Space in semantic typology: The MesoSpace project

Workshop *Grammar, space, and cognition*

FRIAS, November 5-7, 2009

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Overview

- semantic typology
- the Levinson-Gleitman debate
- the MesoSpace project
- evidence from Yucatec
- the meronymy-allocentrism pattern
- conclusions

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Semantic typology

- (non)linguistic categorization

Figure 1. *The spork dilemma*

http://karenjlloyd.com/blog/2009/01/08/extreme-close-up-wall-e/

Semantic typology (cont.)

- languages as engines for the generation of *external representations*

Figure 2. *The semiotic triangle*

"quadruped of genus *Felis*"

Sense ≈ Thought ≈ Concept

Symbol /kæt/   Referent — Felix

| Syntactic structures | — | Conceptual structures | — | Spatial representations (3D model) | Visual representations (2½D sketch) |

Haptic representations

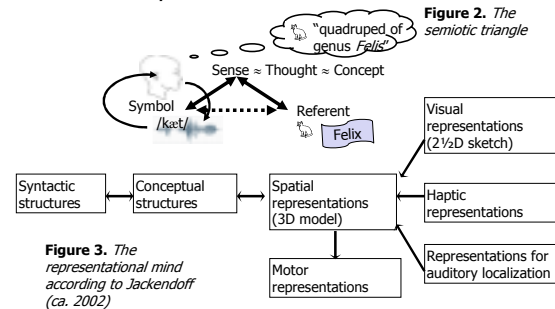Representations for auditory localization

Motor representations

Figure 3. *The representational mind according to Jackendoff (ca. 2002)*

Semantic typology (cont.)

- language specificity in linguistic representations

"…we are parties to an agreement to organize [nature] in this way – an agreement that holds throughout our speech community and is codified in the patterns of our language. This agreement is of course an implicit and unstated one, *but its terms are absolutely obligatory*; we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees." (Whorf [1940] 1956: 212-214)
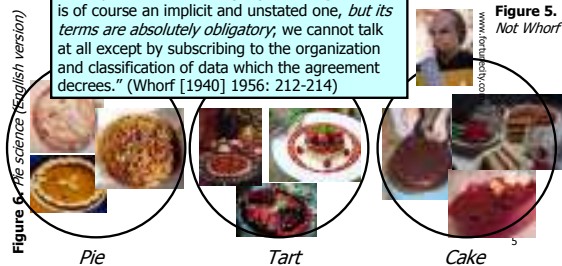
Figure 4. *Whorf*

Figure 5. *Not Whorf*
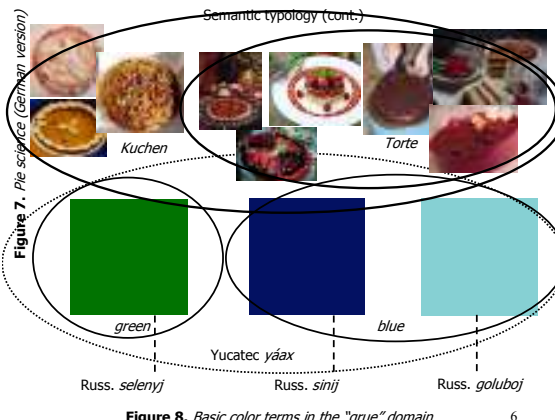
Figure 6. Pie science (English version)

Pie   Tart   Cake

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Semantic typology (cont.)

Figure 7. Pie science (German version)

Kuchen   Torte

green   blue

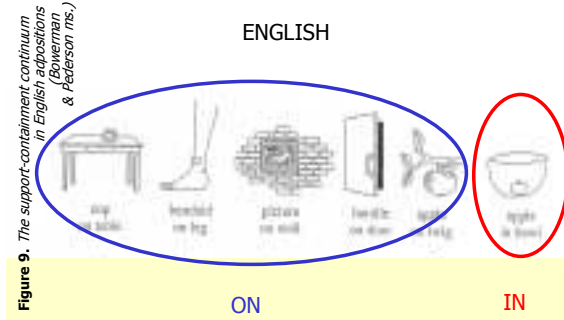*green*   *blue*

Yucatec *yáax*

Russ. *selenyj*   Russ. *sinij*   Russ. *goluboj*

Figure 8. *Basic color terms in the "grue" domain*

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- one more example: spatial relations in English, Dutch, Berber, and Spanish

ENGLISH

Figure 9. *The support-containment continuum in English adpositions (Bowerman & Pederson ms.)*

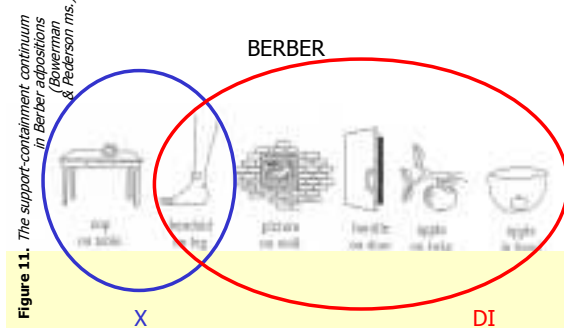ON   IN

do English speakers find the relation between the picture and the wall more similar to the relation between the band aid and the leg than Dutch speakers?
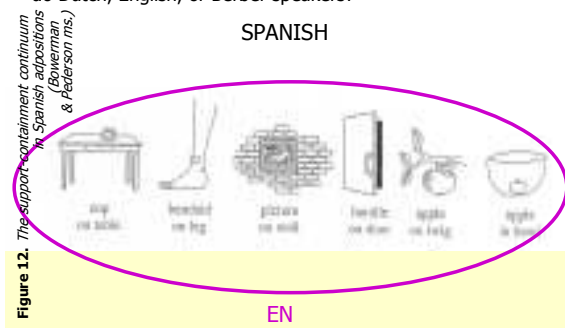
DUTCH

Figure 10. *The support-containment continuum in Dutch adpositions (Bowerman & Pederson ms.)*

OP   AAN   IN
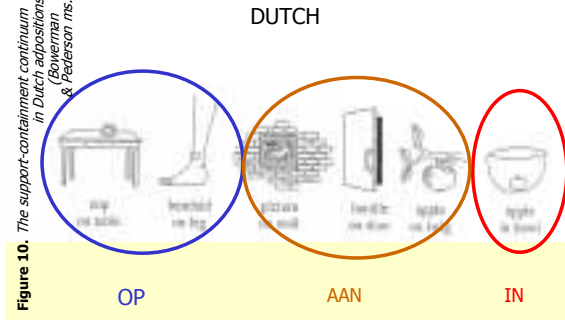
do Berber speakers consider the relation between the apple and the twig more similar to that between the apple and the bowl than Dutch or English speakers?

BERBER

Figure 11. *The support-containment continuum in Berber adpositions (Bowerman & Pederson ms.)*

X   DI

do Spanish speakers find the relation between the cup and the table more similar to that between the apple and the bowl than do Dutch, English, or Berber speakers?

SPANISH

Figure 12. *The support-containment continuum in Spanish adpositions (Bowerman & Pederson ms.)*

EN

- **linguistic categorization** of a given stimulus
  - the representation of that stimulus in a particular language
- **semantic typology** is the cross-linguistic study of linguistic categorization
  - using methods of language typology, the "bottom-up" = inductive study of language universals
- the Big Question
  - what properties of linguistic categorization vary across languages and what are universal?
- corollary
  - to the extent that there is variation
    - what determines the type of representation that occurs in a particular language?

- the Nijmegen approach to semantic typology
  - start from a tentative determination of parameters of variation, based on previous studies
  - construct an *etic grid*
    - a possibility space created by a few independent notional dimensions
      - in which every categorized stimulus can be located as a data point
    - e.g., a network of nuclear-family genealogical relations is used as etic grid in studies of kinship terminology
      - following a method pioneered by L. H. Morgan (1871)
    - Berlin & Kay's (1969) seminal study of color terminologies famously used the Munsell color chart
      - a matrix of 40 hues by eight brightness values, realized in 320 color chips – cf. day 4
      - this approach was pioneered by Brown & Lenneberg 1954

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- encode the "cells" of the grid exhaustively in sets of nonlinguistic stimulus items
- collect preferred descriptions and ranges of possible descriptions
  - in a typologically broadly varied sample of unrelated languages
  - with multiple speakers per language according to a standardized protocol
- try alternative elicitation procedures
  - aimed at exploring the full referential potential of language-particular expressions in the target domain
  - including referential communication tasks
- perform semantic analyses
  - to filter out pragmatically generated meaning components
    - and isolate senses or "intensions"

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- use statistical techniques to analyze correlations
- formulate implicational generalizations
  - e.g., **If** a language has a basic color term for brown
    » **then** it also has basic color terms for black, white, red, green, yellow, and blue (Berlin & Kay 1969)
  - **If** a language uses observer-centered ("relative") frames in a given domain of spatial reference
    » **then** it also uses object-centered ("intrinsic") frames in the same domain (Pederson *et al.* 1998)
  - **If** a language has a pre- or postposition that expresses contact ("ON")
    » **then** it also has a pre- or post-position that expresses inclusion/containment ("IN") (Levinson & Meira 2003)
- three large-scale reference studies to date
  - Pederson *et al.* 1998 on spatial frames of reference
  - Levinson & Meira 2003 on "topological" spatial relations
  - Bohnemeyer *et al.* 2007 on the segmentation of motion events

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- goals of semantic typology
  - an empirical inquiry into the interface between language and cognition
    - look at how supposedly universal domains of cognition are represented across languages
      - to what extent is linguistic encoding constrained by universals of cognitive representation?
      - how much leeway do languages have for variation in semantic construal?
    - sort out the real universals from Euro-centrisms and Anglo-centrisms
      - improve semantic theory
      - ~~debunk~~ test ~~gratuitous~~ innatist claims
      - pave the way for serious research on the LRH
    - illuminate the mechanisms of form-to-meaning mapping
      - and the mapping between linguistic and internal representations
  - other "windows" in the language-cognition interface
    - language acquisition, sign language, co-speech gesture, language processing

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Overview

- semantic typology
- the Levinson-Gleitman debate
- the MesoSpace project
- evidence from Yucatec
- the meronymy-allocentrism pattern
- conclusions

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The Levinson-Gleitman debate

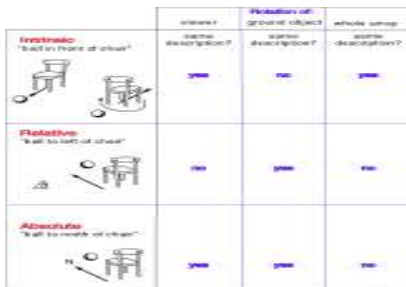- background: spatial frames of reference (FoRs)

Figure 13. *Levinson's (1996) classification of FoRs*

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- surprise, surprise: cross-linguistic variation!

Table 1. *Distribution of the three types of spatial FoRs*

	Intrinsic	Absolute	Relative
Mopan (Mayan)	+	—	—
Guugu Yimithirr (Australian P-N)	—	+	—
Tzeltal (Mayan) Hai//om (Khoisan)	+	+	—
Japanese English *	+	—	+
Yukatek (Mayan) Kalagadi (Bantu)	+	+	+

- primary differences not in lexicon, but in domains of usage
- e.g. English: cardinal directions mostly in geographic space only!
- Tzeltal etc.: *no* uses of relative FoR z-e-r-o! nada! rien!
- intrinsic occurs alone
- absolute occurs alone
- relative implies Intrinsic

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- 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
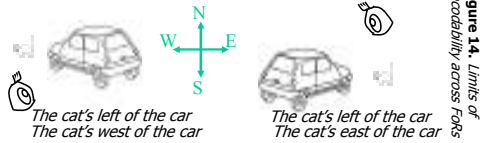   » unless you happen to also memorize where you were with respect to the car in cardinal terms

Figure 14. *Limits of recodability across FoRs*

The cat's left of the car
The cat's west of the car

The cat's left of the car
The cat's east of the car

    - so people remember everything they might want to talk about in a FoR appropriate to their language

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- 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
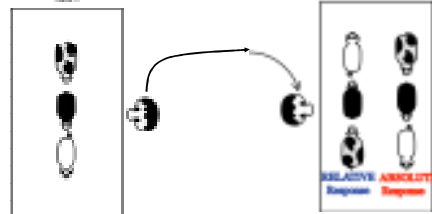
Design: Levinson & Schmitt

Figure 15. *The Animals-In-a-Row memory recognition task*

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- 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*

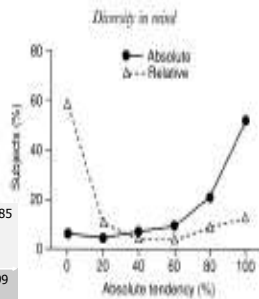| Linguistically Relative	English, Dutch, Japanese, Tamil-Urban	Prediction: Non-verbal coding will be relative	N = 85
Linguistically Absolute	Arrernte, Hai//om, Tzeltal, Longgu, Belhare, Tamil-Rural	Prediction: Non-verbal coding will be absolute	N= 99

Figure 16. *Animals-in-a-Row results in Levinson (2003: 184): The sample corresponding to Table 3*

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- further evidence
  - additional recall memory experiments on color chips rather than toy animals
  - additional recall memory experiments on paths rather than static configurations ("maze" tasks)
  - experiments on transitivity inferences under rotation
    - linguistically relative populations prefer relative solutions on all these tasks
      - while linguistically absolute ones prefer absolute solutions
  - experiments on "dead reckoning" skills
    - measured by the accuracy of pointing to a familiar location after having been brought to an unfamiliar one
    - linguistically absolute populations are shown to have far superior dead reckoning skills to those of relative ones
- Levinson et al.'s interpretation: Whorfian effect!

- 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

"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)
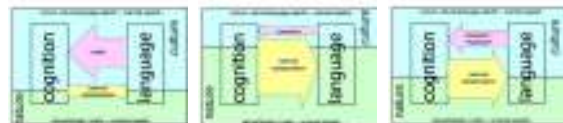
Figure 17. *The big picture according to Whorf*   **Figure 18.** *The big picture according to the innatists*   **Figure 19.** *The big picture according to neo-whorfians*

- 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

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Figure 20. *Levinson's position according to Li & Gleitman*

Figure 21. *Li & Gleitman's position*

Figure 22. *The actual neo-Whorfian position*

- 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

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- thus, as Majid *et al.* 2004 point out, there is no evidence of ecology or modes of production predicting FoR bias

Table 3. *Frames of reference and ecological determinism (Majid et al. 2004: 112)*

  - one possible exception: literacy – but see Levinson 2003

- 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?
    - Levinson *et al.* (2002) show
      - 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 Tzeltal speakers are just as good at reasoning in absolute and relative FoRs

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- 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

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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'anjob'al (E. Mateo Toledo)
    - Tzeltal (G. Polian)
    - Yucatec (J. Bohnemeyer)
  - Mixe-Zoquean
    - Ayutla Mixe (R. Romero Méndez)
    - Soteapanec (S. Gutierrez Morales)
    - Tecpatán Zoque (R. Zavala Maldonado)
  - Oto-Manguean
    - Otomí (E. Palancar)
  - San Lucas Quiaviní Zapotec (G. Pérez Báez)
  - Tarascan
    - Purepecha (A. Capistrán)
  - Totonacan
    - Huehuetla Tepehua (S. Smythe Kung)
  - Uto-Aztecan
    - Cora (V. Vázquez)
    - Pajapan Nawat (V. Peralta)

Figure 23. *MesoSpace field sites*

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- 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*

Figure 24. *MesoSpace field sites*
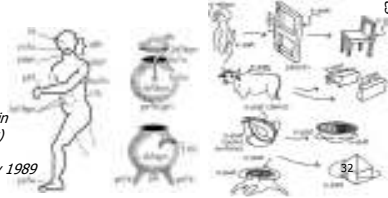
Figure 25. *Meronyms in Ayoquesco Zapotec (left) and Tenejapa Tzeltal (adapted from MacLaury 1989 and Levinson 1994)*

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The MesoSpace project (cont.)

- spatial frames of reference
  - conceptual coordinate systems used to define orientation-dependent place functions (Jackendoff 1983)

Intrinsic	The man is on the side of the tree.
Relative	The man is to the right of the tree.
Absolute	The man is east of the tree.

observer

- why MA
  - productive meronymies affording reference to arbitrary parts of arbitrary objects
    - attested in Mixtec, Purepecha, Totonac, Trique, Tzeltal, Tzotzil, Yucatec, Zapotec
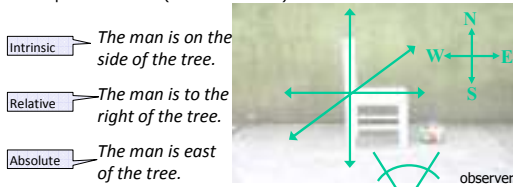
Figure 26. *The three types of spatial FoRs distinguished in Levinson 1996*

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The MesoSpace project (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

Figure 27. *Meronyms in Ayoquesco Zapotec (adapted from MacLaury 1989)*

MacLaury 1989: 130

MacLaury 1989: 123-124

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The MesoSpace project (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 López 2000 and Pérez-Báez in press for other Zapotecan varieties
- Levinson 1994 rejects global analogical mapping for Tenejapan 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.

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The MesoSpace project (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
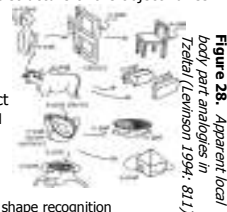

Figure 28. *Apparent local body part analogies in Tzeltal (Levinson 1994: 811)*

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– meronymy as the primary lexical resource for spatial reference – few/no adpositions/case markers
  • including, e.g., in all of the above languages
  • 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 *is* the **ground phrase** (the phrase denoting the place projected from the ground object)
      » or combines with a semantically pale adposition to form it
    – the following examples from Juchiteco Zapotec and Yucatec Maya illustrate the first possibility

(3.1)

Dxi!'ba
za
ike
yoo   37

– relative 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

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• 2 big research questions
  – *does the availability of productive geometrical meronym systems bias FoR selection?*
    • **hypothesis:** meronymies 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 mero-nymies 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?*   39

– *do languages borrow from one another, not just metaphors (-> calques), but entire semantic frames*
  • *such as domain mapping strategies and reference frames*
– *is there variation in the role the human and animal body plays as a conceptual model*
  • *of the structure of objects across languages?*
– *do speakers of all languages employ the same conceptual processes*
  • *in mapping the structure of the body into that of objects?*
• tools
  – picture book for meronym elicitation
    • featuring humans, animals, and plants
      – plus artifacts, some customary in MA culture, some Western
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• a set of plastic objects of unfamiliar shapes

Figure 29. *Some Novel Objects*

  – to be used in referential communication tasks on part identification and localization wrt. parts
• the Ball & Chair (B&C) pictures
  – 4 x 12 photographs of configurations of a ball and chair to be matched in referential communication

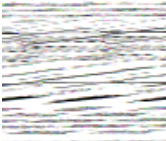**Figure 30.** *Layout of Men and Tree task (Pederson et al. 1998: 562)*

Figure 31. *Two Ball & Chair pictures, featuring an intrinsic contrast*   41

• recall memory task: New Animals
  – a near-identical replication of the Animals In A Row (AIAR) design
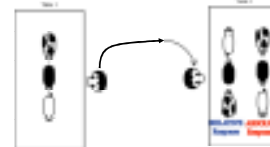   • of Levinson 1996 and Pederson *et al.* 1998

Figure 32. *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   42

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Evidence from 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 800 people in the municipal district of Felipe Carrillo Puerto in Quintana Roo

Figure 33. Approximate dialect regions of Yucatec and location of the field site

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Evidence from Yucatec (cont.)

- 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

Table 4. *Yucatec meronym classes*

volumes	surfaces	extremes
ho'l = nòol 'head'	*ninal* 'bottom'	*nùunta* 'tip'
chùun 'trunk'	*ichil* 'inside'	*tu'k'* 'corner'
it' 'anus	*òok'ol* 'top'	*xuul* 'end'
kàal 'neck'	*pàach* 'back'	
k'ab 'hand/arm'	*táan* 'front'	
nak' 'belly'	*tséel* 'side'	
òok 'foot/leg'		
xbak'et 'buttocks'		
xikin 'ear'		
...		

Evidence from Yucatec (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

Table 5. *Yucatec meronym classes and their properties*

	volumes	surfaces	extremes
possession of other meronyms	occurs	does not occur	does not occur
set	not sharply defined, possibly open	closed	closed
productivity	limited by convention	fully productive	fully productive
use depends on orientation	no	yes	no
possession by descriptors of multi-volume entities	unrestricted	restricted	unrestricted
projected region	"bubble space"	oriented region	"bubble space"

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Evidence from Yucatec (cont.)

- 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

Figure 34. *Novel objects 3, 5-7; bottle gourd*

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Evidence from Yucatec (cont.)

  - in contrast, surface meronyms were used liberally in reference to all *Chunches*
- assignment of volume meronyms frequently involved similes and hedges

Figure 34. *Chunche #7*

(5.1)   *Ko'x* *a'l-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

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– 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
      – the 'head' of a village is its entrance, or the first house one passes when entering the village proper
        » 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' [49]

– 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

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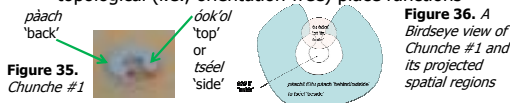 • volumes and extremes only occur as arguments of topological (i.e., orientation-free) place functions

pàach 'back'

óok'ol 'top' or tséel 'side'

Figure 36. *A Birdseye view of Chunche #1 and its projected spatial regions*

Figure 35. *Chunche #1*

Table 6. *Surface meronyms and the expression of place functions*

surface meronym	preferred construction for reference to projected region	gloss	preferred FoR for reference to regions	available alternative FoR
áanal 'bottom'	*áanal (NP)*	'below'	absolute	intrinsic
ichil 'inside'	*ich(il ti')(NP)*	'in(side)'	topological	
óok'ol 'top'	*óok'ol (NP)*	'on/above'	absolute	intrinsic
pàach 'back'	*pàach-il ti' (NP)*	'behind/out side'	intrinsic	relative
táan 'front'	*táanb-il ti' (NP)*	'in front of / 'ah	intrinsic	relative
tséel 'side'	*ti'=tséel (NP)*	'beside'	intrinsic	relative

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• **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

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Figura 37. *Number of descriptions by strategy in the Yucatec Ball & Chair data (5 x 2 speakers; (fine-grained coding)*
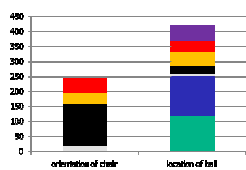
Figura 38. *Number of descriptions by strategy in the Yucatec Ball & Chair data (5 x 2 speakers; (coarse-grained coding)*
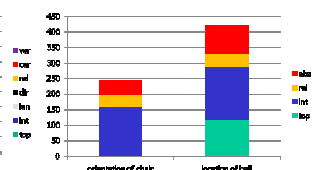
Table 7. *Coding the B&C responses*

Finegrained clasificación	Levinson 1996
ver - vertical relators interpreted wrt. the Earth' field of gravity	*abs* –absolute FoRs
car – cardinal relators	
rel – relative FoRs (anchor = observer's body; external ground)	*rel* – relative FoRs
dir – direct FoRs (anchor = ground= observer's body)	*int* – intrinsic FoRs
lan – landmark-based FoRs (anchor is an entity distinct from both ground and observer's body)	
int – intrinsic FoRs (anchor = ground; ground ≠ observer's body)	
top – topological relators (interpreted independently of FoRs)	*top* – topological relators

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– for the task of orienting the Chair
  • intrinsic FoRs in a narrow sense play no role here
  • the most important type of FoR is the *direct* (Danziger in press), where anchor and ground is the observer's body
    » this, however, *is* treated as intrinsic reference in Levinson 1996)
(5.2)   Tu'x   k-u=nak-tal
                                                                    máa
         where (B3SG) IMPF-A3=lean.against-INCH   person=D2
              estée   **ta=frèente**
              HESIT PREP:A2=front turn\MIDDLE-INC(B3SG)
              'The back (lit. where one leans against),
              uh, it's turned towards your front.'

Figure 39. *Ball & Chair 2.5*

• 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

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- "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

(5.3) T-u=**tséel**,   te=x-**ts'íik**
                    te-estée-le=**chik'in**=o'
              PREP-A3=**side**   PREP:DET=F-**left**
PREP:DET-HESIT-DET=**west**=D2
                    hun-p'éel   bòola
                        ch'uy-k'ah-a'n (...)
                    one-CL.IN   ball
EXIST(B3SG)=D4 hang-MIDDLE-RES(B3SG)
                    'On (the Chair's) side, on the (...) the
west,
              there is a ball, it is suspended (...)'

Figure 40. Ball & Chair 2.2

- predictions for New Animals task

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- FoRs in recall memory: New Animals

Table 8 - *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)*

Age group	Gender	Predominant response type				Total
		absolute	relative	unidirectional	mixed	
< 30	male	1	1	0	0	2
	female	3	0	0	1	4
≥ 30	male	3	0	2	0	5
	female	2	1	1	1	5
Total		9 (56.3%)	2 (12.5%)	3 (18.8%)	2 (12.5%)	16

- interpreting the response types
  - the "absolute" response type is produced by absolute, geocentric, and landmark-based FoRs
    - and by coincidence

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

Age group	Gender	Responses in individual trials					Total
		absolute	relative	non-aligned	wrong order	wrong animal	
< 30	Male (N=2)	7	5	0	0	0	12
	female (N=4)	17	3	3	0	1	24
≥ 30	male (N=5)	17	4	4	3	2	30
	female (N=5)	14	8	3	5	0	30
Total		55 (57.3%)	18 (19%)	10 (10.4%)	10 (10.4%)	3 (3.1%)	96

  - 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

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- 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 predict a strong gender effect in the non-linguistic data
      » comparable to that in the linguistic data
        - contrary to fact

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Overview

- semantic typology
- the Levinson-Gleitman debate
- the MesoSpace project
- evidence from Yucatec
- the meronymy-allocentrism pattern
- conclusions

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The meronymy-allocentrism pattern

- the evidence from Yucatec supports
  - the hypothesis that productive geometrical meronymies disfavor the use of relative FoRs
- the data from the other 15 languages of the sample point in the same direction
  - to the extent that they have been coded and analyzed
- but *why* would there be a connection b/w meronymy and FoRs?
  - productive geometrical meronymies *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

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- 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)
- in contrast, productive meronymies do not affect the use of absolute FoRs
  - because geomorphic and absolute systems do not use meronyms and thus do not create a potential for clashes

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Overview

- semantic typology
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- conclusions

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Conclusions

- 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)

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- spatial frames of reference (FoRs)
  - conceptual coordinate systems used to identify places, orientations, and directions
    - in discourse and in internal cognition
- the Levinson-Gleitman debate
  - 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.: the alignment is a Whorfian effect
  - Li & Gleitman 2002; Li, Abarbanell, & Papafragou 2005, etc.: the alignment is caused by culture
    - cultural factors drive biases in FoR selection in both discourse and internal cognition

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- 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
      - and towards advancing the Levinson-Gleitman debate on two fronts
        » effects of variation in topography, ecology, modes of production/subsistence, education and literacy
        » the possible existence of purely linguistic factors influencing FoR selection – especially the availability of productive meronymies
- meronyms – object-part descriptors
  - many MA languages have highly productive meronymies
    - whose use is governed by object geometry

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- evidence from Yucatec
  - Yucatec has a productive geometric meronymy
    - like Tenejapa Tzeltal and Ayoquesco Zapotec
      - supporting the hypothesis that such meronymies are an areal feature of Mesoamerican languages
  - Yucatec meronymy has traits not attested in previously studied systems
    - in particular, the division into subsystems for volumes, surfaces, and curvature extremes
  - the (fully productive) surface terms are not (used as) body part terms (except for *pàach* 'back')
  - 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
    - algorithmic mapping is not necessarily non-metaphorical!

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- referential promiscuity and the dominance of the intrinsic FoR
  - 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
  - the intrinsic FoR is the most important FoR for expressing place functions among all speakers
  - relative FoRs play only a minor role in both recall memory and discourse
  - confirmed: productive geometrical meronymy aligns w/ dominance of the intrinsic FoR

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