Space exploration: Adventures in semantic typology

Overview

- semantic typology
- spatial frames of reference
- crosslinguistic variation
- cognitive consequences
- tables turned and returned
- summary

Semantic typology

- categorization

Figure 1. The spork dilemma

Semantic typology (cont.)

- semantic categorization and language specificity

Figure 2. Basic color terms in the "grue" domain

Semantic typology (cont.)

- semantic typology: distribution

Figure 3. Green and blue terms in WALS (Kay & Maffi 2008)

Semantic typology (cont.)

- semantic typology: generalizations

Figure 4. Stage model of implicational generalizations, covering 83% (91/110) of the languages of the World Color Survey (Kay & Maffi 1999: 748)
Prelude: Semantic typology (cont.)

- some recent studies
  - Pederson et al. 1998: spatial frames of reference and spatial categorization in 13 languages
  - Levinson, Meira, & L&C 2003; Ketepal, Majid, & Regier 2009: semantic similarity of 'topological' spatial relators in 13 languages
  - Bohnemeyer, Eisenbeiß, & Narasimhan 2006: motion event categorization in 17 languages
  - Bohnemeyer et al. 2007: motion event segmentation in 18 languages
  - Regier, Kay, & Ketepal 2007: semantic similarity of color terms in the 110 languages of the WCS
  - Bohnemeyer et al. 2008: argument structure of verbs of cutting and breaking in 17 languages
  - Majid, Boster, & Bowerman 2008: semantic similarity of verbs of cutting and breaking in 28 languages

Semantic typology (cont.)

- the big picture: culture vs. biology in cognition

- current research: MesoSpace
  - NSF award #BCS-0723694 “Spatial language and cognition in Mesoamerica”
  - 15 field workers
  - 13 MA languages
    - Mayan
      - Chol (J.-J. Vázquez)
      - Q’ejjob’al (E. Mateo Toledo)
      - Tzeltal (G. Polian)
    - Yucatec (J. Bohnemeyer)
      - Purepecha (A. Capodrián)
      - Huehuetla Tepehua (S. Smythe Kung)
    - Mixe-Zoquean
      - Ayutla Mixe (R. Romero Méndez)
      - Sotolapanec (S. Guerreero Morales)
      - Tecpatlán Zoque (R. Zavala Maldonado)
    - Mixe-Zoquean
      - Otomi (E. Palancar; N. H. Green; S. Hernández-Gómez)

- 3 non-MA “controls”
  - Seri (C. O’Heara)
    - Mayangna (E. Benedicto, A. Eggleston in collaboration with the Mayangna Yulbarangyang Balna)
    - Mexican Spanish (R. Romero Méndez)
  - 2 (interrelated) domains
    - frames of reference and meronyms (labels for entity parts)

- semantic typology: field work
  - 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?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 600 people in the municipal district of Felipe Carrillo Puerto in Quintana Roo

- semantic typology: field site
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Spatial frames of reference

- two kinds of place functions (Jackendoff 1983)
  - i.e., functions from reference entities into regions
    - topological (Piaget & Inhelder) - perspective=frame-free
      - means in practice independent of the orientation of the ground, the observer, and the figure-ground array (the configuration)

  \[ \text{Figure 12. Some configurations that might be described in terms of topological place functions} \]

  (1.1) The apple is on the skewer
  (1.2) The band aid is on the shin
  (1.3) The earring is in the ear (lobe)

- alternative classifications and subtypes

  \[ \text{Figure 14. Reference frame types and their classification (A - 'away from', B - 'back', D - 'downriver', F - 'front', L - 'left', R - 'right', T - 'toward', U - 'upriver'; Bohnemeyer & Levinson ms.)} \]

Want more info?
- on the MesoSpace project
  - http://www.acsu.buffalo.edu/~jb77/Mesospace.htm
- on semantic typology
  - http://www.acsu.buffalo.edu/~jb77/SemanticTypology.html
- feel free to come and visit the semantic typology lab
  - meetings this semester
    Tuesdays 2:00 – 3:20pm in 617 Baldy
  - e-mail Randi Tucker (randituc@buffalo.edu)
    if you would like to be added to the mailing list

Semantic typology (cont.)

• want more info?
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Spatial frames of reference (cont.)

• projective – framework-dependent
  - the place function returns a region defined in a coordinate system centered on the reference entity
  - the axes of the coordinate system are derived from an anchor
    » in intrinsic frames, the anchor is the reference entity
    » in relative frames, it is the body of an observer
    » in absolute frames, it is some environmental entity/feature

\[ \text{Figure 13. The three types of spatial FoRs distinguished in Levinson 1996, 2003} \]

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Crosslinguistic variation

- methods for studying frame preferences in language use
  - examine recorded narrative and conversation
  - videotape cultural events in which spatial orientation matters - house building, ceremonies, etc.
  - domains
    - table-top space
    - visual space
    - geographic space
  - elicitation: ‘interactive games’ - referential communication tasks

Crosslinguistic variation (cont.)

- example: the MesoSpace tool for studying frames in discourse - **Ball & Chair (B&C)**
  - 4 x 12 photographs of configurations of a ball and chair
  - participants match corresponding pix in two identical sets through referential communication

Crosslinguistic variation (cont.)

- **finding:** a great deal of crosslinguistic variation
  - in terms of both availability and preferences

Crosslinguistic variation (cont.)

- referential communication tasks, with screened off ‘Describer’ and ‘Matcher’
  - picture matching (Men & Tree, Ball & Chair)
  - object-to-picture matching (Farm-Animals)
  - model-to-object matching (Tinker Toys)
  - route description through model landscape

Cognitive consequences

- **predictions**
  - difficult to translate a place functions from one frame 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 frame appropriate to their language

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Cognitive consequences (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

**Figure 20.** The Animals-in-A-Row memory recognition task

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**The large sample**

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

**Table 1.** Animals-in-a-Row in Levinson 2003: the large sample

<table>
<thead>
<tr>
<th>Linguistically</th>
<th>N</th>
<th>Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative</td>
<td>85</td>
<td>Non-vertical coding will be relative</td>
</tr>
<tr>
<td>Absolute</td>
<td>99</td>
<td>Non-vertical coding will be absolute</td>
</tr>
</tbody>
</table>

**Figure 22.** Animals-in-a-Row results in Levinson (2003: 184): The sample corresponding to Table 3

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**Cognitive consequences (cont.)**

**Recall Memory Task: Results (small sample)**

**Figure 21.** Animals-in-a-Row in Pederson et al. 1998: results — the small sample

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**Further effects:** Cognitive support for linguistic frames

- must code all spatial memories in north/south terms, etc.
- therefore must know constantly where north/south (etc.) is
- must dead-reckon their current location:
  - dead-reckoning requires keeping track of direction and distance

**Figure 23.** Dead reckoning

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**Pointing experiments**

method for testing dead-reckoning skills
- transport consultants to unfamiliar places with restricted visibility
- ask them to point to a range of places, far and near
- assess accuracy of the pointings using prismatic compass, GPS, maps
- test populations
  - **Guugu Yimithirr — Cape York, Queensland** (Levinson);
  - **Hai/om — Khoisan, Kalahari** (Widlok);
  - **Tzeltal — Mayan, Mexico** (Brown, Levinson);
  - contrasted to three relative communities (Dutch, English, Japanese)

**Figure 24.** Pointing accuracy — Guugu Yimithirr and Hai/om speakers
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Cognitive consequences (cont.)

Tzeltal: collective agreement about location of 20 places

true 'downhill'

Tzeltal: systematically skewed by being inside building without windows

Figure 25. Pointing experiments - Tzeltal speakers

Dutch and British English

Figure 26. Pointing experiments - Dutch and English speakers

Cognitive consequences (Cont.)

- new studies
  - primates show a preference for geocentric over egocentric frames in spatial memory
    - suggesting that the preference for egocentric frames in speakers of, e.g., English and Japanese is learned
    - not innate as had been claimed all the way back to Kant (1768)
  - children perform below chance when trained to use a frame type not habitual in their culture
    - cardinal direction terms (in small-scale space) for Dutch children, relative terms for Hai//om children

- Hai//om children use absolute/geocentric frames even to memorize dance moves!
  - Haun & Rapold 2009, Haun 2011

Figure 27. Dancing with the anthropologists

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Tables turned & returned

- Li & Gleitman 2002: language is not the driving force
  - rather than evidence of language influencing cognition
    - the co-variation reported in Pederson et al. (etc.) is the result of cultural adaptations to environmental factors
    - in particular, topography, population density, infrastructure, literacy, and education

Perhaps it is the habitual linguistic practice in these communities that determines the relevant modes of thought, as Levinson seems to imply in the quotation above. On the other hand, it could be that cultural differences in modes of thought render certain linguistic usages handier than others, and thus influence their prominence and frequency of use. Perhaps both such mechanisms are at work with, in Whorf's words, "language and culture constantly influencing each other." (Li & Gleitman 2002: 268)
Li & Gleitman’s hypothesis
- speakers of all languages have innate knowledge of all frame types and are capable of using them
- there are cultural biases of frame use that are the result of environmental adaptations
- these influence language use and internal cognition alike
- Li & Gleitman are ardent supporters of Figure 30
- so how come they are so concerned about culture here?
- culture is arguably a straw man here
- the point is to trivialize the differences Pederson et al. found as rather more shallow and easily mutable

Li & Gleitman’s test
- American college students outdoors ⇒ ?absolute?
  American college students indoors with a landmark cue (a toy duck pond) ⇒ “absolute”
- supposition: Maybe Levinson et al. tested their “absolute” subjects in the big outdoors
  • while their “relative” ones were tested indoors?

Levinson et al.’s (2002) response
- attempt a replication of Li & Gleitman’s outdoor conditions
  • try to compare the Dutch data of Pederson et al. 1998
    - from six rotation experiments conducted indoors
    - which produced overwhelming evidence of consistent relative coding in all participants

discussion
- the discrepancy between the outdoors and indoors conditions in the Animals-in-a-Row task is probably due
  - to more distractions in the outdoors condition
  - memory errors in the relative FoR look like absolute responses
- why was the difference significant in Li & Gleitman’s data?
  - Levinson et al. suggest that this was due to the greater transparency of Li & Gleitman’s task
  - participants were second-guessing the purpose of the experiment
  - and therefore may have exploited available landmark cues in the outdoors condition

replicating Li & Gleitman’s duck pond condition
- this is based on a confusion of absolute FoRs and landmark-based intrinsic FoRs
- Li & Gleitman manipulate the position of the toy duck pond on the replication table
  - the effect of this is that participants simply treat the toy pond as part of the array to be replicated
  - so they are merely being induced to code their responses intrinsically
- to test this, Levinson et al. redo Animals-in-a-Row with the “pond” added à la Li & Gleitman
  - in addition, in one condition, they use only three animals, as in Li & Gleitman’s study
    - while in another, they use four, as in Pederson et al. 1998
Tables turned & returned (cont.)
- thus pitting environmental bias towards the intrinsic frame
  against memory load bias towards the relative frame
- since the latter is more customary among Dutch speakers
- hypothesis confirmed!
  - 3 animals -> predominantly intrinsic coding
    (i.e., tweaking b'dk'd)
  - 4 animals -> predominantly relative coding

Figure 33. Animals-in-a-Row plus "duck pond" with Dutch participants, three-vs.-four-animal conditions

Tables turned & returned (cont.)
- to directly disambiguate between intrinsic and relative coding
- Levinson et al. then replicate again, under 90 degree rotation
  - hypothesis confirmed!

Figure 34. Animals-in-a-Row: 30º vs. 180º rotation

Tables turned & returned (cont.)
- conclusions to Li & Gleitman critique
  - Dutch and English speakers use two FoRs in their linguistic tasks: the intrinsic and the relative
    - in the table-top space, that is!
  - they use only these two FoRs cognitively, for memory and inferences
    - again, in the same domain
  - the relative FoR is dominant over the intrinsic one for these populations
    - in general only ca. 25% of speakers will give an intrinsic description where a relative one is possible (Levitt)
  - contextual effects can trigger selection of the intrinsic FoR over the relative one

Tables turned & returned (cont.)
- deconstructing Li & Gleitman
  - an overemphasis on nativism
    - development of syntactic categories driven innately
    - development of semantic categories driven by labeling innate conceptual categories
  - this only works as long as the linguistic/conceptual categories in question are truly universal!
    - once crosslinguistic variation in semantic categories is accepted
      - relativistic effects actually aide language acquisition!
  - so what Li & Gleitman are really denying is deep variation in linguistic/conceptual categories

Tables turned & returned (cont.)
- new work: Li et al. (in press)
  - claim: Tenejapans when given an appropriate task can be induced to memorize stuff in a relative FoR
  - problem from the get-go: nobody said any population can’t be made to learn a particular FoR
    - no reason not to assume that the possibility of learning to use the three FoRs is innate
  - Levinson & colleagues’ claims merely concern preferences for using particular FoRs in particular domains
    - and the cognitive consequences of these usage patterns
  - method (experiment I)
    - a variation of Brown & Levinson 1993
    - picture-to-picture matching
      - view a card with two dots
      - then rotate and select an identical copy on the demonstration table from out of a set of four differing in their orientation

Tables turned & returned (cont.)
- the participants hold the original card covered in a box
  - as they rotate
    - two conditions
      - "egocentric": the box rotates w/ the participants
      - "geocentric": the participants maintain the orientation
        - of the box in the room
  - findings
    - 74% "correct" responses in the "geocentric" condition, 84.6% in the "egocentric" one
      - the difference is not significant
  - LA&P’s interpretation
    - "correct" responses in the "geocentric" condition require use of a relative FoR
    - therefore, the outcome shows that Tzeltal speakers are just as good at reasoning in absolute and relative FoRs
Tables turned & returned (cont.)

- deconstruction
  - the use of a left-right distinction with respect to the participants’ own body is intrinsic, not relative
  - experimental bias: the task was easier to solve in the egocentric condition
    - since the participants could keep track of the ground - their own body - proprioceptively

Figure 37. Anchor points for spatial memory in Experiment 1 of Li et al. in press (Bohnemeyer & Levinson ms.)

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Summary

- semantic typology
  - the study of universals and crosslinguistic variation in linguistic categorization
- linguistic categorization – categorization of extra-linguistic reality in linguistic expressions
- Linguistic Relativity Hypothesis (LRH)
  - the hypothesis, derived from the writings of Benjamin Lee Whorf
    - that linguistic categories determine categorization
      - (strong formulation, often attributed to Whorf; not in line w/ available data)
    - that linguistic categories influence categorization
      - (weak formulation, compatible with current evidence; still controversial)

Summary (cont.)

- spatial frames of reference (FoRs)
  - conceptual coordinate systems used to identify places, orientations, and directions
    - in discourse and in internal cognition
- the debate on linguistic vs. nonlinguistic factors
  - different populations prefer different FoRs for the same task and domain
  - population-specific preferences for particular types of FoRs in discourse and internal cognition align
    - Levinson (1996, 2003, inter alia), Pederson et al. 1998, etc.: language in the driver’s seat
    - Li & Gleitman 2002; Li et al in press: variation across populations is the result of adaptations
    - to environmental factors that shape both language and cognition

Summary (cont.)

- the MesoSpace project
  - a collaborative study of the semantic typology of space in 13 Mesoamerican (MA) languages
    - plus three non-Mesoamerican controls spoken in the same region
    - focusing on two domain, spatial FoRs and meronymies
    - with a view towards exploring their connection
      - to environmental factors that shape both language and cognition
      - the possible existence of purely linguistic factors influencing FoR selection – especially the availability of productive meronymies

- predictions
  - Li & Gleitman: participants will cluster according to literacy, education, topography, and population geography
    - native language and bilingualism in Spanish should not be strong determinants
  - Levinson & colleagues: participants will cluster primarily according to native language and bilingualism in Spanish
    - literacy, education, topography, and population geography should be weaker factors

- stay tuned!