Volumes, surfaces, and extreme points

Meronymy and object-centered geometry in Yucatec Maya

Field report, Northwestern University & SILC
6 October 2008

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Overview

• MesoSpace
  • Yucatec
    • meronymy: background
    • meronymy: tools and tasks
    • meronymy: findings
  • spatial FoRs: tools and tasks
  • spatial FoRs: findings
  • conclusions

• appendix I: assigning surfaces
• appendix II: projection
• appendix III: coding the B&C data

MesoSpace

• NSF award #BCS-0723694 “Spatial language and cognition in Mesoamerica”
• 15 field workers
• 13 MA languages
  – Mayan
    • Chol (J.-J. Vázquez)
    • Q’aqjob’il (E. Mateo Toledo)
    • Tzeltal (G. Pollan)
    • Yucatec (J. Bohnemeyer)
  – Mixe-Zoquean
    • Ayuila Mixe (R. Romero Méndez)
    • Soteapanec (S. Gutierrez Morales)
  – Tzotzil
    • Tecpatán Zoque (R. Zavala Maldonado)
  – Oto-Manguean
    • Otomi (E. Palancar)
  – San Lucas Quialvi (Zapotec (G. Pérez Béez)
  – Tarascan
    • Purepecha (A. Capistrán)
  – Totonacan
    • Huehuetla Tepehua (S. Smythe Kung)
  – Uto-Aztecan
    • Cora (V. Vázquez)
    • Pajapan Nawat (V. Peralta)

3 controls
  – Seri (C. O’Meara)
  – Sumu (E. Benedicto)
  – Mexican Spanish (R. Romero Méndez)

2 (interrelated) domains
  – meronyms – labels for parts of entities
    • including, but not restricted to, body part metaphors
  – spatial FoRs

– meronymy as the primary lexical resource for spatial reference – few/no adpositions/case markers
  • including, e.g., in all of the above languages
  – egocentric FoRs play a minor or no role
    • attested for Huave, Mopan, Olutec, Totonac, Tzeltal, Tzotzil, and Yucatec
  – the MA sprachbund and specifically the evidence for calquing of meronyms
    • cf. Kaufman 1973; Campbell 1979; Campbell, Kaufman, & Smith-Stark 1986; Smith-Stark 1994
  – the cultural uniformity and topographic and ecological diversity of the MA area
    • to distinguish between possible linguistic and cultural factors influencing spatial cognition
      • in response to Li & Gleitman 2002

why MA

– productive meronomies
  • attested in Mixtec, Purepecha, Totonac, Trique, Tzeltal, Tzotzil, Yucatec, Zapotec

– intrinsic frames of reference
  • conceptual coordinate systems used to reference place functions (Jackendoff 1983)

– relative
  • The man is to the right of the tree.

– absolute
  • The man is east of the tree.

– observer

Figure 1. The three types of spatial FoRs distinguished in Levinson 1996

MesoSpace (Cont.)

spatial frames of reference

• conceptual coordinate systems used to define orientation-dependent place functions (Jackendoff 1983)

MesoSpace (Cont.)

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MesoSpace (Cont.)
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- 2 big research questions
  - *does the availability of productive geometrical meronym systems bias FoR selection?*
    - **hypothesis:** meronomies favor the use of allocentric (intrinsic, geomorphic, or absolute) over egocentric FoRs
  - *does a possible effect of meronym terminology on FoR use extend to non-linguistic cognition?*
    - **hypothesis:** speakers of languages w/ productive meronyms tend to be allocentric thinkers

- oodles of smaller research questions
  - *how much spatial information is represented in language?*
  - *to what extent do languages differ in the expression of geometrical and functional object structure?*

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Overview

- **MesoSpace**
  - **Yucatec**
    - meronymy: background
    - meronymy: tools and tasks
    - meronymy: findings
    - spatial FoRs: tools and tasks
    - spatial FoRs: findings
    - conclusions
    - appendix I: assigning surfaces
    - appendix II: projection
    - appendix III: coding the B&C data

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Yucatec

- the largest member of the Yucatecan branch of the Mayan language family
  - spoken by 759,000 people in the Mexican states of Campeche, Quintana Roo, and Yucatán
    - 2005 Census data show a decline by more than 40,000 speakers age five or older since 2000 (http://www.inegi.gob.mx/.../ept.asp?l=milen10&c=3337)
  - and approximately 5,000 people in the Cayo District of Belize (Gordon Ed. 2005)
- polysynthetic, purely head-marking, VOS, split-intransitive
- the field site: Yaxley
  - a village of about 800 people in the municipal district of Felipe Carrillo Puerto in Quintana Roo
Meronymy: background

• semantic transfer from body parts to object parts and spatial relations may be a universal property
  • cf. Svorou 1994; Heine 1997

• what makes MA meronyms special
  – morphosyntactically: their use as spatial relators
    • i.e., in expressions of place functions (Jackendoff 1983)
  – semantically: their applicability to arbitrary objects on the basis of geometrical properties

• morphosyntactic properties of MA meronyms
  – two varieties
    • in Mayan and Oto-Manguean languages, meronyms tend to be lexicalized as relational nouns
      – depending on the language, these may be inalienable
        » see examples below

Meronymy: background (cont.)

– the following examples from Mixe-Zoquean illustrate the first possibility
  » the possessed nominal headed by the meronym is the ground phrase

(3.1) a. ike(=be*)
  head=3
  'his/her head' / 'on his/her' (Pérez-Báez in press: 4)
b. nuxu sumbre*ru i^ke=be*
  EXIST hat
  head=3
  'The hat is on his head' (Pérez-Báez p.c.)
c. Dol'ta za ike yoo
  raised.over.cloud head house
  'The cloud is over the house' (Pérez-Báez in press: 11)
  – in Yucatec, both constructions exist
    » some meronyms head the ground phrase (e.g., do^ki=top' in (3.2)), others combine with the generic preposition ò (e.g., ti'u 'core')

(3.2) ...h-táal u=balak' y=ôok'ol le=pak=ô'
  PRV-come(B3SG) A3=roll A3=top DET=brickwork=D2
  '"...it came rolling on the wall'" 15

Meronymy: background (cont.)

– how does this work – what makes this productivity and regularity possible?
  • two proposals – global analogies (MacLaury) vs. shape-analytical algorithms (Levinson)

– MacLaury 1989 argues Ayoquesco Zapotec meronymy to operate on global analogical mapping
  • Ayoquesco has a set of seven body part terms that are freely extended to non-human bodies and inanimates

Meronymy: background (cont.)

– in Totonacan and Mixe-Zoquean, meronyms constitute a special closed class of roots
  – these most commonly surface incorporated into verbs and require derivational morphology to form nouns
    • cf., e.g., Levy 1992 on Papantla Totonac and Romero Méndez 2008 on Ayutla Mixe

– in all MA languages, meronyms are the most important lexical resource for coding place functions
  • MA languages have no locative cases and, depending on the language, no or very few adpositions

– when realized as relational nouns, meronyms are used in locative/motion descriptions as follows
  – they are possessed by the ground-denoting nominal (the noun referring to the entity serving as reference point)
  – the resulting possessed nominal either in the ground phrase (the phrase denoting the place projected from the ground object)
    » or combines with a semantically pale adposition to form it

Meronymy: background (cont.)

– as a result, the encoding of place functions in intrinsic and relative frames of reference
  • necessarily involves reference to body/object parts in MA
    – either directly or indirectly, via "normalization" – see Appendix II

– in contrast, expressions of (non-vertical) absolute place functions do not involve meronyms
  – but rather expressions of cardinal directions or environmental gradients

• semantic properties of MA meronyms
  – productivity and generality: meronyms affording reference to arbitrary parts of arbitrary objects

Meronymy: background (cont.)

– according to MacLaury, these are global analogical domain mappings from the geometry of the human body
  – into that of the animal or plant body or object
  – as described by Structure Mapping Theory (Gentner 1983)
  – accounts of meronymy in other Oto-Manguean languages have made similar assumptions and are compatible with MacLaury’s

– cf., e.g., Sinha & Jensen de Lope 2000 and Perez-Báez in press for other Zapotecan varieties

– Levinson 1994 rejects global analogical mapping for Tenejapana Tzeltal on the basis of three properties
  • all parts are named non-uniquely
    – so any object can have an arbitrary number of ‘legs’, ‘noses’, ‘heads’, ‘backs’, etc.
  • parts are named in first approximation on the basis of shape, regardless of place in the structure of the object
    – so ‘arms’ can be assigned growing out of ‘heads’, ‘noses’ out of ‘buttocks’, etc.
Meronymy: background (cont.)

- the place of the labeled part in the structure of the object varies across classes of objects
  - Levinson instead proposes an algorithm
    - that starts from the visual analysis of the outline of the object
      - segmenting it into volumes based on curvature discontinuities
      - and assigning axes to these volumes that generate them as generalized cones
    - following Marr’s (1982) theory of shape recognition
  - the parts on the ends of the axes of each volume are then labeled on the basis of their shape
  - the algorithm accounts for the meaning of body part terms as much as for their uses with inanimate objects
    - which on Levinson’s analysis are non-metaphorical
    - e.g., the ‘buttocks’ are really the less convex end of the generating axis of the main volume

Meronymy: background (cont.)

- research questions about meronymy
  - to what extent is it really possible across MA languages to label arbitrary parts generatively?
  - what is the distribution of global analogical mapping and shape-analytical algorithms across MA?
  - do these really exclude one another, as Levinson claims, or can they co-exist in one meronymy?
  - are the shape-based algorithms really non-metaphorical?

Overview

- MesoSpace
- Yucatec
- meronymy: background
  - meronymy: tools and tasks
    - picture book
      - human, animal and plant body parts
      - a set of artifacts identified through pictures in the elicitation manual
        - some customary in MA culture
        - some Western, with parts commonly identified functionally in Spanish
          - especially where the Spanish labels for these deviate from the labels predicted by geometry
      - task I: elicitation of part descriptors
      - task II: elicitation of locative descriptions w/ parts as ground
        - ideally w/ 10 speakers per language
  - spatial FoRs: tools and tasks
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  - appendix I: assigning surfaces
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Meronymy: Tools and tasks

- Yucatec participants
  - Picture book tasks: 7 speakers
    - six men and one woman in their thirties through sixties
  - Novel objects tasks: 5 pairs of speakers
    - five men and five women in their teens through sixties
    - two all-male dyads, two all-female dyads, and one married couple

Tools and tasks (cont.)

- a set of plastic objects of unfamiliar shapes
  - task I: referential communication; reference to parts
    - in each trial, one participant has an object with stickers attached to various parts in front of them
    - while the other has an identical copy of the object w/o the stickers
    - the first speaker instructs the second speaker to put the stickers on the correct parts, identifying the parts in the process
    - to be carried out with five pairs of speakers
  - task II: referential communication; placement wrt. parts
    - one participant per trial describes the location of color chips on, in, under, or near salient parts of each object
      - so that the other can place a chip in the corresponding location wrt. their copy of the object
    - to be conducted with five pairs of speakers per language
    - the data will be analyzed both for the meronyms and for FoRs
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Meronymy: Findings

- Yucatec meronymy involves a critical distinction between three semi-autonomous subsystems
  - for the labeling of surfaces, volumes, and curvature extremes (edges, corners, tips, etc.)
    - volume meronyms, but not surface and 'extreme' meronyms – can possess other meronyms
  - volume meronyms are not nearly as productive as surface meronyms
    - during the Novel Objects sessions, body part terms played only a relatively minor role
    - objects 3 and 5-7 were said to have 'legs'
    - and 7 in addition for some speakers also has 'arms' and even a 'belly' and a 'head'
  - there is a great deal of variation in these judgments
    - contrasting with a striking uniformity in surface labeling
  - at the same time, there are important parallels to the algorithm Levinson proposed for Tzeltal
    - volume meronyms are assigned independently of the object's overall structure
    - volume meronyms are assigned non-uniquely
      - objects can have multiple 'heads'...
      - e.g., a flashlight can be viewed as a 'leg' with a 'head' on one end and an 'anus' on the other
    - there is a great deal of variation in these judgments
      - contrasting with a striking uniformity in surface labeling

Meronymy: Findings (cont.)

- only the subsystems for surface and curvature extreme naming are fully productive
  - volume naming shares many traits with the algorithm described by Levinson
    - yet, it is much more restricted with unfamiliar objects
      - than surface and 'extreme' labeling
        - and often explicitly metaphorical

Meronymy: Findings (cont.)

- assignment of volume meronyms frequently involved similes and hedges
  (5.11) Ko’x a’-ik u=k’ab
        HORT say=INC(B3SG) A3=arm(B3SG)
        ‘Let’s say (it’s) his arm’
  - there is no evidence whatever that the assignment of surface meronyms was considered metaphorical
    - I expect the use of similes and hedges with surface meronyms to be anomalous – but didn’t test this
  - asked to name inanimate objects that have, e.g., 'heads' or 'bellies'
    - speakers quickly ran out of examples

Meronymy: Findings (cont.)

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  - volume naming shares many traits with the algorithm described by Levinson
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        - and often explicitly metaphorical

Meronymy: Findings (cont.)

- in contrast, surface meronyms were used liberally in reference to all Chunches
- volume meronyms are not nearly as productive as surface meronyms
  - during the Novel Objects sessions, body part terms played only a relatively minor role
    - except for pàach 'back'
  - objects 3 and 5-7 were said to have 'legs'
  - and 7 in addition for some speakers also has 'arms' and even a 'belly' and a 'head'
  - although the latter two assignments seem to be based on a local comparison to bottle gourds

Meronymy: Findings (cont.)

- there is a great deal of variation in these judgments
  - contrasting with a striking uniformity in surface labeling
  - at the same time, there are important parallels to the algorithm Levinson proposed for Tzeltal
  - volume meronyms are assigned independently of the object's overall structure
    - e.g., a flashlight can be viewed as a 'leg' with a 'head' on one end and an 'anus' on the other
  - volume meronyms are assigned non-uniquely
    - objects can have multiple 'heads'...
      - e.g., hills with multiple tops
    - and a village can have as many of those as it has roads leading into it
  - ...and certainly an arbitrary number of 'arms', 'legs', 'ears'
– the evidence from volume meronyms suggests
  • that a shape-analytical algorithm as described by
    Levinson is not necessarily non-metaphorical
  • shape-analytical algorithmic mapping may be merely a
different kind of metaphorical mapping

• surface meronyms are assigned fully
  productively
  – but, except for pàach 'back', cannot be assigned to
    humans or animals
  • but only to parts of their bodies – suggesting surface
    meronyms are not body part terms
  – the assignment of surface meronyms is likewise
    algorithmic, but based on a distinct algorithm
    • see the Appendix for details

Meronymy: Findings (cont.)

– only surface meronyms project spatial regions that
  can be referenced in intrinsic or relative FoRs
  • volumes and extremes only occur as arguments of
topological (i.e., orientation-free) place functions

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Spatial FoRs: Tools and tasks

– referential communication:
  Ball & Chair (B&C), to replace Men & Tree (M&T)
  • this new task/stimulus puts us in a position to assess preferences
    in the selection among all three types of FoRs
    » in room-sized domains
    » M&T effectively suppresses intrinsic choices for a variety of reasons

– linguistic tasks

Spatial FoRs: Tools and tasks (cont.)

– Ball & Chair: 5 pairs of speakers
  • five men and five women in their teens through sixties
    – these are the same participants who also did the two Novel
      Objects (aka Chunches) tasks
    – all participants completed the Novel Objects tasks before doing
      B&C
  
  – New Animals: 18 speakers
    • eight male speakers in their teens thru sixties and ten
      female speakers in their teens thru fourties
    • two of the male speakers’ responses were excluded from
      analysis because of high error rates
      – these two produced wrong-animal or wrong-order responses in
        at least 50% of the trials
    • 7 of the 18 participants also did some of the other tasks
      – all of these did New Animals before any of the other tasks

Figure 11. Chunche #1
Figure 12. A Birdseye view of Chunche #1 and its projected spatial regions
Figure 13. Layout of Men and Tree task (Pederson et al. 1998: 562)
Figure 14. Two Ball & Chair pictures, featuring an intrinsic contrast
Figure 15. Layout of the AIAR memory recognition task
Table 7. Surface meronyms and the expression of place functions

Spatial FoRs: Tools and tasks (cont.)
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Spatial FoRs: Findings

- FoRs in discourse: Ball & Chair
  - all five pairs of speakers used the relative FoR
    - but not necessarily the terms for 'left' and 'right'; see below
  - whereas only the first two dyads - the all-male dyads - used the absolute FoR
    - the third pair used it once
  - this in line with previous reports (Bohnemeyer & Stolz 2006; Le Guen ms.)
  - for the task of locating the Ball vis-à-vis the Chair, the intrinsic FoR is the most important
    - for all five pairs of speakers
    - this is likewise as predicted by previous work

Spatial FoRs: Findings (cont.)

- for the task of orienting the Chair ...
  - where the intrinsic FoR plays for obvious reasons no role
    - except in the guise of landmark-based and direct reference
    - which are considered intrinsic in Levinson's typology
  - ...the five dyads are pretty much all over the place
    - all the all-male dyads use absolute, landmark-based, and direct frames
    - with the married couple, the relative FoR dominates
    - the all-female dyads relied predominantly on the direct
  - the use of cardinal direction terms could be a "genderlect" phenomenon in Yucatec
    - Bohnemeyer & Stolz 2006, Le Guen ms., and the present study all find a strong gender bias
    - however, there is no evidence that the use of cardinal direction terms is interpreted as expressing masculinity

Spatial FoRs: Findings (cont.)

- "referential promiscuity"
  - use of all types of FoRs in table-top space is customary in the community
  - all adult speakers are extremely versatile and switching between different FoRs
    - and combining multiple FoRs in a single description
  - (7.1) Yun-pet le'exel tek-xel-te est-e-léek léek'ox
    - PREP-ADJ=side PREP=DET=F-left PREP=DET=EST-MIDDLE-RES=DIRECT
    - 'On (the Chair's) side, on the left in the, uh, the west, there is a ball, it is suspended (...')
  - predictions for New Animals task
    - no clear predictions
      - neither the relative nor the absolute FoR is linguistically dominant

Spatial FoRs: Findings (cont.)

- FoRs in recall memory: New Animals
  - Table 5 - Cross-tabulation of participants (N = 16) by age group, gender, and predominant response type (at least three trials have to instantiate a particular type in order for that type to qualify as the predominant type for the participant; "mixed" means there was no dominant type)

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Predominant response type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>male</td>
<td>direct, landmark, based</td>
</tr>
<tr>
<td>3-4</td>
<td>female</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>5-6</td>
<td>male</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>7-8</td>
<td>female</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>9-10</td>
<td>male</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>11-12</td>
<td>female</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>13-14</td>
<td>male</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>15-16</td>
<td>female</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>17-18</td>
<td>male</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
<tr>
<td>19-20</td>
<td>female</td>
<td>absolute, geocentric, and landmark-based</td>
</tr>
</tbody>
</table>

- interpreting the response types
  - the "absolute" response type is produced by absolute, geocentric, and landmark-based FoRs
  - and by coincidence
Spatial FoRs: Findings (cont.)

- "relative" responses are produced by relative and direct FoRs - and by coincidence
- intrinsic FoRs (in the narrow sense) are compatible with both response types
- "unidirectional" means the participant lined the animals up in the same direction in every trial

Table 6 - Break down by trial. Unidirectional responders' responses are mixed in as "absolute" or "relative" since they are not manifest at the trial level

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Responses in individual trials</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>Male</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>30-40</td>
<td>Male</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>40-50</td>
<td>Male</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td>50-60</td>
<td>Male</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td>60+</td>
<td>Male</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17</td>
<td>55</td>
</tr>
</tbody>
</table>

Spatial FoRs: Findings (cont.)

- non-aligned responses are "relative" in terms of facing direction and "absolute" in terms of order - or vice versa
  - each variant occurred five times
  - the frequency of mixed, unidirectional, and non-aligned responses could be a reflex of intrinsic use
- there is no obvious effect of age or gender
- the "relative" response type is more marked and the "absolute" one more frequent
  - and widespread
  - than the B&C data predict on a Whorfian account
- but: there are arguably no clear "Whorfian" predictions for Yucatec
  - due to its "referential promiscuity" and the role of the intrinsic FoR

Spatial FoRs: Background (cont.)

- making sense of the meronymy-allocentrism hypothesis
  - productive geometrical meronomies afford the consistent use of intrinsic frames of reference
    - b/c the ability to consistently use intrinsic FoRs entails the ability to consistently reference object geometry
    - and/or object function
  - using relative FoRs in a language like Yucatec means assigning meronyms egocentrically
    - thus overriding the geometry of the object
  - this is always possible in Yucatec (contrary to Bohnemeyer & Stolz 2006!) - but always dispreferred
  - it seems that the availability of a productive geometrical meronymy boosts the salience of intrinsic interpretations
    - this may well be a Thinking-for-Speaking effect (Slobin 2003)

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Conclusions

- Yucatec has a productive geometric meronymy
  - like Tenejapa Tzeltal and Ayoyucos Zapotec
    - supporting the hypothesis that such meronymies are an areal feature of Mesoamerican languages
  - novelty value – Yucatec meronymy has traits not attested in previously studied systems
    - in particular, the division into subsystems for volumes, surfaces, and curvature extremes
- good news and bad news for Levinson’s (1994) non-metaphorical analysis
  - good news: the (fully productive) surface terms are not (used as) body part terms
    - with the exception of pach ‘back’
  - bad news: volume labeling has all the signature traits of the algorithm Levinson described for Tzeltal
    - and yet is not fully productive and frequently involves hedges and similes
    - suggesting algorithmic mapping is not necessarily non-metaphorical
- referential promiscuity and the dominance of the intrinsic FoR
  - the Ball & Chair data confirm
    - all three types of FoRs of the Levinson classification are used commonly and frequently in table top space
    - speakers routinely switch between FoRs or combine multiple FoRs in their descriptions
  - in terms of distribution over speakers, the relative FoR is more widespread than the use of the cardinal directions
    - the latter are mostly restricted to (adult or older adolescent) male speakers

References (Cont.)


Appendix I: Assigning surfaces

- the assignment of surface meronyms appears to be likewise based on a Levinsonian algorithm
  - if a volume has only a single surface, that surface is its 'back'
    - the entire skin of an avocado is its 'back'
      - as is the bark of a tree
      - there is a separate term that means 'peel' or 'bark'
        - which remains applicable even when the peel/bark is no longer attached to the fruit/tree, which 'back' of course does not
  - the outer surface of baskets and jugs are their 'backs'
  - if a volume has two surfaces, one convex and one planar or less convex
    - think of a cylinder - ignoring its circular surfaces at the 'ends' for the moment - that has been "squashed" on one side
      - or cut in half parallel to the generating axis
    - the more convex side is the 'back' and the less convex one the 'front'

- if a volume has two flat and one convex surfaces
  - a cylinder, or for example the first of the Chunches
    - the convex surface is the 'back' and the planar surfaces are 'top' and 'bottom'
  - if the volume is canonically oriented in the vertical such that the two surfaces wind up in the appropriate places
    - and 'sides' otherwise

'sides' are assigned by the remainder principle

Appendix II: Projection

- next up: the role meronyms play in reference to spatial regions
  - in the expression of the kind of place functions (Jackendoff 1983)
    - whose interpretation depends on spatial frames of reference (FoRs)
      - i.e., place functions that map referential or ground objects into "quadrants" of coordinate systems defined with respect to them
    - as opposed to orientation-free "topological" (Piaget & Imhälter 1956) place functions
  - how does the shape and the labeling of projected regions interact with the meronymy?
    - consider for an introductory example again the first of the Chunches

Appendix II: Projection (cont.)

- reference to parts does not seem to depend much on the object's actual orientation at all
  - for parts - unlike for projected regions - there is no uniqueness requirement
    - in principle, an object can have an arbitrary number of 'backs', 'fronts', and so on
    - an example of an object with two 'backs' is a cylinder squashed along the generating axis
      - at opposite sides so that the two resulting convex surfaces are more salient than the two concave ones
        - sort of the inverse of the fourth of the Chunches
    - if the two convex surfaces are roughly symmetrical, they are both 'backs'

- the entire convex outside surface is both the 'back' (pàach) and the 'side' (tséel) of the object
  - so the entire region represented by the blue shape in the figure can be referred to
    - either as pàach-il t' (NP) 'behind/outside (NP)',
    - to=pàach (NP) PREP-A3=behind/outside (NP),
    - or to=tséel (NP) PREP-A3=side (NP) 'beside (NP)'

Appendix I: Assigning surfaces (cont.)

- if a volume has two surfaces and an edge
  - like a table top, a piece of paper, a coin, the body of a hammock, etc.
    - there are a number of possible solutions
      - if both surfaces are flat, both can be 'fronts'
      - alternatively, if the object has a canonical vertical orientation, one surface can be the 'top'
        - and the other the 'bottom'
    - in the case of flat curved objects like a comal, a hammock, or a spoon
      - the convex side is the 'back' or the 'bottom'
      - and the concave side can be the 'front', the 'top', or the 'inside'
        - the hammock can be said to have an 'inside' and a 'bottom'

Appendix I: Assigning surfaces (cont.)

- the spoon an 'inside' and a 'back'
  - and the comal a 'front' and a 'bottom' or 'back'
    - there is variation in judgments here
      - some prefer one solution or the other, others consider multiple solutions equally acceptable

- 'sides' are assigned by the remainder principle
Appendix II: Projection (cont.)

- the aperture can be labeled with a variety of more or less ad-hoc volume meronyms
  - including for example hóol 'hole' (from the verb root hol 'perforate')
- if this volume meronym heads the complement of the generic preposition ti'
  - the resulting ground phrase t=unhóol (NP) PREP-A3=hole (NP)
  - describes a region defined by proximity to the opening
  - a "bubble space"
- bubble spaces
  - the construction ti'POSS=NM (NP)...
    - where ti' or t is the generic preposition and NM, the meronym
      - is available for all meronyms (except for ich(II) 'in(side)')
    - not just the volume meronyms
- it does not distinguish between projected regions and surface contact

• implications
  - surface meronyms are the lexical resource for reference to "oriented regions" in Yucatec

Appendix II: Projection (cont.)

- the expressions in the second column of the table below are the only or the most frequent expression
  - of the meanings represented in the middle column
- this groups Yucatec together with Tseltal and Zapotec
  - and distinguishes it from Spanish and English and other European languages
  - where orientation-dependent place functions are expressed by adpositions that may etymologically relate to meronyms
  - but do not synchronically involve them

Table A1. Surface meronyms and the expression of place functions

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<tr>
<th>Surface</th>
<th>Preferred</th>
<th>Gloss</th>
<th>Preferred</th>
<th>Available</th>
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<td>construction</td>
<td>forms</td>
<td>surface</td>
<td>projection</td>
</tr>
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</tr>
</tbody>
</table>

Appendix II: Projection (cont.)

- the shape of the projected regions in intrinsic FoRs depends on the language-specific logic
  - of the meronym system
    - the example of the 'back'/side' region of the horseshoe Chunchu illustrates this well
- "normalization"
  - the regions intrinsically referred to using the expressions in the second column of the table
    - are generally the regions geometrically projected from the parts named by the corresponding meronyms
    - there are a number of important exceptions
      - the intrinsic 'back' region of animals is not the region geometrically projected from the 'back' part
      - but rather the one opposite the 'front' region
      - the region above the 'back' part is referred to using dok'b'top'

Appendix II: Projection (cont.)

- something similar happens in the horizontal
  - humans and animals project an intrinsic front region designated by tánan-il ti'
    - the region in which they face in canonical orientation
    - even though they lack a part that can be identified as u=tánan 'their front'
  - so there is a sense in which projection relies on a "fixed armatures" logic
    - similar to what Levinson (2003) attributes to Zapotec
    - however
      - the Yucatec system relies on fixed armatures only for projection, not for part labeling
      - the regions projected geometrically from parts named by using páach 'back' or tsél'side' are "normalized"
        - in the vertical but not in the horizontal - as per the horseshoe example
Projection (cont.)

- the "fixed armatures" of Yucatec are still intrinsic
  - in the sense that they only depend on the object's canonical orientation, not on its actual one
  - the vertical terms óok/"top" and ñana/"bottom" are used intrinsically in reference to projected regions in Yucatec
    » although the absolute use based on the object's actual orientation in the Earth's gravitational field appears to be the preferred one
- the $64,000 question
  - does the availability of a productive shape-based meronymy favor the use of the intrinsic FoR?
  - for Yucatec, the case can be made
    - the terms used for reference to oriented regions are based transparently on meronyms
    - and these meronyms are applied fully productively to arbitrary objects on the basis of their geometry.
      » the "normalization" of the front and back regions does not reduce the validity of this analysis

Appendix II: Projection (cont.)

- since it only applies to exceptional cases which are themselves defined in geometrical terms
- the apparent predominantly absolute use of the terms for the top and bottom regions only strengthens the case
  » since the use of these terms is not based on the geometry of the object
    » any object has 'top' and 'bottom' regions regardless of whether it has a 'top' part, a 'head' part, or neither
      » as in the case of containers of liquids

Appendix III: Coding the B&C data

- absolute - exclusively for the cardinal direction terms
- direct - (Danziger in press)
  - for descriptions in which the body of speaker/addressee serves as both "anchor" and ground
    » e.g., 'in your direction' or 'on your left', referring to the side of the picture closest to the addressee's left hand
- intrinsic - the design of B&C makes it generally possible to distinguish intrinsic from relative uses
  - however, cases in which the same term can describe the same configuration intrinsically and relatively exist
    » e.g., if the Ball is at the intrinsic back of the Chair while the Chair is turned with its front towards the observer
    » it's impossible to tell whether 'behind the Chair' is used intrinsically or relatively
  - I coded such responses as intrinsic

- landmark-based - ad hoc landmarks used as points of reference
  - the fan, window, me, the volleyball /cancha/ outside
  - a special case of intrinsic reference in Levinson 1996
  - however, if the landmark is the "anchor" but not the ground
    » e.g., if a landmark is used to locate the Ball wrt. the Chair
    - then landmark-based systems do in fact pattern with absolute systems in terms of their logical ("rotational") properties
- relative - the most frequent use of the relative FoR was not with 'left' and 'right'
  - but with 'front', 'back', and 'side'
  - the distinction between direct and relative uses of 'left' and 'right' is subtle

- topological - i.e., no FoR involved
- vertical - apparently all Yucatec speakers use 'top'/"above" and 'bottom'/'below' intrinsically
  - as well as with respect to the gravitational vertical
    » I coded the first type of use as 'intrinsic' and the second as 'vertical'
    » in Levinson's typology, the gravitational vertical is an absolute FoR
      » I treat it as a category apart since it clearly does not pattern with other absolute FoRs in terms of its cross-linguistic distribution