Overview

- the MesoSpace project
- frames of reference in language and cognition
- FoRs in Yucatec discourse
- FoRs in the memory of Yucatec speakers
- discussion
- conclusions
- appendix I: the Levinson-Gleitman debate
- appendix II: FoRs – the fine-grained picture

The MesoSpace project

- NSF award #BCS-0723694 “Spatial language and cognition in Mesoamerica”
- 15 field workers
- 13 MA languages
  - Mayan
    - Chol (J.-J. Vázquez)
    - Q’eqchi’ (E. Mateo Toledo)
    - Tzeltal (G. Polian)
    - Yucatec (J. Bohnemeyer)
  - Mixe-Zoquean
    - Ayutla Mixe (R. Romero Méndez)
    - Soteapanec (S. Gutierrez Morales)
    - Tocuatl Mixe (R. Zavala Maldonado)
  - Otomanguean
    - Otomí (E. Palancar; Néstor H. Green; Selene Hernández-Gómez)

- why MA
  - relative FoRs play a minor or no role
    - attested for Huave, Mopan, Olutec, Totonac, Tseltal, Tzotzil, and Yucatec
  - productive meronymies affording reference to arbitrary parts of arbitrary objects
    - attested in Mixtec, Purepecha, Totonac, Trique, Tseltal, Tzotzil, Yucatec, Zapotec
  - meronyms often are the primary lexical resource for spatial reference – few/no adpositions/case markers
    - including, e.g., in all of the above languages
  - the MA sprachbund and specifically the evidence for calquing of meronyms

The MesoSpace project (cont.)

- 3 controls
  - Seri (C. O’Meara)
  - Mayangna (E. Benedicto, Alyson Eggleston in collaboration with the Mayangna Yulbarangyang Balina)
  - Mexican Spanish (R. Romero Méndez)
- 2 (interrelated) domains
  - meronyms – labels for parts of entities
    - including, but not restricted to, body part metaphors
  - spatial frames of reference
    - conceptual coordinate systems used to define orientation-dependent spatial descriptions
      - intrinsic: The ball is in front of the chair.
      - relative: The ball is to the right of the chair.
      - absolute: The ball is east of the chair.

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

Figure 2. Meronyms in Ayoquesco Zapotec (left) and Tenejapa Tseltal (adapted from MacLaury 1989 and Levinson 1994)
The MesoSpace project (cont.)

- the overarching hypothesis we are testing: the meronomy-allocentrism pattern
  - the availability of productive geometric meronym systems disfavors the use of relative FoRs
  - if this hypothesis is confirmed, meronomy is the first purely linguistic factor influencing FoR selection
  - this linguistic factor could then be pitted against ecological and cultural factors
    - in particular, the cultural uniformity and topographic/ecological diversity of the MA area
  - the goal: advance the Levinson-Gleitman debate
    - about possible linguistic and cultural factors influencing spatial cognition – see Appendix!

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Frames of reference in language and cognition

- background: spatial frames of reference (FoRs)

<table>
<thead>
<tr>
<th>Intrinsic</th>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 1. Distribution of the three types of spatial FoRs

<table>
<thead>
<tr>
<th>FoR</th>
<th>Intrinsic</th>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mopan (Mayan)</td>
<td>+</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Guugu Yimithir (Australian P-N)</td>
<td>—</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td>Tseltal (Mayan)</td>
<td>+</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hai/om (Khoisan)</td>
<td>+</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Japanese</td>
<td>+</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>English</td>
<td>+</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>Yucatec (Mayan)</td>
<td>+</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>Kalagadi (Bantu)</td>
<td>+</td>
<td>—</td>
<td>+</td>
</tr>
</tbody>
</table>

- primary differences not in lexicon, but in domains of usage
- e.g. English: cardinal directions mostly in geographic space only!
- Tseltal etc.: no uses of relative FoR z-e-r-o! nada! rien!

But see Gilles Polian on Tseltal momentarily!

Frames of reference in language and cognition (cont.)

- predicted effects on internal cognition
  - it’s difficult to translate a locative relation from one FoR into another
  - suppose you memorize the cat as being left of the car
  - it’s difficult to talk about this in terms of cardinal directions later
  - unless you happen to also memorize where you were with respect to the car in cardinal terms
  - so people remember everything they might want to talk about in a FoR appropriate to their language

Frames of reference in language and cognition (cont.)

- observed effects
  - experiment: recall memory under 180° rotation
    - Animals in a Row task
      - note this is just one out of a battery of experiments!
      - step I: memorize a row of toy animals
      - step II: rotate 180° to face second table
      - step III: choose the row that matches the first one

But see Gilles Polian on Tseltal momentarily!
Frames of reference in language and cognition (cont.)

Results: the large sample

Scholars involved:
Eric Pederson, Kyoko Inoue, Sotaro Kita, David Wilkins, Thomas Widlok, Penelope Brown, Steve Levinson, Balthasar Bickel, Debby Hill ...

Table 2. Animals-In-a-Row in Levinson 2003: the large sample

<table>
<thead>
<tr>
<th>Linguistically</th>
<th>English, Dutch, Japanese, Tamil-Urban</th>
<th>Prediction: Non-verbal coding will be relative</th>
<th>N = 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linguistically</td>
<td>Arrernte, Hindi, Tamil, Longau, Belhare, Tamil-Rural</td>
<td>Prediction: Non-verbal coding will be absolute</td>
<td>N = 99</td>
</tr>
</tbody>
</table>

Figure 7. Animals-in-a-Row results in Levinson (2003: 194): The sample corresponding to Table 3

Figure 8. Approximate dialect regions of Yucatec

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FoRs in Yucatec discourse

- 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?t=mlen10&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

FoRs in Yucatec discourse (cont.)

- MesoSpace tools for studying FoRs
  - the Ball & Chair (B&C) pictures
    - 4 x 12 photographs of configurations of a ball and chair to be matched in referential communication

Figure 9. Layout of Men and Tree task (Pederson et al. 1998: 562)

Figure 10. Two Ball & Chair pictures, featuring an intrinsic contrast

Recall memory task: New Animals

- a near-identical replication of the Animals In A Row (AIAR) design
  - of Levinson 1996 and Pederson et al. 1998

Figure 11. Layout of the AIAR memory recognition task

» minor differences: the toy animals used; the number of trials; ...
» big drawback: no intrinsic response pattern
  - during pilots in Buffalo, we tried to engineer one
    - but all our attempts would push all participants towards using intrinsic FoRs
FoRs in Yucatec discourse (cont.)

- **FoRs in discourse: Ball & Chair**
  - all five pairs of speakers used the relative FoR
    - though not necessarily the terms for 'left' and 'right'
  
  ![Figure 12](image1.png)
  - only the two all-male dyads used horizontal FoRs in the horizontal
  - with cardinal direction terms
    - the mixed-gender dyad used this once
  
  ![Figure 13](image2.png)
  - all speakers even produced intrinsic uses of terms for vertical relations
    - in contexts where the same terms would not be applicable in the absolute gravitational vertical
  
  ![Figure 14](image3.png)
  - so the **Principle of Canonic Orientation** (Levitt 1984, 1996) is not an absolute constraint.
  - unlike in Dutch and Finnish

- **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
  
  ![Figure 15](image4.png)
  - predictions for New Animals task

---

**Note:**
- 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 as predicted by previous work and in line with the meronymy-allocentrism pattern
  - the mixed-gender dyad used this once
  - no clear predictions
  - all speakers even produced intrinsic uses of all types of FoRs in table-top space

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**Figure 17.** Number of descriptions by strategy in the Yucatec Ball & Chair data (5 x 2 speakers; fine-grained coding)

**Figure 18.** Number of descriptions by strategy in the Yucatec Ball & Chair data (5 x 2 speakers; coarse-grained coding)

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**Table 3.** Coding the B&C responses

<table>
<thead>
<tr>
<th>Fine-grained classification</th>
<th>Levitin 1996</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>vl</em> – vertical relators interpreted as: the Earth's field of gravity</td>
<td>abs – absolute FoRs</td>
</tr>
<tr>
<td><em>ca</em> – cardinal relators</td>
<td><em>rel</em> – relative FoRs</td>
</tr>
<tr>
<td><em>or</em> – relative FoRs (anchor = observer's body; external ground)</td>
<td><em>rel</em> – relative FoRs</td>
</tr>
<tr>
<td><em>dir</em> – direct FoRs (anchor = ground; observer's body)</td>
<td><em>ort</em> – orientation</td>
</tr>
<tr>
<td><em>lm</em> – landmark-based FoRs (anchor is an entity defined from both ground and observer's body)</td>
<td><em>ort</em> – orientation</td>
</tr>
<tr>
<td><em>tp</em> – topological relators (interpreted independently of FoRs)</td>
<td><em>top</em> – topological relators</td>
</tr>
</tbody>
</table>
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FoRs in the memory of Yucatec speakers

- "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 4 - 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 group</th>
<th>Gender</th>
<th>Predominant response type</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>male</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>≥ 30</td>
<td>male</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9 (56.3%)</td>
<td>2 (12.5%)</td>
</tr>
</tbody>
</table>

Table 5 - 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 group</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>17</td>
<td>24</td>
</tr>
<tr>
<td>≥ 30</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>Total</td>
<td></td>
<td>55 (57.3%)</td>
<td>96 (100%)</td>
</tr>
</tbody>
</table>

Discussion

- 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
- even so
  - the apparent discrepancy between the linguistic and nonlinguistic data calls for an explanation
• Le Guen (ms.) finds the same discrepancy
  – based on evidence from a battery of tasks
    • conducted with a substantially larger population of participants (57)
  – he points out that the cardinal directions play a role in ritual practice and horticulture
    • that isn’t quite reflected in their use in everyday linguistic interactions
  – however, this does not explain the uniformity of the responses across the adult population
    • Le Guen’s account predicts a strong gender effect in the non-linguistic data
      – comparable to that in the linguistic data
      – contrary to fact

• comparing Yucatec to Mopan (Danziger 2001)
  – Mopan is a close cousin of Yucatec from the same branch of the Mayan language family
  – in discourse, Mopan speakers use **exclusively intrinsic** FoRs
    – Animals-in-a-Row: original protocol
      • of four participants “A, B, C, D”
        – B, C, and D used a unidirectional coding strategy
        – A and C changed the axis of the array of animals
    – Animals-in-Row: Danziger’s first modified protocol
      1 now altered the protocol, and started asking explicitly that consultants pay attention to the orientation of the animals. In the absence of any direct way of expressing this in Mopan I asked consultants, in the initial instruction, to pay attention to the identity of the animals (horse, pig, cow) and also to notice: *tuba tun-ch’ak’an* [where they are looking].” (Danziger 2001: 212)

• of 17 participants who performed under this protocol
  – nine produced an absolute response pattern
  – three a relative one

  − Animals-in-Row: Danziger’s third protocol
    "Fearing that the instructions, and particularly the word *tuba* [where] were too environmentally oriented, I enlisted twelve more consultants to solve the problem when asked to pay attention to *[how] (Mopan *b’ikij*) the animals were looking.” (Danziger 2001: 212)
    • of 12 participants who performed under this protocol
      – nine produced an absolute response pattern
      – and none a relative one

  − Route-Completion task
    • one of the tasks mentioned above that involve motion paths rather than static spatial configurations
      – here, too, Danziger had to modify the protocol in order to get codable results
    • of 16 participants, nine now went with a relative response pattern and five with an absolute one

− the frequency of mixed, unidirectional, and non-aligned responses *could* be a reflex of intrinsic use
  • although only one single response occurred that altered the axis of the array – during a practice trial
  − suppose, then, that Yucatecans, just like Mopans, are intrinsic thinkers...
    • in terms of the practice of spatial reference that is most strongly incultuated
  − ... but most of them were pushed towards an absolute pattern by their interpretation of the task
    • I did not tell them to pay particular attention to the direction in which the animals were facing
    • however, during the practice trial(s), I would correct responses that changed the order of the animals
      – or that had different animals facing in different directions
    – this may have tipped some of the participants off

• making sense of these findings
  • Mopan speakers’ preferences for absolute or relative response patterns in the experiments are **task-specific**
  • they do not appear to represent established cultural practices of spatial cognition
  • intrinsic reference, however, is "supported" by language and therefore presumably incultuated in the speakers
    – besides, it may be a cognitive universal anyway
  • the relative and absolute response patterns are compatible with the participants using intrinsic FoRs

• interpreting the Yucatec data
  through the prism of the Mopan evidence
  − intrinsic FoRs (including direct ones) are the most important FoRs in Yucatec discourse
    • just as in Mopan, although unlike in Mopan, they’re not the only type of FoR used in discourse

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Conclusions

- all types of frames of reference (FoRs) occur regularly in Yucatec discourse
  - including in the table top domain
- use of cardinal direction terms is restricted to adult males
- referential promiscuity
  - FoR selection in Yucatec is highly variable both across and within speakers
  - all speakers frequently combine multiple FoRs in a single spatial description
- intrinsic and direct FoRs dominate in discourse with all speakers

References


Le Guen, D. M. Culture in cognition: Geocentric representation of space among the Yucatec Maya. Manuscript. Max Planck Institute for Psycholinguistics.


Appendix I: The Levinson-Gleitman debate

Li & Gleitman 2002: culture, rather than language, as the driving force

- rather than evidence of language influencing cognition
  - the co-variation reported in Pederson et al. (etc.) is the result of cultural biases and predilections
  - different cultures adapt to different topographies and differences in “social cohesion”
  - as a result, different populations prefer different FoRs in both discourse and internal cognition

References (Cont.)


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Li & Gleitman’s background assumptions

- Li & Gleitman are ardent supporters of Figure 18
- so how come they are so concerned about culture here?
- Li & Gleitman want to disabuse us of the idea that language could play a formative role in cognition
- accordingly, they claim that variation in linguistic categorization is itself culturally determined

Li & Gleitman’s hypothesis

- independently of language, people have innate knowledge of the 3 FoRs and are capable of using them
- there are cultural biases of FoR use that have to do with the environment and modes of production
- these influence language use and internal cognition alike
  - culture is arguably a straw man here
  - the real point is to trivialize the differences Pederson et al. found as rather more shallow and easily mutable

Li & Gleitman’s experiments

- American college students outdoors → ?absolute?
  - supposition: Maybe Levinson et al. tested their “absolute” subjects in the big outdoors
    - while their “relative” ones were tested indoors?
  - Levinson et al. (2002) fail to replicate this with Dutch college students
  - the use of local landmarks such as buildings instantiates intrinsic, not absolute, FoRs on Levinson’s classification
    - however such landmark-based FoRs do share important logical properties with absolute FoRs!
  - American college students indoors with a landmark cue (a toy duck pond!) → ?absolute?
    - participants’ performance under this condition involves memorizing the array intrinsically wrt. the toy pond
  - bottom line: Li & Gleitman failed to demonstrate that American college students use absolute FoRs
    - in table top space

new work: Li, Abarbanell, & Papafragou 2005

- claim: Tenejapans when given an appropriate task can be induced to memorize stuff in a relative FoR
  - method (experiment I)
    - picture-to-picture matching: view a card with two dots
      - then rotate and select an identical copy on a second table
    - the participants rotate holding the original card in a box
    - “egocentric” condition: the box rotates w/ the participants
      - “geocentric” condition: the participants maintain the orientation of the box in the room
  - findings: no significant difference b/w conditions
  - LA&P’s interpretation
    - “correct” responses in the “egocentric” condition require use of a relative FoR
    - therefore, the outcome shows that Tseltal speakers are just as good at reasoning in absolute and relative FoRs

new work: Li, Abarbanell, & Papafragou 2005

- claim: Tenejapans when given an appropriate task can be induced to memorize stuff in a relative FoR
  - method (experiment I)
    - picture-to-picture matching: view a card with two dots
      - then rotate and select an identical copy on a second table
    - the participants rotate holding the original card in a box
    - “egocentric” condition: the box rotates w/ the participants
      - “geocentric” condition: the participants maintain the orientation of the box in the room
  - findings: no significant difference b/w conditions
  - LA&P’s interpretation
    - “correct” responses in the “egocentric” condition require use of a relative FoR
    - therefore, the outcome shows that Tseltal speakers are just as good at reasoning in absolute and relative FoRs
Appendix I: The Levinson-Gleitman debate (cont.)

- deconstruction
  - the use of one’s own body as both ‘anchor’ of a FoR and referential ground involves intrinsic, not relative, FoRs
  - it is only the projection onto an external ground that makes egocentric reference relative in Levinson 1996
  - Danziger (in press) proposes the term direct for the intrinsic use of the observer’s body as ground
  - of course, LA&P’s “geocentric” condition likewise involved an intrinsic FoR, not an absolute one, as they thought

- bottom line
  - just as Li & Gleitman failed to show that American college students use absolute FoRs in table top space...
  - ...so LA&P failed to show that Tenejapans use relative FoRs

Appendix II: FoRs – the fine-grained picture

### place functions

#### topological:
- place functions

#### perspectival/“projective”:
- true absolute: anchor abstracted from environ-mental gradient
- direct: anchor = ground is the observer’s body
- landmark-based: anchor = landmark or environ-mental gradient

#### allocentric: anchor = ground
- object-centered: anchor = ground is some entity distinct from observer’s body
- direct: anchor = ground is the observer’s body

#### egocentric: anchor = ground
- true absolute: anchor abstracted from environ-mental gradient
- direct: anchor = ground is the observer’s body

### vectors

#### definition in terms of head or tail plus ‘sense’
- allocentric
- egocentric

#### definition in terms of direction
- allocentric
- egocentric

#### landmark-based:
- head/tail is a place intrinsically projected from a ground entity
- true absolute: anchor abstracted from environ-mental gradient
- direct: anchor = ground
- relative: anchor is observer’s front-back axis

#### direct:
- true absolute: anchor abstracted from environ-mental gradient
- direct = direct.
- The chair is facing upstream; Sally walked uphill.
- The chair is facing uphill; Sally walked downhill.
- The chair is facing away from the door.
- Sally walked towards/towards/away from the tree.
- Sally walked towards/towards/away from the tree.

#### landmark-based:
- anchor is environmental gradient
- The chair is facing upstream; Sally walked downhill.
- Sally walked towards/towards/away from the tree.
- Sally walked away from the door.
- The chair is facing away from the door.
- The chair is facing uphill; Sally walked downhill.

#### true absolute:
- anchor abstracted from environ-mental gradient
- The chair is facing upstream; Sally walked uphill.
- The chair is facing uphill; Sally walked downhill.
- The chair is facing away from the door.
- Sally walked towards/towards/away from the tree.
- Sally walked away from the door.
- The chair is facing away from the door.

#### direct:
- The chair is facing uphill; Sally walked downhill.
- The chair is facing uphill; Sally walked downhill.
- The chair is facing away from the door.
- The chair is facing away from the door.
- The chair is facing away from the door.
- The chair is facing away from the door.
- The chair is facing uphill; Sally walked downhill.
- The chair is facing downhill; Sally walked uphill.
- The chair is facing uphill; Sally walked downhill.
- The chair is facing downhill; Sally walked uphill.
- The chair is facing downhill; Sally walked uphill.
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