Reference frames in language and thought

Beyond Mesoamerica

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Synopsis

• frame wars: what Whorf wrought
• unconfounding language
• frame use in discourse: Talking Animals
• frame use in recall memory: New Animals
• discussion

Frame wars: What Whorf wrought

• the Linguist Relativity Hypothesis (LRH):
  strong vs. weak interpretations

The strong (deterministic) orthodox interpretation of the LRH:
"The structure of anyone’s native language strongly influences or fully determines the world-view he will acquire as he learns the language."

The weak (non-deterministic) neo-Whorfian interpretation of the LRH:
"Structural differences between language systems will, in general, be paralleled by nonlinguistic cognitive differences, of an unspecified sort, in the native speakers of the two languages." (Brown 1976: 128)

– the recent neo-Whorfian debate has focused on the weak interpretation
  • i.e., on the existence of language-on-thought effects
  • there are to our knowledge no contemporary proponents of the strong interpretation

Frame wars: What Whorf wrought (cont.)

• proposed versions of the “big picture”

Frame wars: What Whorf wrought (cont.)

• the test case: spatial frames of reference
  – cognitive axis (“coordinate”) systems used to interpret ‘projective’ (Piaget & Inhelder 1956) spatial relations
    • in representations of location, motion, and orientation

Frame wars: What Whorf wrought (cont.)

• classifying frames

Table 1. A classification of frame types based on Danziger (2010)

<table>
<thead>
<tr>
<th>Egocentric axes</th>
<th>Allocentric axes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>anchored</em> to the body of the observer</td>
<td>independent of the body of the observer</td>
</tr>
</tbody>
</table>

Intrinsic: centered on the anchor (model of the axes)

- F: The ball is in front of me
- D: The ball is in front of the chair

Extrinsic: transposed from the anchor

- F: The ball is right of the chair
- D: The ball is in front of the chair
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**Unconfounding language (cont.)**

  - two studies: reference frame use in referential communication and recall memory
    - w/ speakers of 6 Mesoamerican languages, 2 non-Mesoamerican indigenous languages, and 3 dialects of Spanish
  - GLMMs regressing egocentric vs. geocentric use against
    - 11; 12 use; literacy; education; topography; pop. density
  - results
    - L1 makes a sig. contribution to almost all models
      - so the effect of language cannot apparently be reduced to covariation with other variables, contrary to L & Gleitman (2002)
    - L2 use makes a sig. contribution to egocentric models
      - exposure to Spanish is a conduit for the cultural diffusion of egocentric cognition in Mesoamerica
    - topography and pop. density influence egocentric models
    - no sig. contributions from literacy or education to any models
Unconfounding language (cont.)

- and now for more of the same
  - today’s studies apply a similar design
to a new population sample
  - combining speakers of two Mesoamerican languages...
    - Yucatec Maya and Isthmus Zapotec
  - ... with eight Asian populations...
    - rural and urban Japanese speakers from Honchu vs. Okinawa
    - monolingual speakers of Mandarin vs. Taiwanese Southern Min
      (TSM) vs. Mandarin-TSM bilinguals
    - Vietnamese speakers
  - ... and English speakers
- we also introduce a new tool
  for the study of linguistic preferences of frame use
  - the Talking Animals task

Frame use in discourse: Talking Animals

- which independent variables drive the use of FoRs
  in verbal reference to small scale space?
- all of the languages in the sample have the lexical
  and grammatical resources for using all FoR types
  - in no case does the grammar or lexicon of the language
    constrain the use of particular frame types
  - reference frames are semantic patterns
    - which are only indirectly related to particular lexical items

Figure 12. Truth conditions of intrinsic and relative descriptions
of Ball & Chair 3.9 (left) and 3.12

| The ball is in front of the chair | relative | intrinsic |
| The ball is left of the chair    | intrinsic | relative |

Figure 13. Design of the Talking Animals task (Pederson et al. 1998: 562)

Figure 14. One of four Talking Animals trials

Frame use in discourse: Talking Animals (cont.)

- coding
  - we coded descriptions of the location and orientation
    of the animals, distinguishing among eight categories
    - egocentric
      - egocentric intrinsic = direct (Danziger 2010)
      - egocentric extrinsic = relative (Levinson 1996)
    - allocentric
      - allocentric intrinsic = relative (Levinson 1996)
      - allocentric extrinsic = relative (Levinson 1996)
    - intrinsic relative ambiguity
      - i.e., the description is true of the same picture
        under both allocentric intrinsic
        and egocentric extrinsic interpretations
    - topological (no reference frame involved; Piaget & Inhelder 1956)
- analysis: assumptions
  - every description comprises
    an arbitrary number of propositions
    - each potentially coded in a different reference frame
    (1) T=ts‘ël, te=x-¥s’tik te-¥stële=¥ch‘ï’=¥c’,
        PREP:A3=side PREP:DET=F-left PREP:DET=HEST-DET+west=¥D
        hun-¥p-¢ët bëòta ¥yan=¥, 
        ch‘uy=k’ah-a’n
        one-CL.IN ball EXIST(3SG)=¥D hang-MIDDLE-RES(3SG)
        ‘On (the chair’s) side, on the left in the, uh, the west, there is a ball, it is
        suspended […]’
  - thus, the odds of a given FoR type
    being used in response to a pic
    - are independent of the odds of
      any other type being used
    - in response to the same pic

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Frame use in discourse: Talking Animals (cont.)

- our tool for studying the use of FoRs in discourse
  - a referential communication task: Talking Animals (TA)
    - TA allows us to discover selection preferences for any of the FoR types
    - at the small (personally manipulable) scale
    - advantages over previous tools employing photographs
      - Men & Tree (M&T, Pederson et al. 1998);
        Ball & Chair (B&C; Bohnemeyer et al. 2014, 2015)
      - 2D stimuli seem to slightly depress the use of geocentric frames
    - M&T may for various reasons depress the use of intrinsic FoRs
Frame use in discourse: Talking Animals (cont.)

- independent variables: language (L1; L2 use)
  - we modeled L2 use on a 3-point frequency scale
    - none > occasional > frequent
- based on participants’ responses to a questionnaire

Frame use in discourse: Talking Animals (cont.)

- independent variables: literacy and education
  - education: 3-point scale
    - elementary school only > some secondary > any post-secondary
  - writing (frequency): 4-point scale
    - none > rarely > occasional > frequent/regular
    - no writing data was collected from the Vietnamese participants
  - reading (frequency): 4-point scale
    - none > rarely > occasional > frequent/regular
- assessed again based on questionnaire responses

Table 4. Regression models of the Talking-Animals data: summary of effects
(Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1)

|          | Tiering | Headings | saliva | visual | literacy | education patience | population density | topography | Geography | Results: efficacy of the independent variables
we fitted binomial mixed-effects logistic regression models of the probability of use of two response types
- relative (egocentric extrinsic) and geographic frames
  - using the 5%β@5%β% package in R

|          | Tiering | Headings | saliva | visual | literacy | education patience | population density | topography | Geography | Results: discussion
- as in the Ball & Chair study, language makes an irreducible contribution to predicting frame use
  - this contribution cannot apparently be reduced to covariance with the nonlinguistic variables, contra Li & Gleitman (2002)
  - however, unlike in Ball & Chair, there are no sig. L2 effects
- we also once again find an effect of geography
  - population geography is positively correlated with egocentrism and strongly negatively with geographic frame use
  - however, unlike in the Ball & Chair study, we did not find an effect of topography
- the Talking Animals models show significant independent effects of literacy, unlike Ball & Chair
  - literacy boosts egocentrism and depresses geographic frame use

Table 3. Field sites by population density and geomorphology

<table>
<thead>
<tr>
<th>Population Densit</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geomorphology</td>
<td>REL GEO REL</td>
<td>GEO REL REL</td>
<td>GEO REL REL</td>
</tr>
</tbody>
</table>

Figure 15. Study populations: L1, L2, researchers

Figure 16. Mean education and literacy scores by population

Figure 17. Percentage of spatial descriptions featuring a given response strategy by population/linguistic group

Figure 18. Spatial distributions of response strategies by population/linguistic group

Figure 19. Population Averages

Figure 20. Mean education and literacy scores by population

Figure 21. Spatial distributions of response strategies by population/linguistic group
Frame use in discourse: Talking Animals (cont.)

• results: discussion (cont.)
  – these findings are in line with weak interpretations of the Linguistic Relativity Hypothesis
    • language is one robust predictor of spatial cognition
    • but it is not the only one
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    • but it is not the only one

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Frames in recall memory: New Animals

• 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 18. Layout of the AIAR memory recognition task

– minor differences: the toy animals used; the number of trials; ...
– big drawback: no intrinsic response pattern

Frames in recall memory: the New Animals study (cont.)

• participants
  – we tested b/w 11 and 28 speakers of each variety
    • the mean number was 16.8
  – data from participants with errors in more than two of the six trials was excluded from the analysis

Table 5. Participants whose responses were included in the analysis by language, site, age, sex, and study. L1—Mesoamerican; L2—non-Mesoamerican Indigenous; Sp.—Spanish

<table>
<thead>
<tr>
<th>Language Group</th>
<th>Locality</th>
<th>2.5-7</th>
<th>8-13</th>
<th>14-20</th>
<th>21-28</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-L1-Spanish speakers included</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1-L2-Spanish use</td>
<td>0.5***</td>
<td>0.1*</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literacy</td>
<td>1.3***</td>
<td>0.9***</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Density</td>
<td>1.3***</td>
<td>0.9***</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table 6. Summary of the four regression models for egocentric reconstructions.</td>
<td>0.6</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.7</td>
<td>0.4</td>
<td></td>
<td></td>
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</tbody>
</table>

Frames in recall memory: the New Animals study (cont.)

• analysis
  – regression models of the probability of egocentric reconstructions
    • against the same set of predictor variables used in the analysis of the linguistic data
• results
• results (cont.)
  – as before, EDUCATION did not yield an effect and was eliminated to improve the AIC
  – LANGUAGE GROUP effects in all models except the GEOCENTRIC model that excludes the L1-Spanish speakers
  – TOPOGRAPHY and POPULATION DENSITY effects in the models that include the L1-Spanish speakers
  – no L2-Spanish use of LITERACY effects
    • a possible explanation: most populations preferred geocentric responses
      – even those that did not show a linguistic bias

<table>
<thead>
<tr>
<th>Frame</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOCENTRIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LANGUAGE GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOPOGRAPHY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POPULATION DENSITY</td>
<td></td>
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</table>

Discussion

• confirmed: L1 makes an irreducible contribution to frame choice, contra Li & Gleitman (2002)
• non-linguistic factors driving reference frame use
  – literacy and population density

Discussion (Cont.)

• the LTH compared to the LRH
  – the LTH entails cognitive effects of language use, but does not entail effects from the lexicon or grammar
  – it is compatible with, but does not entail, the weak interpretation of the LRH
  – it emphasizes the role of language as a potential conduit
    • in the transmission of cultural “styles” or “practices” of cognition
    • a role it shares with other types of perceivable behavior
      – e.g., co-speech gesture (Haviland 1979; Le Guen 2011)
      agricultural and religious practices (Bohmeyer 2011)

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Discussion (Cont.)

• a new take:
  the Linguist Transmission Hypothesis (LTH)
  Linguistic Transmission Hypothesis (LTH) – abstract formulation:
  “Using a language or linguistic variety may facilitate the acquisition of cultural practices of non-linguistic cognition shared among the speakers of the language.”

  – more concretely:

  Linguistic Transmission Hypothesis (LTH) – concrete formulation:
  “The comprehension of utterances may provide clues to the cognitive practices involved in their production, and both the comprehension and the production of utterances may afford habituation to these cognitive practices. The cognitive practices so acquired may or may not subsequently be extended beyond the domain of speech production.”

Discussion (Cont.)

• the LTH is not a new idea
  – a precursor: Levinson (2003: 315-325)
  – closely related: Slobin’s (1996, 2003) work on Thinking-for-Speaking (TfS) effects
    • the LTH unilaterally entails the existence of TfS effects
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