Discourse, cognition, and Whorf

• an innocent (?) assumption
  – when people communicate about states of affairs
    • the hearer’s ability to reconstruct the speaker’s intended meaning depends on the “sharing” of cognitive models

• a real example
  context: downtown Bielefeld, Germany, 5/21/11, around 8:30pm
  FM: Dann treffen wir uns im Oettker Park in 10 Minuten!
    ‘Let’s meet in Oettker Park in 10 minutes!’
  JB: Ist das bei der Oettker Halle?
    ‘Is that near Oettker Hall?’
  FM: Na klar, das ist doch direkt davor!
    ‘But of course, it’s right in front of/before it!’
  JB: [confused – remembers passing Oettker Hall two hours earlier w/o seeing a park in front of it]

**Figure 1. The Oettker Park incident**

• **discourse models** (d-models)
  – are sets of assumptions shared between speaker and hearer as part of the common ground of a conversation
  – are typically not explicitly introduced or altered in the course of a conversation, but presupposed
  – have ancillary functions
    • in the interpretation of individual propositions
    • in the integration of information from across propositions
  – a hotchpotch of examples
    • cultural scripts; frames in the sense of Frame Semantics
    • types of
      – spatial representations; e.g., spatial reference frame types
      – time lines
      – kinship and other social networks
      – biological taxonomies

**Figure 2. Reference frame use in small-scale horizontal space across languages (Bohnemeyer & Levinson ms.)**
• does this variation produce Whorfian effects?
  — after all, the success of communication seems to depend on interlocutors agreeing on the models they use
  — and at least in some cases, the models used in discourse also play a role in nonlinguistic cognition

“...If (a) the experience and therefore the linguistic expression of crude space is universal (invariant across languages/cultures) and if (b) the process of typifying nonspatial experiential domains in terms of spatial ones is invariant across languages/cultures, then (c) the linguistic expression of the experience of time will also have a universal invariant component or aspect across languages and cultures.”

Study I: temporal relators
• tenselessness: universalist predictions

“(...) if (a) the experience and therefore the linguistic expression of crude space is universal (invariant across languages/cultures) and if (b) the process of typifying nonspatial experiential domains in terms of spatial ones is invariant across languages/cultures, then (c) the linguistic expression of the experience of time will also have a universal invariant component or aspect across languages and cultures.”

Study I: temporal relators (cont’d)
• tenselessness: relativist predictions

“After long and careful study and analysis, the Hopi language is seen to contain no words, grammatical forms, constructions or expressions that refer directly to what we call ‘time’ (...)”
(Whorf (Carroll ed.) 1956: 57-58)

“Hence, I find it gratuitous to assume that Hopi thinking contains any such notion as the supposed intuitively felt flowing of ‘time’, or that the intuition of a Hopi gives him this as one of its data.”
(Whorf (Carroll ed.) 1956: 144-145)

Study I: temporal relators (cont’d)
• tenselessness: typological variation

Figure 4. Past tense in WALS (Dahl & Welupillai 2011)
Study I: temporal relators (cont’d)

• tenselessness: the case of Yucatec
  — in main clauses
    • in perfective clauses, future time reference requires marking of modality or ‘degree of remoteness’
    • in all other clauses, no grammatical constraints obtain on the relation between utterance time and ‘topic time’
      » i.e., the time about/for which an assertion is made, a question is asked, etc.
    — nor is the relation b/w topic time and reference times in context grammatically constrained
  — in certain finite subordinate clauses, future time reference requires irrealis mood marking
  — viewpoint aspect is heavily constrained
    • there are separate forms for perfective, imperfective, progressive, prospective, and perfect

— radical tenselessness
  • no explicit topic time restrictors of any kind
    » with the exception of deictic adverbs meaning ‘now’ and ‘formerly’
  • no absolute or relative tenses and no temporal connective constructions
    • no words for ‘after’, ‘before’, or ‘while’

— structure of the stimulus

Figure 5. The contents of three of the 28 pairs of TEMPEST clips schematically

(2.1) Ts’o’ik le=nah=o’
TERM A1SG=do:APP TERM=house=D2
‘I (will) have/had built the house’

(2.2) Táan le=nah=o’
PROG A1SG=do:APP TERM=house=D2
‘I am/was/will be building the house’

— does the grammaticalization of temporal relators affect d-models of time?
— the TEMPEST study (Bohnemeyer 1998)
  — research questions
    • in communicating the same event orders, do speakers of Yucatec and German express ordering relations (to the same extent)?
    • are speakers of Yucatec and German equally able to and adapt at identifying, categorizing and communicating — the orders of events?

— design of the task

Figure 6. The TEMPEST task
study I: temporal relators (cont’d)

• the German participants express ordering relations pervasively
  — whereas the Yucatecans do so only marginally
• yet, performance on the task is roughly identical
  — except for the linguistic expressions used
• no observable difference in mental representations of temporal order

study I: temporal relators (cont’d)

• toward an explanation
  — viewpoint aspect information and temporal ordering information are partially complementary
  — they tap into the same linear order model of time
    • which does not appear to vary with culture
  — if one type of information is asserted, another may be inferred from it via Gricean implicatures

study I: temporal relators (cont’d)

• Yucatec examples
  — topic time (Klein 1994): the time about which an utterance makes an assertion or asks a question, etc.
  — in conversation, the topic time of utterances stereotypically overlaps with utterance time
  — in narratives, topic time is inferred to be the time of some event described in preceding discourse
    • resulting in the temporal anaphora interpretations familiar from European languages (Bohnemeyer 2009)
Study I: temporal relators (cont’d)

(2.3) Tāan in=m'éet-ik le=nah=ò'
PROG A1SG=do:APP-INC(B3SG) DET=house=D2
‘I am/was will be building the house’

(2.4) Kā=h-tāal-ech way
CON=PRV-come-B2SG here
h-ts’ò’k ka’=p’éel ha’b=e’,
PRV-end(B3SG) two=CL.IN year=D3

tāan in=m'éet-ik le=nah=ò'.
PROG A1SG=do:APP-INC(B3SG) DET=house=D2
‘When you came here two years ago, I was building the house’

Overview

• Discourse, cognition, and Whorf
• study I: temporal relators
  • interlude: metaphors for temporal relations
• study II: spatial reference frames
• discussion: domain-specificity
• acknowledgments

Interlude: spatial metaphors for temporal relations

• does this mean that English and Mandarin speakers employ different d-models of time?
• very tentative answer: perhaps not
  – Yucatec speakers use hardly any spatial metaphors for time relations at all
  – possible ‘deep’ reason:
    apparently no encoding of path functions
    • Bohnemeyer 2010
  – yet, study I has produced no evidence of an effect on Yucatec speakers’ ability to reason about time

• no spatial metaphors for temporal connectives
  – it has often been suggested that temporal connectives such as after and before are based on path metaphors
    • e.g., Clark 1973; Traugott 1978
  – Yucatec lacks such expressions, resorting instead to aspectual operators; cf. Bohnemeyer (2010)
    • e.g., instead of (3.1), one gets (3.2)
    (3.1) Everyday after Pedro writes a letter, he smokes a cigarette
    (3.2) Pedro writes a letter, he smokes a cigarette

• discussion
  – d-models of time do not appear to be affected by the grammaticalization of temporal relators
  – likewise, no evidence was found of cognitive differences in the representation of temporal order
  – possible interpretation
    • d-models of time may rely on cognitive representations that are too far removed from language to be affected by it
    • “removed from”: not directly interfacing with

Figure 10. Vertical metaphors for temporal relations (cont’d)

Figure 11. Spatial primes in Boroditsky’s experiments (examples) Boroditsky 2001: 7–8
• direct evidence against path semantics in Maya
  – path-neutral ground phrases
    • ground phrase: the argument/oblique that dominates the ground-denoting nominal
    • in Indo-European languages the ground phrase encodes locative and path functions
    • this holds for S-framed and V-framed languages alike

<table>
<thead>
<tr>
<th>S-framed: English</th>
<th>V-framed: Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The cart is in the box</td>
<td>le=kàa=PRV=ascend(B3SG) in / PREP DET=cart=D2</td>
</tr>
<tr>
<td>b. The cart went into the box</td>
<td>le=kàa=PRV-enter(B3SG) in / PREP DET=cart=D2</td>
</tr>
<tr>
<td>c. The cart went out of the box</td>
<td>le=kàa=PRV-exit(B3SG) in / PREP DET=cart=D2</td>
</tr>
<tr>
<td>goal</td>
<td>ground phrase</td>
</tr>
<tr>
<td>source</td>
<td>ground phrase</td>
</tr>
<tr>
<td>loc</td>
<td>ground phrase</td>
</tr>
</tbody>
</table>

– Yucatec motion descriptions are compatible with non-figure-motion scenarios
  • location change verbs that do not entail motion of the figure/theme were first described by Kita 1999
  – for Japanese hani ‘enter’ and deru ‘exit’
  • in Yucatec, the same phenomenon arguably generalizes to all verbs of ‘inherently directed motion’ (Levin 1993)
  • consider Figure 12
    – out of context: (3.6) would be infelicitous
    » as a description of this scenario:

(3.6) a. Le=kàaro=o’ ti’ le=bòola=o’
    DET=ball=D2 PREP=ENTRY(B3SG)
    ‘The ball entered the circle.’ [ENTER_EXIT D3 EMB]

• result state reference works even better with such scenarios

(3.9) Le=shìbòola=o’ kàaro=h-àaro-nah=ìh,
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘The ball, it slid.’

• in contrast, Yucatec ground phrases are path-neutral
  – they encode merely place functions (Bohnemeyer & Stolz 2006; Bohnemeyer 2010)

(3.5) a. Le=kàa=PRV=àaro=h=ì’kíl-
    DET=cart=D2 PREP=ENTRY(B3SG)
    ‘The cart, it entered (lit. in) the box’

b. Le=kàa=PRV=àaro=h=ì’kíl-
    DET=cart=D2 PREP=ENTRY(B3SG)
    ‘The cart, it entered (lit. in) the box’

c. Le=kàa=PRV=àaro=h=ì’kíl-
    DET=cart=D2 PREP=ENTRY(B3SG)
    ‘The cart, it entered (lit. in) the box’

– but (3.6) is not semantically in contradiction w/ Figure 12
  » it merely triggers a strong implicature to figure motion
  – and this implicature may be blocked or cancelled in context

(3.7) H=tàal le’kàaro=h=péek
    DET=ball=D2 RMC=ENTRY(B3SG)
    ‘The ring came to the ball; the ball, it entered.’ [ENTER_EXIT D3 EMB]

• another example: change of location in the vertical

(3.10) Kàaro=h=ì’kíl-
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(When/and) (the ball) vanished,’

kàaro=h=ì’kíl-le=shìbòola=o’
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(And) it reappeared, on the other side’

kàaro=h=ì’kíl-le=shìbòola=o’
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(And) it reappeared, on the other side’

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kàaro=h=ì’kíl-le=shìbòola=o’
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
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    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(And) it reappeared, on the other side’

kàaro=h=ì’kíl-le=shìbòola=o’
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(And) it reappeared, on the other side’

kàaro=h=ì’kíl-le=shìbòola=o’
    DET=ball=D2 CON-PRV-slide-CMP(B3SG)=TOP
    ‘(And) it reappeared, on the other side’
Interlude: metaphors for temporal relations (cont’d)

– compatibility w/ such scenarios suggests
  • location change verbs do not entail motion of the figure along
    a path (or even motion of any entity)
  – not all location change verbs are compatible with non-
    figure-motion scenarios
  • the data suggest a cline of acceptability

![Figure 15. Acceptability of location change roots w/ non-figure motion scenarios](image)

• the source of this cline seems to be that
  the verbs on the right presuppose stationary grounds

Interlude: metaphors for temporal relations (cont’d)

• English metaphors that cannot be rendered with the change
  of location verbs aren’t expressed in Yucatec:
  – so it may be more appropriate to speak of ‘fictive change of location’
  – example: no ‘line of sight’ or ‘sensory path’ metaphors
    » e.g., (3.13) is the closest equivalent of
      ‘You looked through the window’

(3.13) Klàng=apokat-aq, te=bebtenañ=a’n,
CON-PRV=A2=look.at-CMP BEGINC(3SG) PREP DET=window=D2
k’a=ts’a’-a-yam, ich le=nah=a’n.
CON=PRV=A2=use-CMP BEGINC(3SG) ALT=D2
‘[When/and then] you looked (lit. at it) at the window, [when/and then]
you saw what was in the house.’

Interlude: metaphors for temporal relations (cont’d)

– a pilot study (Bohnemeyer & Romero Méndez 2009)
  confirms this pattern
  • we collected descriptions of 46 animated motion clips by L1 Spanish
    speakers and L2 speakers with L1 English and Yucatec, respectively

![Figure 16. Findings of our pilot study: response type frequencies by population](image)

• ‘bounded path’ (Jackendoff 1983):
  source and/or goal specifications
• ‘other’ in Figure 16 conflates all response types except for ‘bounded path encoding’
  – and ‘path-neutral or non-L1-like’

Interlude: metaphors for temporal relations (cont’d)

• indirect evidence: no fictive motion metaphors
  • Yucatec location change verbs can be used metaphorically in reference
    to static situations
    – but are then subject to the same constraints as in dynamic
      descriptions – no more than one ground per clause, etc.
    – example: ‘co-extension paths’ in the sense of Talmy 2000: 138-139

(3.11) The road extends from Señor via Tixcacal to Yaxley
(3.12) Le-bi-béé he’li’s’, k=ul=ts’a’-a’-el Señor,
DET=way PRS=V=O IMPF=A3=exit–INC
Señor
k=ul=ts’a’-a’-el, k=ul=ts’a’-a’-el Tixcacal,
IMPF=A3=exit–INC TOP IMPF=A3=pass(INC)
Tixcacal
k=ul=ts’a’-a’-el, k=ul=ts’a’-a’-el Yaxley
IMPF=A3=exit–INC TOP IMPF=A3=arrive–INC
Yaxley
‘This road here, it exits Señor; then [lit. that having ended] it passes
through Tixcacal; then [lit. that having ended] it arrives [in] Yaxley.’

Interlude: metaphors for temporal relations (cont’d)

• anecdotal indirect evidence: widespread L1 transfer in motion descriptions in L2 Spanish
  • L1-Yucatec speakers often use ground phrases in Spanish
    utterances Yucatecan-style, i.e., path-neutrality

(3.14) a. ¿Dónde vienes?
  L2SPA where come:PRS=2SG
  ¿Dónde vienes?
  L2SPA where come:PRS=2SG
  ‘Where do you come from? [intended: ‘where from?’]

b. ¿De dónde vienes?
  L1SPA where come:PRS=2SG
  ¿De dónde vienes?
  L1SPA where come:PRS=2SG
  ‘Where do you come from?’

(3.15) a. El ratón salió en su agujero.
  L2SPA the rat exist=PAST=3SG in its hole
  ‘The mouse came out in its hole.’ [intended: ‘of its hole’]

b. El ratón salió de su agujero.
  L1SPA the mouse exist=PAST=3SG from its hole
  ‘The mouse came out of its hole.’ (Lehmann 1992: 626)

Interlude: metaphors for temporal relations (cont’d)

• discussion
  – there is reason to think that path metaphors for
    temporal relations are systematically absent in Yucatec
    • converging evidence from a variety of sources suggests
      that there is no encoding of path functions in Yucatec
    • Yucatec speakers’ ability to reason about time (⇒ study
      1) and motion does not seem to be affected by this
    – suggests that d-models of time and path (can) rely on
      cognitive systems that are removed from language
    • consequently, different kinds of spatial metaphors for
      temporal relations do not mean different d-models of time
    • the effects observed by Boroditsky and colleagues
      appear to be shallow processing effects

Discourse Representation, Comprehension and Production in a Cross-
linguistic Perspective; CAS Oslo; June 6-8, 2011
Overview

- Discourse, cognition, and Whorf
- study I: temporal relators
- interlude: metaphors for temporal relations
- study II: spatial reference frames
- discussion: domain-specificity
- acknowledgments

Study II: spatial reference frames

- 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)

\[\begin{align*}
\text{(4.1) The apple is on the skewer} \\
\text{(4.2) The band aid is on the shin} \\
\text{(4.3) The earring is in the ear (lobe)}
\end{align*}\]

Study II: spatial reference frames (cont'd)

- projected –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

\[\begin{align*}
\text{Intrinsic:} & \quad \text{The man is on the side of the tree.} \\
\text{Relative:} & \quad \text{The man is to the right of the tree.} \\
\text{Absolute:} & \quad \text{The man is east of the tree.}
\end{align*}\]

Study II: spatial reference frames (cont'd)

- alternative classifications and subtypes

\[\text{Figure 19. Reference frame types and their classification (A - 'away from', B - 'back'; D - 'downriver', F - 'front'; L - 'left', R - 'right', T - 'toward', U - 'upriver'; Bohnemeyer & Levinson ms.)}\]

Study II: spatial reference frames (cont'd)

- predicted cognitive consequences
  - difficult to translate a place function 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

\[\begin{align*}
\text{The cat's left of the car} & \quad \text{(the cat's west of the car)} \\
\text{The cat's left of the car} & \quad \text{(the cat's east of the car)} \\
\text{so people remember everything they might want to talk about in a frame appropriate to their language}
\end{align*}\]
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

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

<table>
<thead>
<tr>
<th>Linguistically</th>
<th>Relative</th>
<th>Prediction: Non-vertical coding will be relative</th>
<th>N = 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Dutch, Japanese, Tamil-Urban</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linguistically</th>
<th>Absolute</th>
<th>Prediction: Non-vertical coding will be absolute</th>
<th>N = 99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amurete</td>
<td>Hai//om, Tagital, Longgu, Belhare, Tamil-Rural</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 22. The Animals-In-a-Row memory recognition task

Study II: spatial reference frames (cont'd)

Recall Memory Task: Results (small sample)

- speakers of absolute languages have superior dead-reckoning skills (Levinson 2003)
- primates show a preference for egocentric over geocentric 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)
  - Haun, Rapold, Call, Janzen, & Levinson (2006)
- 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

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).
Bohnemeyer, *Discourse and Cognition*

**Question:**

Which linguistic perspective is being discussed in the document?

**Answer:**

The document discusses the linguistic perspective known as the *MesoSpace* project. This project focuses on the study of spatial reference frames across different languages and cultures, examining how speakers of various languages engage with spatial cognition and linguistic frames. The project involves empirical research conducted with speakers of different languages to explore the influence of cultural and linguistic factors on spatial thinking and expression.
Study II: spatial reference frames (cont’d)

- B&C data from 11 languages
  - at five dyads of speakers per language
    - except for Chacoma Tseltal, for which data from only three dyads are included in the preliminary analysis
  - we computed for each dyad an eight-dimensional vector
    - assigning to each frame type the frequency with which the dyad used it
  - interpreting these vectors as points in an eight-dimensional space
    - we calculated their Euclidean distances
    - as a measure of the similarity between them
    - a left-triangular distance matrix was input into the NeighborNet algorithm (Bryant & Moulton 2004)
      - implemented in Splitstree4 (Huson & Bryant 2006)

- evidence of considerable inter-speaker variation too
  - and more so in some populations than in others
  - e.g., the Yucatec speakers differentiate strongly by gender and use of Spanish

- and of the second dimension with the use of ‘direct’ frames
  - cf. Danziger 2010
  - Figure 40: Spearman’s Rho 0.935386, p-value < 2.2e-16

- a multidimensional scaling analysis projects the eight-dimensional distances into three dimensions
  - with a goodness of fit of 0.878947
  - the first two dimensions are shown in Figure 37
  - strong correlation of the first dimension with geocentric...
    - Figure 38, Spearman’s Rho 0.9097071, p-value < 2.2e-16
  - and relative usage frequencies
    - Figure 39, Spearman’s Rho -0.8927574, p-value < 2.2e-16

- first application of multivariate analysis to modeling variation across speakers in semantic typology
  - as far as we know

- the point
  - analyze to what extent participants’ usage clusters
    - by linguistic factors
      - native language
      - L2/Use of Spanish
    - by non-linguistic factors
      - literacy
      - education
      - local topography
      - urbanization
      - population density
— then do the same with recall memory data and see to what extent the results match
— 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

Table 3 - Breakdown 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>Group</th>
<th>Gender</th>
<th>Number</th>
<th>Direction</th>
<th>Language</th>
<th>Distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>Male</td>
<td>2</td>
<td>Adj</td>
<td>Geocentric</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Trial 2</td>
<td>Female</td>
<td>3</td>
<td>Adj</td>
<td>Geocentric</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Trial 3</td>
<td>Male</td>
<td>4</td>
<td>Rel</td>
<td>Geocentric</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

• drawback: no intrinsic response pattern
  — during plots in Buffalo, we tried to engineer one
  — but all our attempts would push all participants towards using intrinsic fictions

— non-aligned responses are egocentric in terms of facing direction and geocentric in terms of order
  — or vice versa
  • each variant occurred five times
  — there is no obvious effect of age or gender

Table 2 - 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 predominant type)

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Number</th>
<th>Direction</th>
<th>Language</th>
<th>Distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>Male</td>
<td>2</td>
<td>Adj</td>
<td>Geocentric</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Trial 2</td>
<td>Female</td>
<td>3</td>
<td>Adj</td>
<td>Geocentric</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Trial 3</td>
<td>Male</td>
<td>4</td>
<td>Rel</td>
<td>Geocentric</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

• a look at just the Yucatec data
  • work in progress – we have not yet attempted to analyze the data from the entire language sample together
  • "unidirectional" - the participant lined the animals up in the same direction in every trial

Table 2 - 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 predominant type)

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Number</th>
<th>Direction</th>
<th>Language</th>
<th>Distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>Male</td>
<td>2</td>
<td>Adj</td>
<td>Geocentric</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Trial 2</td>
<td>Female</td>
<td>3</td>
<td>Adj</td>
<td>Geocentric</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Trial 3</td>
<td>Male</td>
<td>4</td>
<td>Rel</td>
<td>Geocentric</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

• the overall distribution of responses across the four response types is significant ($\chi^2 = 8.5, df = 3, p < .04$)
• there are no significant differences by age ($\chi^2 = 2.252, df = 3, p > .5$) or gender ($\chi^2 = 2.229, df = 3, p > .5$)

— discussion
  — spatial reference frames vary greatly across languages
  — reference frame use for linguistic and nonlinguistic tasks tend to align
  • people use the same frame type to memorize a scene and to talk about it
  — preliminary evidence suggests that language may be a determinant of reference frame use
  • for both linguistic and nonlinguistic tasks

— why language
  • frame types must be at least to some extent learned cultural knowledge
  — this is particularly obvious in the case of geocentric frames
  • along with other observable practices, language permits the intergenerational transfer of cultural knowledge
  • environmental adaptations happen at a phylogenetic timescale, language learning at an ontogenetic one

Figure 41. Layout of the AIAR memory recognition task

Figure 42. Two-perspective analysis of the layout of the AIAR memory recognition task: ANS can be seen from one perspective only, this is not the case for AIAR.
Discussion: domain specificity

- the evidence presented here suggests
  - d-models of time do not appear to vary with language
  - languages vary in the grammaticalization of temporal relators
  - and in the spatial metaphors they use to express temporal relations
  - yet this variation does not appear to affect
    the cognitive representation of time
  - d-models of space do vary with language
  - and this variation does appear to align with, and possibly
    cause, variation in the cognitive representation of space
- why this difference b/w the two domains?

Overview

- Discourse, cognition, and Whorf
- study I: temporal relators
- interlude: metaphors for temporal relations
- study II: spatial reference frames
- discussion: domain-specificity
- acknowledgments

Thank you!

References

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  - Steve Levinson
  - this material is based upon work supported by the National Science Foundation
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Figure 43. Wink-wink, nudge-nudge

Thank you!
References (cont’d)


References (cont’d)


