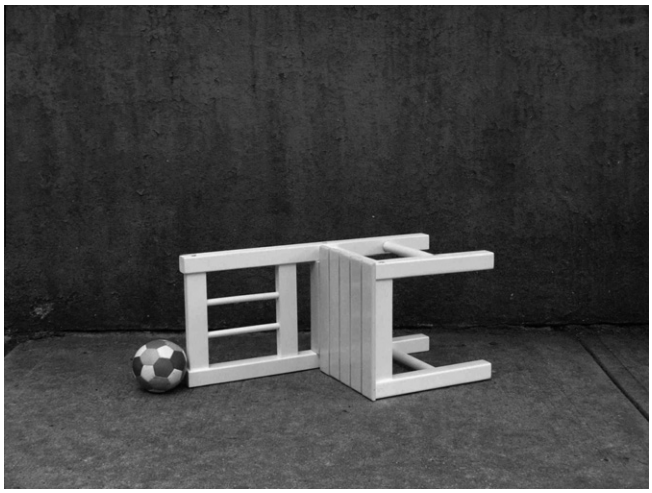

Fig. 20. B&C 1–10, jëp'äm and këpäjkp 'at the tip'.

The ambiguity between projective and non-projective interpretations is not restricted to locative phrases containing part-naming morphemes, as in (46) above, it also happens with the locative question word *mä* 'where', with locative subordinate clauses, and with manner and locative adverbial demonstratives, among others. The full extent of this phenomenon is not completely relevant here, though.

The third possible explanation for the preference of topological relations over FoRs, and perhaps the strongest one, has to do with the use of specific versus non-specific expression. Even if an angular system provides information that is more precise (not just proximity to a reference point, but a coordinate based on such a reference point), AyMi speakers very often provide rather unspecific information for the localization of the ball with respect to the chair. For example in (48) the speaker only indicates that the ball is where the stick is, which provides rather insufficient information taking into account that it is a wooden chair. However, pragmatically it could be understood as "the ball is where a relevant stick is", which in turn could be used to pick up the right picture. In example (49), the description only indicates that the ball is where the back and the legs are, but in the context of the elicitation task that information is really helpful to narrow down the search (see Fig. 21).

(48) *Jam ttimyëët mä yë' kipyë'n.*

jam	t-timy-mëët	mä	yë'ë	kipy-ë'n	
DEIC.D	3A-just-have[INCH.DEP]	where	DEM.M	stick=ADJN	

'[The chair] has [the ball] where the stick is.' (B&C 1–6 AC)

(49) *Mä jyënë'ëkë'n ja' ku mä ja' tyekyë'n ti'iny kyäjpn.*

mää	y-jënë'ëk=ë'n	ja' ku	mää	ja'a	y-teky=ë'n	ti'ny
where	3POSS-back=ADJN	although	where	DEM.D	3POSS-leg=ADJN	just
y-käp-n						
3POSS-be-PERF;DEP						

'Where its back is, although where its leg is.' (B&C 2–11 BE)

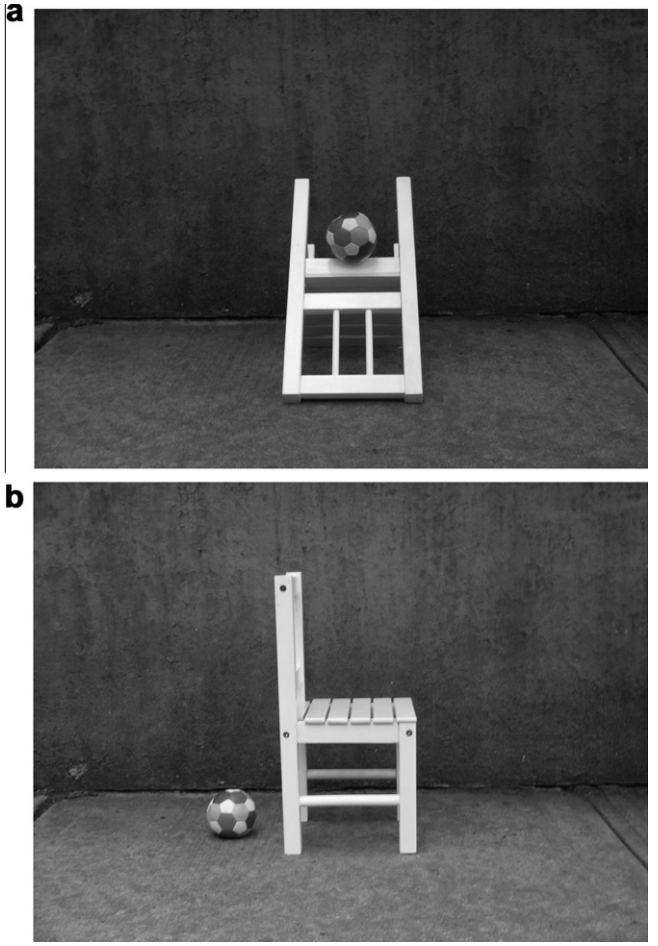

Fig. 21. Pictures used in examples 48 and 49. a. B&C 1–6, b. B&C 2–11.

Notice that this is not because AyMi lacks expressions to convey fine-grained spatial information, as part-naming morphemes both in locative phrases and verbs can be really specific. Rather, AyMi native speakers, at least when solving the B&C task, assumed that this amount of information was sufficient for the others to solve the task. Also, since this happens with all the speakers that participated in the task (five pairs), rather than being an arbitrary selection of data from particular speakers, it seems to be a general tendency in the language. The same has been noticed for other languages, such as Arrernte (Wilkins, 2006, p. 53).

6. Concluding remarks

To date, there have been no published accounts of the use of FoRs for any Mixe-Zoque language, so the most important contribution of this paper is the documentation of FoR use and preferences in AyMi. In doing so, this study intends to shed light on the topic at hand among Mixe-Zoque languages which are among the least described in Mesoamerica. It has been shown in this paper that AyMi speakers use most types of FoRs with the exception of geomorphic and absolute FoRs. This is surprising given the environmental conditions where AyMi is spoken, in a community on a mountain slope where there are several geographic features that can be used as reference points. A naïve assumption would have been that AyMi speakers ought to use geomorphic or absolute FoRs, as Tseltal speakers do (Levinson, 1996; *inter alia*). However, the data presented in this paper corroborate that not all cultures use absolute FoRs in table-top space (Levinson and Wilkins, 2006; Bohnemeyer, 2011) and that there does not seem to be a direct correlation between FoRs and ecological conditions (Majid et al., 2004).

An interesting point with respect to AyMi is that most expressions can have multiple readings. There are at least two parameters with respect to which an expression can present more than one interpretation. First, they might be vague with respect to projective and topological descriptions (as discussed in Section 5). Second, a single expression might be interpreted with respect to more than one FoR. In practical terms, there are ways to identify a single sense with respect to most examples (see Section 3.1) and the polysemy or vagueness with respect to multiple FoRs is attested even in English, since 'The cat is in front of the car' can be interpreted relatively and intrinsically. However, the ambiguity between projective and non-projective expressions needs more attention in future research.

Additionally, it seems to be the case that AyMi speakers tend to use expressions that are underspecified with respect to the exact location of a figure with respect to a ground. This might be due to the fact that, in context, it is relatively easy to know where a figure is and to discriminate two possible figures even with relatively small amounts of information. Perhaps this is one of the explanations as to why AyMi speakers tend to use topological descriptions more often than projective descriptions, which provide not only general locative information of a figure with respect to a ground (as topological relations do), but also an angular system to locate such a figure with respect to a ground and an anchor. In this regard, a topological description suffices and there is no need to add the extra information that an angular system provides.

Another point of discussion has to do with one of the primary hypotheses in the MesoSpace project, namely, that part-denoting words (or bound morphemes, as in AyMi) play a key role in spatial descriptions. This is, indeed, the case for AyMi: intrinsic and direct FoRs are expressed almost exclusively by part-naming morphemes; they are needed in landmark-based FoRs whose anchor is a body part (a person's front); they are used in relative terms; and they are extensively used in topological relations. To a great extent, the prevalent occurrence of part-naming morphemes is responsible for the vagueness with respect to projective and non-projective descriptions, as well as the ambiguity with respect to relative, intrinsic, direct and landmark-based FoRs. Nonetheless, part-naming morphemes play different roles in different FoRs. In relative terms they are restricted to the sagittal plane and the front is the only part mentioned in direct and landmark-based descriptions. In contrast, most of the part-naming morphemes are used in intrinsic descriptions. That is perhaps why intrinsic FoRs are used almost half of the time when speakers locate the ball with respect to the chair.

Finally, an important theoretical point discussed, not only in the present article but also in this special issue in general, is the introduction of the anchor as a reference point (Danziger, 2010). The explicit mention of the anchor has helped to discriminate among landmark-based, direct and intrinsic (or object-centered) FoRs, which were grouped as intrinsic in Levinson (1996, 2003) and Pederson et al. (1998). However, in discourse it was not always easy to determine whether some of the examples should be considered as expressing landmark-based or direct FoRs. According to Danziger (2010) two parameters should be considered for differentiating among different types of FoRs: one whether the anchor is (part of) the ground, and the other whether the anchor is a speech act participant (SAP). The first distinction is useful to distinguish between landmark-based FoRs when the anchor is part of the ground and direct FoRs that also mention a part of the ground. However, when FoRs are used to orient a figure, there is only one reference point (the anchor) and cases like 'The chair is facing me' may result problematic to classify. The second distinction, the difference between SAP and non-SAP as anchor is also the key to classifying direct descriptions as another type FoR. However, one could wonder why it is so important to make this difference and whether it should always be maintained. If so, why is it that the difference between intrinsic (or object-centered) and direct FoRs is based on whether the anchor is a SAP or not, but there is no difference between landmark-based FoRs when the anchor is a SAP or not? In order to be consistent, a new FoR should be proposed for those cases where the landmark is a SAP. Of course, more research is needed in this respect.

7. Role of the funding source

This material is based upon work supported by the National Science Foundation under Grant No. BCS-0723694 *Spatial language and cognition in Mesoamerica* (PI J. Bohnemeyer) and partially supported by the Instituto de Investigaciones Filológicas at the Universidad Nacional Autónoma de México.

Acknowledgments

The author thanks all native speaker consultants who participated in the elicitation tasks, and who assisted me in transcribing the recordings. Special thanks go to Agripina Patricio Ramírez and Rosario Patricio Martínez for their help and patience. Also, my visits to Ayutla would not be as pleasant as they are without the kind support of Elena Vázquez Ramírez. This paper has benefited a great deal from discussions with other members of the MesoSpace group, particularly Carolyn O'Meara, and from suggestions of two anonymous reviewers. An earlier version of this paper was presented in the symposium *Spatial frames of reference in languages of Mesoamerica* at the 2010 Annual Meeting of the Society for the Study of the Indigenous Languages of the Americas. I am grateful for the comments received there. Finally, it is necessary to acknowledge the great effort that Carolyn O'Meara and Gabriela Pérez Báez have put into this special issue, this paper would not be the same without their commitment and professionalism. It goes without saying that all unnoticed mistakes are my own.

References

Aguilar Gil, Y.E., Arellanes, F., in press. La oposición fortis-lenis y el estatus de la cantidad vocálica en el Mixe de Ayutla. In: Madrid, E. (Ed.), Tópicos en lingüística, UAM, México.
Bohnemeyer, J., 2008. Field Manual: MesoSpace, Spatial language and cognition in Mesoamerica, Manuscript, University at Buffalo. <http://www.acsu.buffalo.edu/jb77/MesoSpaceManual2008.pdf>.
Bohnemeyer, J., 2011. Spatial frames of reference in Yucatec: referential promiscuity and task-specificity. Language Sciences 33 (6), 892–914.
Bohnemeyer, J., Stolz, C., 2006. Spatial reference in Yukatek Maya: a survey. In: Levinson, S.C., Wilkins, D.P. (Eds.), Grammars of space. Cambridge University Press, Cambridge, UK, pp. 273–310.
Boudreault, L. de J., 2009. A Grammar of Sierra Popoluca (Soteapanec, a Mije-zoquean Language). Ph.D. dissertation, University of Texas at Austin.
Brown, P., 1994. The INs and ONs of Tzeltal locative expressions: the semantics of stative descriptions of location. Linguistics 32 (4/5), 743–790.
Brown, P., 2006. A sketch of the grammar of space in Tzeltal. In: Levinson, S.C., Wilkins, D.P. (Eds.), Grammars of Space. Cambridge University Press, Cambridge, UK, pp. 230–272.
Brown, P., Levinson, S.C., 1993. 'Uphill' and 'downhill' in Tzeltal. Journal of Linguistic Anthropology 3 (1), 46–74.
Brown, P., Levinson, S.C., 2004. Frames of spatial reference and their acquisition in Tenejapan Tzeltal. In: Assmann, A., Gaier, U., Trommsdorff, G. (Eds.), Zwischen Literatur und Anthropologie: Diskurse, Medien, Performanzen. Gunter Narr, Tübingen, pp. 285–314.
Clark, L.E., 1962. Sayula Popoluca Morpho-Syntax. International Journal of American Linguistics 28 (3), 183–198.
Clark, L.E., 1981. Diccionario popoluca de Oluta: popoluca-español. español-popoluca. Instituto Lingüístico de Verano, México.
Clark, L.E., 1995. Vocabulario popoluca de Sayula, Veracruz, México. Instituto Lingüístico de Verano, Tucson, AZ.
Cruse, D.A., 1986. Lexical Semantics. Cambridge University Press, Cambridge, UK.
Danziger, E., 1996. Parts and their counter-parts: social and spatial relationships in Mopan Maya. The Journal of the Royal Anthropological Institute, Inc. Man 2 (1), 67–82.
Danziger, E., 2010. Deixis, gesture, and cognition in spatial frame of reference typology. Studies in Language 34 (1), 167–185.
Departamento de la Estadística Nacional, 1927. Censo General de Habitantes. Talleres Gráficos de la Nación, México.
Dirección General de Estadística, 1930. Quinto Censo de Población. Secretaría de la Economía Nacional, Dirección General de Estadística, México.
Dirección General de Estadística, 1948. 6o. Censo de Población 1940. Secretaría de la Economía Nacional, Dirección General de Estadística, México.
Dirección General de Estadística, 1950. Séptimo Censo General de Población. Estado de Oaxaca. Secretaría de Economía, Dirección General de Estadística, México.
Dirección General de Estadística, 1963. VIII Censo General de Población 1960. Secretaría de la Estadística, México.
Dirección General de Estadística, 1971. IX Censo General de Población 1970. Estado de Oaxaca. Secretaría de Industria y Comercio, Dirección General de Estadística, México.
Elson, B., 1960. Gramática del popoluca de la Sierra. Universidad Veracruzana, Xalapa, México.
Engel, R., de Engel, M.A., 1987. Diccionario Zoque de Francisco León. Instituto Lingüístico de Verano, México.
Harrison, R., de Harrison, M.B., 1984. Vocabulario zoque de Rayón. Instituto Lingüístico de Verano, México.
Herrera Zendejas, E., 2006. La palatalización y aspiración en mixe: Dos procesos de realce fonético. In: Ortiz Ciscomani, R.M. (Ed.), Memoria del VIII Encuentro Internacional de Lingüística en el Noroeste. Hermosillo, Sonora, pp. 279–293.
Herrera Zendejas, E., 2010. Formas sonoras: Mapa fónico de las lenguas mexicanas. El Colegio de México, México.
Hoogshagen, S., de Hoogshagen, H.H., 1993. Diccionario mixe de Coatlán. Oaxaca. Instituto Lingüístico de Verano, México.
Instituto Nacional de Estadística Geografía e Informática, 1992. XI Censo General de Vivienda 1990. INEGI, México.
Instituto Nacional de Estadística Geografía e Informática, 1996. Conteo de Población y Vivienda 1995. INEGI, México.
Instituto Nacional de Estadística Geografía e Informática, 2002. XII Censo General de Población y Vivienda 2000. INEGI, México.
Instituto Nacional de Estadística Geografía e Informática, 2005. II Conteo de Población y Vivienda 2005. INEGI, México.
Jany, C., 2006. Vowel length and phonation contrasts in Chuxnabán Mixe. Paper presented at Proceedings from the 9th Annual Workshop on Native American Languages, University of California, Santa Barbara.
Johnson, H., 2000. A Grammar of San Miguel Chimalapa Zoque. Ph.D. dissertation, University of Texas at Austin.
Landau, B., Jackendoff, R., 1993. 'What' and 'where' in spatial language and spatial cognition. Behavioral and Brain Sciences 16, 217–238.
Laughren, M., 1978. Directional terminology in Warlpiri. Working Papers in Language and Linguistics 8. Tasmanian College of Advanced Education, Launceston, pp. 1–16.
Levinson, S.C., 1994. Vision, shape and linguistic description. Tzeltal body-part terminology and object description. In: Haviland, J.B., Levinson, S.C. (Eds.), Space in Mayan Languages. Mouton de Gruyter, Berlin, pp. 791–855, Special issue of Linguistics 32 (4).
Levinson, S.C., 1996. Frames of reference and Molyneux's Question: crosslinguistic evidence. In: Bloom, P., Peterson, M.A., Nadel, L., Garrett, M.F. (Eds.), Language and Space. MIT Press, Cambridge, MA, pp. 109–169.
Levinson, S.C., 2003. Space in Language and Cognition: Explorations in Cognitive Diversity. Cambridge University Press, Cambridge, UK.
Levinson, S.C., Meira, S., 2003. 'Natural concepts' in the spatial topological domain-adpositional meanings in cross-linguistic perspective: an exercise in semantic typology. Language 79, 485–516.

Levinson, S.C., Wilkins, D.P., 2006. The background to the study of the language of space. In: Levinson, S.C., Wilkins, D.P. (Eds.), Grammars of Space. Cambridge University Press, Cambridge, UK, pp. 1–23.
Levy, P., 1992. Body part prefixes in Papantla Totonac. In: de León, L., Levinson, S.C. (Eds.), Spatial Description in Mesoamerican Languages. Zeitschrift fur Phonetik, Sprachwissenschaft und Kommunikationsforschung, vol. 45, pp. 530–543.
Levy, P., 1996. Compuestos verbales en totonaco: Incorporación nominal? In: Estrada, Z., Figueroa, M., López, G. (Eds.), Tercer Encuentro de Lingüística en el Noroeste. Universidad de Sonora, Hermosillo, México, pp. 97–118.
Levy, P., 1999. From 'Part' to 'Shape': incorporation in Totonac and the issue of classification by verbs. International Journal of American Linguistics 65 (2), 127–175.
Li, P., Abarbanell, L., Papafragou, A., 2005. Spatial reasoning skills in Tenejapan Mayans. Proceedings of the Twenty-sixth Annual Conference of the Cognitive Science Society. Lawrence Erlbaum Associates, Inc., Mahwah, NJ.
Li, P., Gleitman, L., 2002. Turning the tables: language and spatial reasoning. Cognition 83 (3), 265–294.
Lillehaugen, B., 2006. Expressing location in Tlacolula Valley Zapotec. Ph.D. dissertation, University of California, Los Angeles.
Majid, A., Bowerman, M., Kita, S., Haun, D.B.M., Levinson, S.C., 2004. Can language restructure cognition? The case for space. Trends in Cognitive Sciences 8 (3), 108–114.
O'Meara, C., Pérez Báez, G., 2011. Spatial frames of reference in Mesoamerican languages. Language Sciences 33 (6), 837–852.
Pederson, E., Danziger, E., Wilkins, D.P., Levinson, S.C., Kita, S., Senft, G., 1998. Semantic typology and spatial conceptualization. Language 74, 557–589.
Pérez Báez, G., 2011. Spatial frames of reference preferences in Juchitán Zapotec. Language Sciences 33 (6), 943–960.
Pérez Báez, G., in press. Semantics of body part terms in Juchiteco locative descriptions. In: Sonnenschein, A.H., Lillehaugen, B.L. (Eds.), Expressing location in Zapotec. LINCOM, Munich.
Piaget, J., Inhelder, B., 1956. The Child's Conception of Space. Routledge and Kegan Paul, London, 1948.
Polian, G., Bohnemeyer, J., 2011. Uniformity and variation in Tseltal reference frame use. Language Sciences 33 (6), 868–891.
Reyes Gómez, J.C., 2005. Aportes al proceso de enseñanza aprendizaje de la lectura y la escritura de la lengua ayuuk. CEA-UIIA, Oaxaca, México.
Reyes Gómez, J.C., 2009. Fonología de la lengua Ayuuk de Alotepec, Oaxaca, ENAH: BA Thesis.
Romero Méndez, R., 2009. A reference grammar of Ayutla Mixe. Ph.D. dissertation, University at Buffalo.
Secretaría de Fomento, 1906. Censo y División Territorial del Estado de Oaxaca. Imprenta y Fototipia de la Secretaría de Fomento, México.
Secretaría de Hacienda, 1918. División Territorial de los Estados Unidos Mexicanos Correspondiente al Censo de 1910. Oficina Impresora de la Secretaría de Hacienda, México.
Schoenhals, A., Schoenhals, L., 1965. Vocabulario mixe de Totontepec. Instituto Lingüístico de Verano, México.
Talmy, L., 1985. Lexicalization patterns: Semantic structure in lexical forms. In: Shopen, T. (Ed.), Language Typology and Syntactic Description. Grammatical Categories and the Lexicon, vol. III. Cambridge University Press, Cambridge, UK, pp. 57–149.
Talmy, L., 2000. Toward a cognitive semantics. Concept Structuring Systems, vol. 1. The MIT Press, Cambridge, MA/London.
Wichmann, S., 1993. Mixe-Zoquean linguistics, a status report. In: Lastra, Y., Bartholomew, D. (Eds.), Panorama de los estudios de las lenguas indígenas de México. Ediciones Abya-Yala, Quito, pp. 193–267.
Wichmann, S., 1995. The Relationship among the Mixe-Zoquean Languages of Mexico. University of Utah Press, Salt Lake City.
Wichmann, S., 2002. Diccionario analítico del popoluca de Texistepec. UNAM, México.
Wilkins, D., 2006. Towards an Arrernte grammar of space. In: Levinson, S.C., Wilkins, D.P. (Eds.), Grammars of Space. Cambridge University Press, Cambridge, UK, pp. 24–62.
Wonderly, W.L., 1951a. Zoque I: introduction and bibliography. International Journal of American Linguistics 17 (1), 1–9.
Wonderly, W.L., 1951b. Zoque II: phonemes and morphophonemes. International Journal of American Linguistics 17 (2), 105–123.
Wonderly, W.L., 1951c. Zoque III: morphological classes, affix list, and verbs. International Journal of American Linguistics 17 (3), 137–162.
Wonderly, W.L., 1951d. Zoque IV: auxiliaries and nouns. International Journal of American Linguistics 17 (4), 235–251.
Wonderly, W.L., 1952a. Zoque V: other stem and word classes. International Journal of American Linguistics 18 (1), 35–48.
Wonderly, W.L., 1952b. Zoque VI: text. International Journal of American Linguistics 18 (4), 189–202.
Zavala Maldonado, R., 2000. Inversion and other topics in the grammar of Olutec (Mixe). Ph.D. dissertation, University of Oregon.