Synopsis

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

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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

- proposed versions of the "big picture"

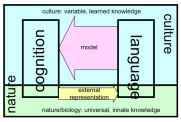


Figure 1. *The big picture according to Whorf*

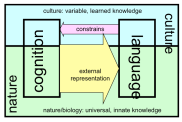


Figure 2. *The big picture according to mainstream cognitive science*

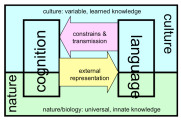


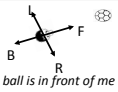
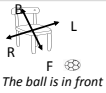
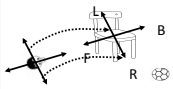
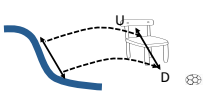
Figure 3. *The big picture according to Neo-Whorfians*

- the proper goal of the "Neo-Whorfian" program
  - determine the role of culture in human cognition

- 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

- classifying frames

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

	egocentric: axes "anchored" to the body of the observer	**allocentric**: axes independent of the body of the observer
intrinsic: centered on the **anchor** (the model of the axes)	 *The ball is in front of me* **Direct** (Danziger 2010)	 *The ball is in front of the chair* **Object-centered** (Carlson-Radvansky & Irwin 1993)
extrinsic: transposed from the anchor	 *The ball is right of the chair* **Relative** (Levinson 1996)	 *The ball is downriver of the chair* **Geocentric**

Frame wars: What Whorf wrought (cont.)

- crosslinguistic variation

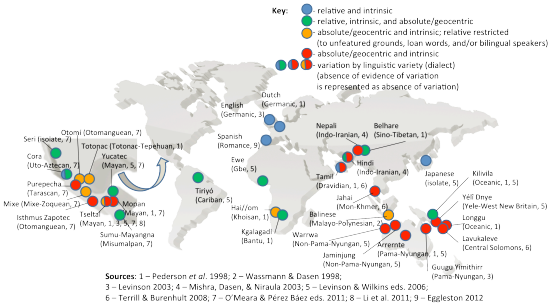


Figure 5. *Reference frame use in small-scale horizontal space across languages (Bohnemeyer & Levinson ms.)*

Frame wars: What Whorf wrought (cont.)

- alignment between language and cognition
  - preferences for particular frame types in discourse and recall memory covary

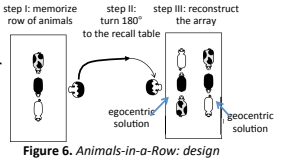


Figure 6. *Animals-in-a-Row: design*

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

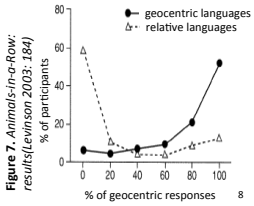


Figure 7. *Animals-in-a-Row: results(Levinson 2003: 184)*

Frame wars: What Whorf wrought (cont.)

- two competing interpretations

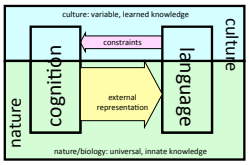


Figure 8. *The mainstream vision*

Non-Whorfian interpretation (Li & Gleitman 2002; Li et al 2011; *inter alia)*

- innate knowledge of all frame types
- variation only in usage preferences
- variation caused by adaptation to the environment - topography, population geography, education, literacy
- language plays no role in the cultural transmission of practices of spatial reference

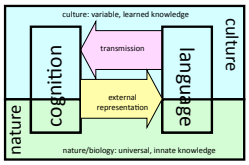


Figure 9. *The Neo-Whorfian vision*

Neo-Whorfian interpretation (Levinson 1996, 2003; Pederson et al 1998; *inter alia)*

- knowledge of some frame types is culturally transmitted
- language plays a key role in the cultural transmission of practices of spatial reference
- the adaptation to the environment happens at the phylogenetic level, not at the ontogenetic level

Synopsis

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

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Unconfounding language

- the forest, the trees, and statistics
  - adjudicating b/w neo- and non-Whorfian interpretations
    - presupposes isolating the effects of language, literacy, education, topography, etc., on the use of reference frames
  - the problem: many of these factors can co-vary
    - e.g., populations that speak different languages may also differ in their levels of education and literacy
      - and they will of course differ on geographic variables
  - the solution: larger population samples and multivariate statistics

Figure 11. *Seeing the forest for the trees*

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Unconfounding language (cont.)

- previous research: Bohnemeyer et al (2014, 2015)
  - 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
    - L1; L2 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 Li & 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 geocentric models
    - no sig. contributions from literacy or education to any models

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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

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Synopsis

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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*

	true in which type of FoR?	
The ball is in front of the chair	relative	intrinsic
The ball is left of the chair	intrinsic	relative

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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

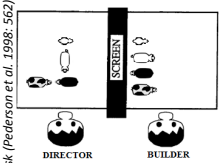

Figure 13. *Design of the Talking Animals task (Pederson et al. 1998: 562)*

Figure 14. *One of four Talking Animals trials*

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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
      - geocentric
        - » absolute or geomorphic
        - » based on an internal landmark (another animal as landmark)
        - » based on an external landmark
    - 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)

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Frame use in discourse: Talking Animals (cont.)

- analysis: assumptions
  - every description comprises an arbitrary number of propositions
    - each potentially coded in a different reference frame

(1) 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 yàan=i', ch'uy-k'ah-a'n (. . .)
one-CL.IN ball EXIST(B3SG)=D4 hang-MIDDLE-RES(B3SG)
'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

Figure 15. *Ball & Chair 2.2*

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- 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

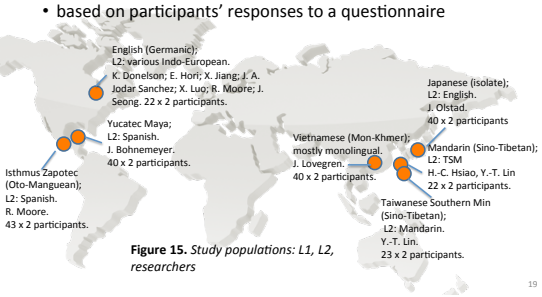

Figure 15. *Study populations: L1, L2, researchers*

- 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

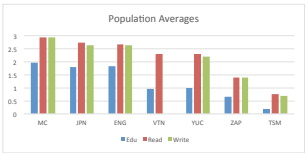

Figure 16. *Mean education and literacy scores by population*

- independent variables: geography of the fieldsites
  - topography: geomorphic 'provinces'
    - 5-level categorical variable
      - orogenic belts; volcanic belts; coastal high plateaus; continental shelf; coastal basins and littoral transgressions
  - population density: log of inhabitants/km^2

Language	Locality	Country	Density (population/km²)	log scale	Topographic classification
Japanese	Setagaya	Japan (Mainland)	15,951	4.19	coastal
Taiwanese Southern Min	Taipei	Taiwan	9,949	4.00	coastal
Mandarin Chinese	Taipei	Taiwan	9,949	4.00	coastal
Japanese	Naha	Japan (Okinawa)	8,244	3.92	volcanic
English	Buffalo	United States	2,569	3.41	plateau
Japanese	Yomitan	Japan (Okinawa)	1,200	3.08	coastal
Taiwanese Southern Min	Tainan	Taiwan	855	2.93	coastal
Vietnamese	Long Mỹ	Vietnam	406	2.61	coastal
Japanese	Fujinomiya	Japan (Mainland)	339	2.53	volcanic
	Aizuwakamatsu	Japan (Mainland)	321	2.51	volcanic
	Nago	Japan (Okinawa)	293	2.47	volcanic
	Miyakojima	Japan (Okinawa)	268	2.43	coastal
	Shiabo	Japan (Mainland)	64	1.81	volcanic
	Yonagoni	Japan (Okinawa)	58	1.76	coastal
Isthmus Zapotec	La Ventosa	Mexico	5	0.70	coastal
	Juchitán de Zaragoza	Mexico	5	0.70	coastal
Yucatec	Yaxley	Mexico	2	0.30	shelf
	Felipe Carrillo Puerto	Mexico	2	0.30	shelf

Table 3. *Field sites by population density and geomorphology*

- results: response strategies across populations

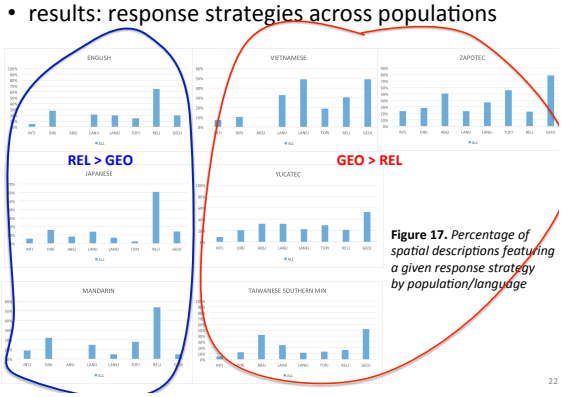

Figure 17. *Percentage of spatial descriptions featuring a given response strategy by population/language*

- 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 geocentric frames
      - using the $%$#@^&^%% package in R

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

Dependent variable	Literacy variable		Independent variables (fixed effects)					
	Writing	Reading	L1	L2 use	Education	Literacy	Pop. density	Topography
Geocentric	Yes	No	*			.	***	
	No	Yes	*			**	***	
Relative	Yes	No	***			**	.	
	No	Yes	***			**	*	

- 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 w/ egocentrism and strongly negatively with geocentric 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 geocentrism

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 preditor of spatial cognition
    - but it is not the only one

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- frame wars: what Whorf wrought
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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

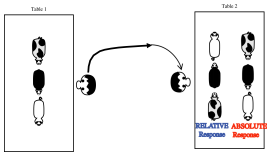

Figure 18. *Layout of the AIAR memory recognition task*

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

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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 (MA – Mesoamerican; NMA – non-Mesoamerican indigenous; Sp. – Spanish)*

Language Group	Locality	Age ≤ 30 / ≥ 30	Sex M / F
–		NA	NA
Tseltal (MA)	Chacona	9/7	9/7
Yucatec (MA)	Yaxley	4/10	7/7
	Felipe Carrillo Puerto	0/1	0/1
Mixe (MA)	Ayutla	4/8	3/9
Otomí (MA)	San Ildefonso Tultepec	0/5	1/4
Zapotec (MA)	La Ventosa	4/8	3/9
Tarascan (MA)	Santa Fe de la Laguna	7/9	8/8
Seri (NMA)	El Desemboque	0/2	1/1
Sumu (NMA)	Rosita	4/6	4/6
Mexican Sp.	San Miguel Balderas	5/6	4/7
Nicaraguan Sp.	Rosita	5/13	4/14
European Sp.	Barcelona	6/4	6/4
Total		48/79	50/77

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

- coding
  - facing direction: egocentric vs. geocentric vs. neither
  - order of animals: egocentric vs. geocentric vs. neither
    - the analysis presented here is based on order only
- errors
  - wrong animal; wrong order
  - responses by participants who produced errors in more than two of the six trials were excluded altogether

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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

	Models	1	2	3	4
Sample	L1-Spanish speakers included	✓		✓	
Dependent variable	GEOCENTRIC	✓	✓		
	EGOCENTRIC			✓	✓
Effects	LANGUAGE GROUP	***		*	**
	L2-SPANISH USE				
	LITERACY	N/A		N/A	
	TOPOGRAPHY	***		*	
	POPULATION DENSITY	**		*	

Table 6. *Summary of the four regression models of the NA responses based on self-reported participant data. Models that include L2 use exclude L1-Spanish speakers (Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.').*

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

- 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 or LITERACY effects
    - a possible explanation: most populations preferred geocentric responses
      - even those that did not show a linguistic bias

	Models	1	2	3	4
Sample	L1-Spanish speakers included	✓		✓	
Dependent variable	GEOCENTRIC	✓	✓		
	EGOCENTRIC			✓	✓
Effects	LANGUAGE GROUP	***	.	*	**
	L2-SPANISH USE				
	LITERACY	N/A		N/A	
	TOPOGRAPHY	***		*	
	POPULATION DENSITY	**		*	

Synopsis

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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

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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 nonlinguistic 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 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 (Bohnemeyer 2011)

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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  - … our teachers and consultants, the speakers of the lenguages the MesoSpace team has been studying
  - … NSF, for the necessary resources to realize these studies
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  - … the institutions who have partnered with MesoSpace to lend us support
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    - for comments on previous presentations of some of the material
  - … you!

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