The grammar of parts, places, and paths in languages of Mexico

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To what extent and along what dimensions or parameters is there crosslinguistic variation in compositional semantics? Beside differences in the functional category system and perhaps the rules of semantic composition operative in a language (see von Fintel & Matthewson in press for discussion), the semantic type system and the mapping between semantic types and syntactic categories are primary candidates for loci of variation. We present a micro-typology of the syntax-semantics interface in a domain that has so far attracted relatively little attention among formal semanticists – spatial descriptions – drawing on data from three genealogically unrelated languages of the Mesoamerican *sprachbund* – Yucatec Maya (YM), Ayutla Mixe (AM), and Juchitan Zapotec (JZ) – and one isolate spoken north of Mesoamerica, Seri (SI). Our findings indicate a surprising amount of variation in the alignment between the syntax and semantics of spatial descriptions. What is invariant across the four languages of our study is the general logical form of spatial descriptions, which can be represented as in (1) (we focus on descriptions in which some entity serves as reference point or 'ground'):

(1) verb(event argument)(path argument)(figure)
& path function(place function(meronym(ground)))(path argument)

The 'figure' is the entity whose motion/location is described. For simplicity's sake, we treat the descriptors of figure and ground as entity-denoting (i.e. of type e). 'Meronyms' are object-part designators. They denote functions of type <e,e> which select a part of the ground to which the place function then assigns a region defined with respect to it. Meronyms play a pervasive role in spatial descriptions in all four languages. They surface as relational nouns in JZ, SI, and YM, but form a special class of bound morphemes in AM. Place functions are of type <e,r>, r being the type of regions (we treat regions as primitives). Since place functions have type <e,r> and meronyms <e,e>, place functions can apply to the ground directly, yielding the simplified (1'):

(1') verb(event argument)(path argument)(figure)
& path function(place function(ground))(path argument)

We treat paths as mappings from intervals of the real (for density) numbers into regions; these mappings are characterized in terms of mereological and topological properties (cf., e.g., Kracht 2002, Krifka 1998, Zwarts 2005). Path functions constrain the set of paths compatible with a given motion description by fixing their beginning or final region, some region passed through in between, etc. Path functions are of type <r,<p,t>>, mapping regions into characteristic functions over a path argument (p is the type of paths). All four languages can be considered 'verb-framed' (Talmy 2000): their most basic type of motion descriptions requires path encoding in the verb. However, whereas better-studied verb-framed languages such as Japanese, Spanish, and Turkish in addition reflect the path in the form of the 'ground phrase' (cf. Bohnemeyer *et al.* 2007), the ground phrase is not sensitive to the path of the event at all in the languages in our sample. The ground phrase is the highest node dominating the nominal describing the 'ground' but not the lexical head of the locative/motion predicate. Depending on the language, the ground phrase can be an argument, oblique, or adjunct and an NP/DP or a PP. Path neutrality is illustrated for YM in (2); the same preposition *ich* 'in' occurs in goal function in (2a) and in source function in (2b):[1]

(2) a. Le=kàaro=o' h-òok **ich** **le=kàaha=o'**
DET=cart=D2 PRV-enter(B3SG) in DET=box=D2
'The cart, it entered (lit. in) the box'
b. Le=kàaro=o' h-hóok' **ich** **le=kàaha=o'**
DET=cart=D2 PRV-exit(B3SG) in DET=box=D2
'The cart, it exited [lit. in] the box'

The composition in (2a') illustrates the style of the analyses we propose, taking the case of (1a) as an example. ρ and π are place (= region-denoting) variables, h is a path variable, *goal'* denotes a path function and *in'* a place function. The verb *òok* on this analysis has a semantic place argument position saturated by the place-denoting PP. It furthermore specifies inclusion of the goal of the path in the region denoted by the place argument. This restriction is not part of (1)-(1') because it is not expressed by verbs that take the ground phrase as a syntactic argument (see below). The path argument and π will be subsequently bound by existential closure by default.

(2) a'. *òok* 'enter': $\lambda\rho\lambda x\lambda h\lambda e[move'(e)(h)(x)\ \&\ goal'(\pi)(h)\ \&\ \pi\subseteq\rho]$
ich le kàahao' 'in the box': $in'(box')$
òok ich le kàahao': $\lambda\rho\lambda x\lambda h\lambda e[move'(e)(h)(x)\ \&\ goal'(\pi)(h)\ \&\ \pi\subseteq\rho](in'(box'))$
$=\lambda x\lambda h\lambda e[move'(e)(h)(x)\ \&\ goal'(\pi)(h)\ \&\ \pi\subseteq in'(box')]$

The simplest kind of ground phrases are bare argument nominals similar to the complement of Latinate path verbs in English. In SI, some path verbs take bare argument ground phrases, while others select for place-denoting postpositional phrases. Both possibilities are illustrated in (3), with the ground phrases bolded:

(3) a. Carolina quih
Carolina DEF.SG
[hast **cop** **i-izc** **hac]$_{NP/DP}$** i-y-aao
stone DEF.SG.stand 3POSS-front DEF.SG.ABSTR 3>3-DPAST-pass.by
'Carolina went past the front of the mountain.'
b. Carolina quih
Carolina DEF.SG
[hast **cop** **i-izc** **hac** **i-ti]$_{PP}$** y-eectim
stone DEF.SG.stand 3POSS-front DEF.SG.ABSTR 3POSS-on DPAST-pass
'Carolina went past the front of the mountain.'

In AM, bare argument ground phrases are licensed by a dedicated spatial applicative prefix *ta-* on the verb (4a). The alternative is an oblique NP/DP which generally involves both a meronym *-ojt* 'inside' in (4b) and an expression of the place function (*-py* in (4b)) suffixed to the head. (The meronym can also be incorporated into the verb, though not in (4)).

(4) a. Luis të **y-tëjk** t-ta-pëtsëm-y
Luis PAST 3POSS-house 3A-APPL-exit-DEP
'Louis exited his house'
b. Luis të y-pëtsëm-y **y-tëk-ojt-py**
Luis PAST 3S-exit-DEP 3POSS-house-inside-PLACE
'Louis exited his house'

YM has two prepositions, *ich* 'in' illustrated in (2) and *ti'*. The latter expresses a generic place function whose interpretation depends on the meronym if one is selected (a counterpart to AM *–ojt* in (4b)) and is supplied by stereotype implicature otherwise. The same appears to be the case with the AM place suffix

[1] Key to interlinear glosses: - – affixation; = – clisis; 3 – 3rd person; 3>3 – 3rd person subject/actor acting on 3rd person object/undergoer; A – transitive subject/actor agreement/cross-reference; ABSTR – abstract (Seri articles); APPL – applicative; B – agreement/cross-reference 'set B' (transitive object/undergoer, stative subject, intransitive subject in completive and subjunctive status); D2 – distal/anaphoric clause-final particle; DEF – definite; DEP – dependent (mood/status); DET – determiner; DPAST – distant past; EXIST – locative/existential predicate; INDEF – indefinite; PAST – past tense; PLACE – place function; POSS – possessor agreement/cross-reference; PRV – perfective; S – intransitive subject agreement/cross-reference; SG – singular.

in (4b). YM meronyms fall into two classes: those that head the ground phrase themselves instead of a preposition and those that require *ti'* to head the ground phrase. In contrast, the ground phrase of JZ spatial descriptions is either the ground-denoting nominal by itself or it is headed by a meronym. Whereas the ground phrase is invariably of type r (place-denoting) in YM even when it is headed by a meronym, it is invariably of type e in JZ. Yet unlike the bare-argument ground phrases of AM and SI, their JZ counterparts are obliques. To illustrate: *ike* 'head' heads (no pun intended) the ground phrase in (5); the ground phrase in (6) is the description of the ground itself.

(5)	Lii*bi	beji*ga **ike**	**ti=ba*ra**	
	tied	balloon head	INDEF=stick	
	'The balloon is tied to the end (lit. 'head') of a stick'			
(6)	Nuu*	ti^=(g)a^ni!w	**bikwini**	**na*7**
	EXIST	INDEF=ring	finger	hand
	'There is a ring on the finger'			

Thus, in JZ, even the specification of the place function is done compositionally and pragmatically.

To summarize, while the four languages agree on the logical form of locative descriptions – and thus on the role of parts, places, and paths in it – they vary in the syntactic category and semantic type of the ground phrase and in the alignment between the two (AM and YM having NP/DPs of type r and JZ having obliques of type e). We argue that what is driving this variation are differences in the expression of the place and path functions, and thus ultimately differences in the lexicon and the functional category system.

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