Discourse and cognition: Whorfian effects are domain-specific

Discourse Representation, Comprehension and Production in a Cross-linguistic Perspective
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Overview

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

acknowledgments

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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, then!'
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]

- why I was confused

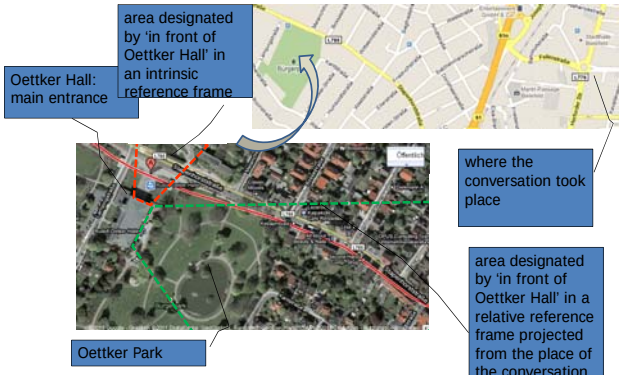

Figure 1. *The Oettker Park incident*

- ***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

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- languages vary in the d-models they make use of
  - example: reference frames

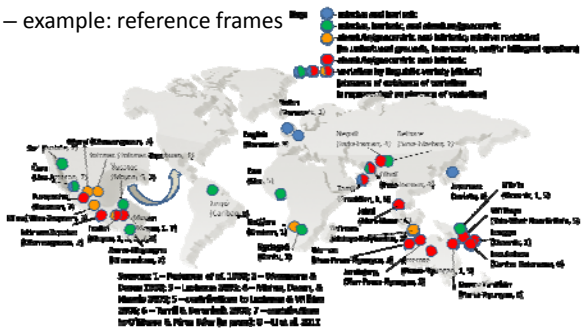

Figure 2. *Reference frame use in small-scale horizontal space across languages (Bohnemeyer & Levinson ms.)*

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Discourse, cognition, and Whorf (cont'd)

- 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

"We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way – an agreement that holds throughout our speech community and is codified in the patterns of our language." (Whorf 1956: 213)

Figure 3. *Benjamin Lee Whorf (1897-1941)*
http://en.wikipedia.org/wiki/

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Discourse, cognition, and Whorf (cont'd)

- three studies: d-models for time and space
  - study I: tense and temporal connectives
  - interlude: spatial metaphors for temporal relations
  - study II: spatial frames of reference
- the comparison is motivated in part by the similarity of the structural properties of the models
  - in both cases, directed axes are used to define search domains with respect to reference entities

(1.1) *The ball is in front of the chair*

(1.2) *Floyd submitted the abstract before he realized that he found the analogy tortured*

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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."
(Alverson 1994: 38)

"Another basic meaning one would expect to be able to express in any language involves the concept of 'time' (WHEN). One would expect to be able to say the equivalent of 'When did it happen?' and 'It happened at this time'. (…) in addition to the semantically simple temporal adjunct 'at some time', there must be in any language some complex ones: 'at this time', 'at the same time', 'at some time before this time' and so on. (…) The pairs of elements BEFORE and AFTER, and UNDER and ABOVE are necessary to accommodate relational concepts in the temporal and locational domains, respectively." (Goddard and Wierzbicka 1994: 45-46)

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 & Velupillai 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

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Study I: temporal relators (cont'd)

(2.1) Ts'o'k in=mèet-ik le=nah=o'
TERM A1SG=do:APP-INC(B3SG) DET=house=D2
'I (will) have/had built the house'

(2.2) Táan in=mèet-ik le=nah=o'
PROG A1SG=do:APP-INC(B3SG) DET=house=D2
'I am/was/will be building the house'

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Study I: temporal relators (cont'd)

- *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'

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Study I: temporal relators (cont'd)

- 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?

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Study I: temporal relators (cont'd)

- structure of the stimulus

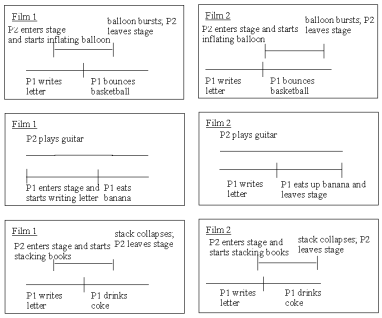


Figure 5. *The contents of three of the 28 pairs of TEMPEST clips schematically*

Study I: temporal relators (cont'd)

- design of the task

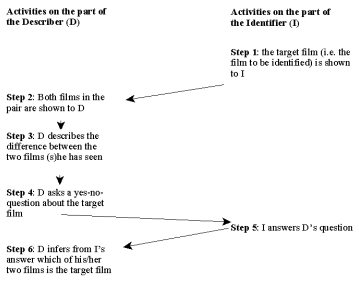


Figure 6. *The TEMPEST task*

Study I: temporal relators (cont'd)

– setup

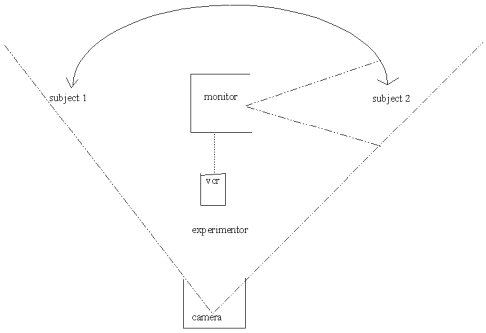


Figure 7. *The TEMPEST setup*

Study I: temporal relators (cont'd)

– results: expression of event order

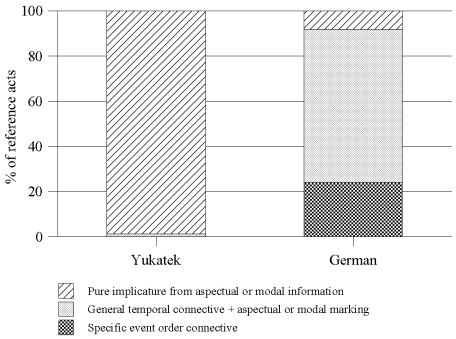
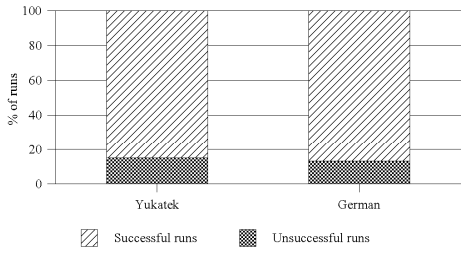


Figure 8. *TEMPEST results: expressions of event order*

Study I: temporal relators (cont'd)

– results: error rates



Unsuccessful runs	18	16
Successful runs	102	106

Figure 9. *TEMPEST results: error rates*

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) Táan in=mèet-ik le=nah=o'
PROG A1SG=do:APP-INC(B3SG) DET=house=D2
'I am/was/will be building the house'

(2.4) Káa=h-tàal-ech way
CON=PRV-come-B2SG here
h-ts'o'k ka'=p'éel ha'b=e',
PRV-end(B3SG) two=CL.IN year=D3
táan in=mèet-ik le=nah=o'.
PROG A1SG=do:APP-INC(B3SG) DET=house=D2
'When you came here two years ago,
I was building the house'

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Study I: temporal relators (cont'd)

- 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

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Interlude: spatial metaphors for temporal relations

- study I suggests: d-models of time are not affected
  - by the grammaticalization of temporal relators
- yet, language-specific spatial metaphors for temporal relations may affect reasoning about time
  - Boroditsky 2001; Boroditsky & Gaby 2010

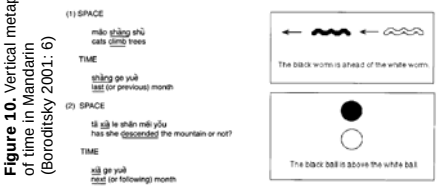

Figure 10. Vertical metaphors of time in Mandarin (Boroditsky 2001: 6)

Figure 11. *Spatial primes in Boroditsky's experiments (examples) Boriditsky 2001: 7-8*

Interlude: metaphors for temporal relations (cont'd)

- 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

Interlude: metaphors for temporal relations (cont'd)

- 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=e'* *sáansamal=e'* *le=k-u=ts'o'k-ol*
Pedro=TOP RED:tomorrow=TOP DET=IMPF-A3=end-INC
u=ts'iib-t-ik *hun-p'éel* *kàarta=o',*
A.3=write-APP-INC(B3SG) one-CL.IN letter=D2
k-u=ts'u'ts'-ik *hun-p'éel* *chamal.*
IMPF-A3=suck-INC(B3SG) one-CL.IN cigarette
'Pedro, every day, it being finished his writing a letter, he smokes a cigarette.'

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- 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

	S-framed: English		V-framed: Spanish		
loc	(3.3) a. *The cart* ***is***	***in*** *the box*	(3.4) a. *El carro* ***estaba***	***en*** *la caja*
goal	b. *The cart* ***went***	***into*** *the box*	b. *El carro* ***entró***	***en*** *la caja*
source	c. *The cart* ***went***	***out*** *of the box*	c. *El carro* ***salió***	***de*** *la caja*
		ground phrase		ground phrase

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

(3.5) a. *Le=kàaro=o'* *ti'=**yàan***
DET=cart=D2 PREP=EXIST(B3SG)
'The cart, it is in the box'

b. *Le=kàaro=o'* *h-**òok***
DET=cart=D2 PRV-enter(B3SG)
'The cart, it entered (lit. in) the box'

c. *Le=kàaro=o'* *h-**hóok'***
DET=cart=D2 PRV-exit(B3SG)
'The cart, it exited [lit. in] the box'

ich l ti'	*le=kàaha=o'*
in / PREP	DET=box=D2
ich l ti'	*le=kàaha=o'*
in / PREP	DET=box=D2
ich l ti'	*le=kàaha=o'*
in / PREP	DET=box=D2

ground phrase

- so if there is path encoding in Yucatec, it has to happen exclusively in the verb root
  - but the evidence from non-figure-motion scenarios shows that this is not the case either

- 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 *hairu* '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:

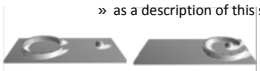
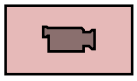


Figure 12. *First and last frame of ENTER_EXIT 03*



(3.6) #Le=bòola=o' h-**òok** te=sìirkulo=o'.
DET=ball=D2 PRV-enter(B3SG) PREP:DET=circle=D2
'The ball, it entered the circle.' (ENTER_EXIT 03 EMB)

- 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

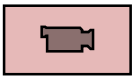
(3.7) *H=tàal* *le=àaro* *y=iknal* *le=bòola=o';*
PRV=come(B3SG) DET=ring A3=at DET=ball=D2

le=bòola=o' *h=**òok**-ih.*
DET=ball=D2 PRV=enter-B3SG

'The ring came to the ball; the ball, it entered.' (ENTER_EXIT 03 SBM)

- another example: change of location in the vertical

Figure 13. *First and last frame of FIGURE_GROUND 14*



(3.8) *Le=chan* *tàabla=o'* *h=péek-nah-ih,* *káa=h=**na'k***
DET=DIM plank=D2 PRV=move-CMP-B3SG káa=PRV=ascend(B3SG)

le=chan *kanìika* *y=éetel* *che'* *te'l* *y=óokol=o'.*
DET=DIM marble A3=with wood there A3=on=D2

'The little plank, it moved, (and) the little marble and the tree ascended there on top.' (FIGURE_GROUND 14 EMB)

- result state reference works even better with such scenarios

(3.9) *Le=tàabla=o'* *káa=h-háarax-nah=e',*
DET=plank=D2 CON=PRV-slide-CMP(B3SG)=D3
'the plank, it slid,'

káa=h-em *kàabal.*
CON=PRV-descend(B3SG) low
'(and) it went down.'

Káa=h-p'áat *le=bòola* *y=óokol* ***na'k**-a'n.*
CON=PRV-quit\ACAUS(B3SG) DET=ball A3=on **ascend**-RES(B3SG)
'(And) the ball ended up on top of it ascended.' (FIGURE_GROUND 14 RMC)

- final example: teleportation across an obstacle

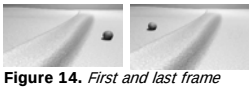
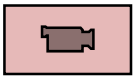


Figure 14. *First and last frame of PATHS 06*



(3.10) *Káa=h=sáat=e',*
CON=PRV=lose/ACAUS (B3SG)=TOP
'(When/and) (the ball) vanished,'

káa=h=ka'=chíik-pah=e' *tu=láahun-tséel*
CON=PRV=REP=appear-SPONT(B3SG)=TOP PREP:A3=other:one-side
'(and) it reappeared, on the other side'

le=pak' ***màah**-a'n* *yàan=o'.*
DET=wall pass:CMP-RES(B3SG) EXIST(B3SG)=D2
'of the wall it was(, having) passed.' (PATH 06 RMC)

– 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

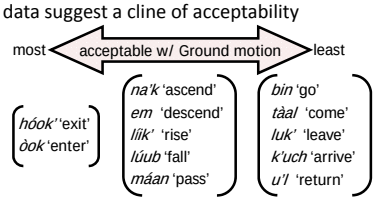


Figure 15. *Acceptability of location change roots w/ non-figure motion scenarios*

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

- 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=bèeh	*he'l=a',*	*k-u=hóok'-ol*
DET=way	PRSV=D1	IMPF-A3=exit-INC
Señor,		
Señor		
k-u=ts'o'k-ol=e',	*k-u=máan*	*Tixcacal,*
IMPF-A3=end-INC=TOP	IMPF-A3=pass(INC)	Tixcacal
k-u=ts'o'k-ol=e',	*k-u=k'uch-ul*	*Yaxley*
IMPF-A3=end-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.'

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  - 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' in Yucatec – cf. Matsumoto 1996 for Japanese
    – 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)
Káa=t-a=pakat-ah		*te=béentanah=o',*
CON=PRV-A2=look.at-CMP(B3SG)		PREP:DET=window=D2
káa=t-aw=il-ah	*ba'x yàan*	*ich le=nah=o'.*
CON=PRV-A2=see-CMP(B3SG)	what EXIST(B3SG)	in DET=house=D2

'[When/and then] you looked (lit. at it) at the window, [when/and then] you saw what was in the house.'

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- 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-neutrally

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

b. *¿De dónde vienes?*
L1SPA from where come:PRS:2SG
'Where do you come from?'

(3.15) a. *El ratón salió en su agujero.*
L2SPA the rat exit: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 exit:PAST:3SG from its hole
'The mouse came out of its hole.' (Lehmann 1992: 626)

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– 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

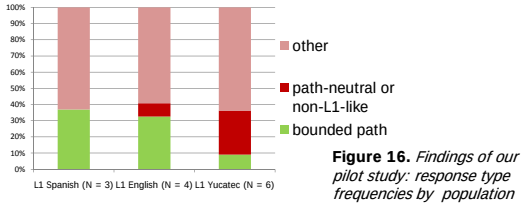

Figure 16. *Findings of our pilot study: response type frequencies by population*

  - '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'

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- 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 I) 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

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Overview

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

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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)

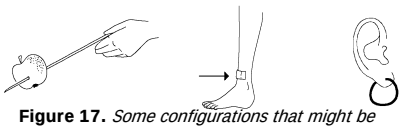

Figure 17. *Some configurations that might be described in terms of topological place functions*

(4.1) *The apple is on the skewer*
(4.2) *The band aid is on the shin*
(4.3) *The earring is in the ear (lobe)*

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Study II: spatial reference frames (cont'd)

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

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.*

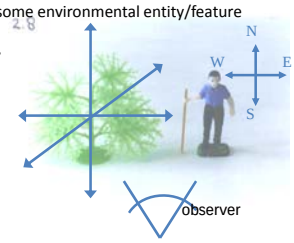

Figure 18. *The three types of spatial FoRs distinguished in Levinson 1996, 2003*

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Study II: spatial reference frames (cont'd)

- alternative classifications and subtypes

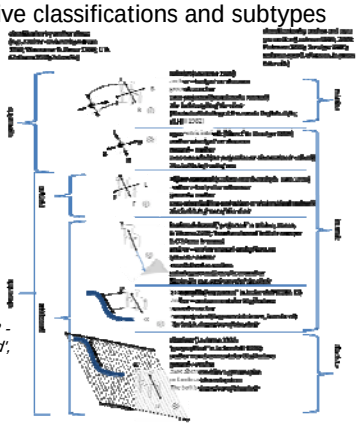

Figure 19. *Reference frame types and their classification (A - 'away from', B - 'back', D - 'downriver', F - 'front', L - 'left', R - 'right', T - 'toward', U - 'upriver'; Bohnemeyer & Levinson ms.)*

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Study II: spatial reference frames (cont'd)

- great amount of crosslinguistic variation
  - in terms of both availability and preferences

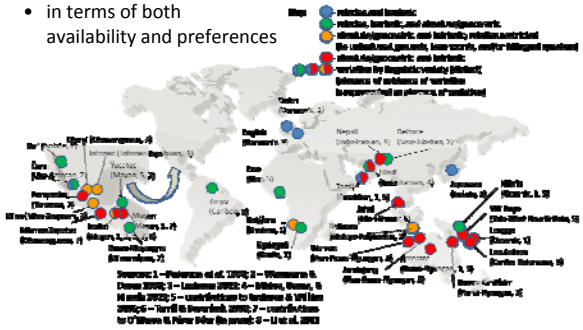

Figure 20. *Reference frame use in small-scale horizontal space across languages (Bohnemeyer & Levinson ms.)*

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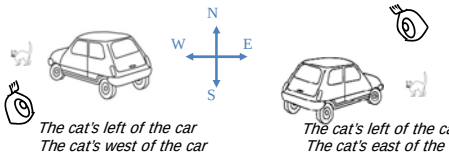
Study II: spatial reference frames (cont'd)

- predicted cognitive consequences
  - difficult to translate a place functions from one frame into another
    - suppose you memorize the cat as being *left* of the car
      - it's difficult to talk about this in terms of cardinal directions later
        - » unless you happen to also memorize where you were with respect to the car in cardinal terms



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 frame appropriate to their language

Figure 21. *Limits of recodability across FoRs*

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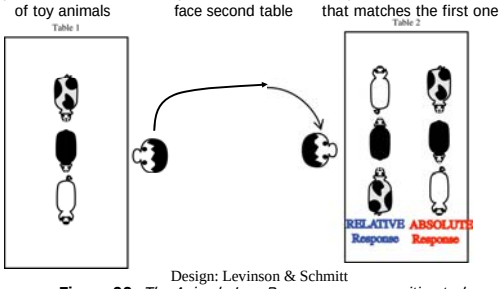
Study II: spatial reference frames (cont'd)

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

Study II: spatial reference frames (cont'd)

Recall Memory Task: Results (small sample)

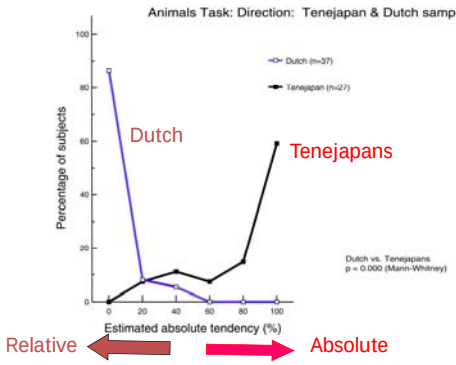


Figure 23. *Animals-in-a-Row in Pederson* et al. 1998: *– results – the small sample*

Study II: spatial reference frames (cont'd)

The large sample

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

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

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

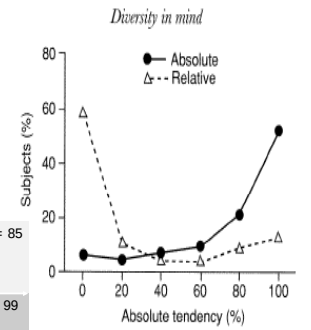


Figure 24. *Animals-in-a-Row results in Levinson (2003: 184): The sample corresponding to Table 3*

Study II: spatial reference frames (cont'd)

- new studies
  - speakers of absolute languages have superior dead-reckoning skills (Levinson 2003)
  - primates show a preference for geocentric over egocentric frames in spatial memory
    - suggesting that the preference for egocentric frames in speakers of, e.g., English and Japanese is learned
      - not innate as had been claimed all the way back to Kant (1768)
    - 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
    - Haun, D. B. M., Rapold, C., Janzen, G., & Levinson, S. C. (2011)

Study II: spatial reference frames (cont'd)

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

Figure 25. *Dancing with the anthropologists*

Study II: spatial reference frames (cont'd)

- 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)

Study II: spatial reference frames (cont'd)

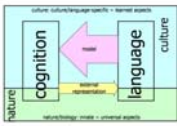


Figure 26. *The big picture according to Whorf*

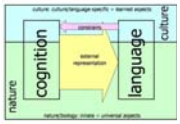


Figure 27. *The big picture according to the innatists*

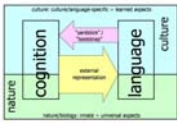


Figure 28. *The big picture according to neo-whorfians*

- Li & Gleitman's hypothesis
  - speakers of all languages have innate knowledge of all frame types and are capable of using them
  - there are cultural biases of frame use that are the result of environmental adaptions
  - these influence language use and internal cognition alike
- Li & Gleitman are proponents of Figure 27
  - so how come they are so concerned about culture here?
- culture is arguably a straw man here
  - the point is to trivialize the differences Pederson *et al.* found as rather more shallow and easily mutable

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Study II: spatial reference frames (cont'd)

- empirical support
  - Li & Gleitman 2002: American college students can be induced to perform like Tenejapan Tseltal speakers
    - however, the observed effects do not actually involve geocentric frames to the extent that they are replicable
      - and are not replicable to the extent that they might involve geocentric frames (Levinson et al. 2002)
  - Li et al. in press: Tenejapan Mayans can be induced to perform like English speakers
    - however, the tests employed by Li and colleagues do not distinguish b/w relative frames and egocentric intrinsic frames
      - and the latter are predicted to occur universally (Bohnemeyer & Levinson ms.)
- sorting out linguistic and nonlinguistic factors in frame use: the **MesoSpace** project

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Study II: spatial reference frames (cont'd)

- ongoing research: MesoSpace
  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)
    - Tseltal (G. Polian)
    - Yucatec (J. Bohnemeyer, PI)
  - Mixe-Zoquean
    - Ayutla Mixe (R. Romero Méndez)
    - Soteapanec (S. Gutierrez Morales)
    - Tecpatán Zoque (R. Zavala Maldonado)
  - Oto-Manguean
    - Otomí (E. Palancar; N. H. Green; S. Hernández-Gómez)
    - Juchitán Zapotec (G. Pérez Báez)
  - Tarascan
    - Purepecha (A. Capistrán)
  - Totonacan
    - Huehuetla Tepehua (S. Smythe Kung)
  - Uto-Aztecan
    - Cora (V. Vázquez)
    - Pajapan Nawat (V. Peralta)

Figure 29. *MesoSpace field sites*

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Study II: spatial reference frames (cont'd)

- 3 non-MA "controls"
  - Seri (C. O'Meara)
  - Mayangna (E. Benedicto, A. Eggleston in collaboration with the Mayangna Yulbarangyang Balna)
  - Mexican, Nicaraguan, and European Spanish (E. Benedicto, A. Eggleston, R. Romero Méndez)

Figure 30. The *MesoSpace team (minus V. Peralta and R. Tucker)*

- 2 (interrelated) domains
  - **frames of reference** and **meronyms** (labels for entity parts)

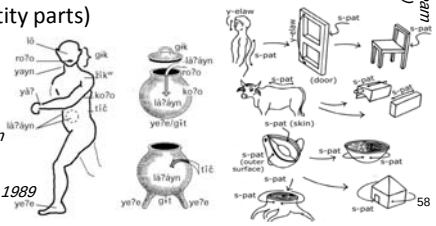

Figure 31. *Meronyms in Ayoquesco Zapotec (left) and Tenejapa Tseltal (adapted from MacLaury 1989 and Levinson 1994)*

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Study II: spatial reference frames (cont'd)

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

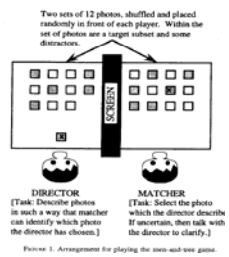

Figure 32. *Layout of Men and Tree task (Pederson et al. 1998: 562)*

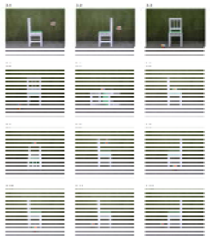

Figure 33. *Set 3 of Ball & Chair*

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Study II: spatial reference frames (cont'd)

- B&C was conducted
  - with five pairs of Yucatec speakers
    - in the summer of 2008
- results
  - cf. Bohnemeyer in press

Figure 34. *A Yucatec B&C trial*

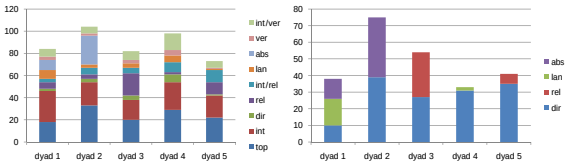

Figure 35. *Numbers of locative (left) and orientation descriptions by frame type*
top – topological; int – object centered; dir – direct (Danziger 2010); rel – relative; int/rel – object-centered/relative ambiguity; lan - landmark-based; abs – cardinal direction terms; ver - absolute vertical; int/ver – object-centered/absolute-vertical ambiguity

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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 Neighbor-net algorithm (Bryant & Moulton 2004)
      - implemented in Splitstree4 (Huson & Bryant 2006)

Study II: spatial reference frames (cont'd)

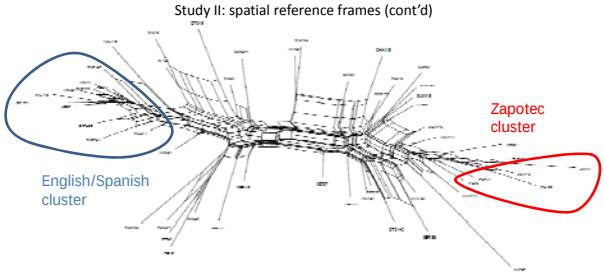
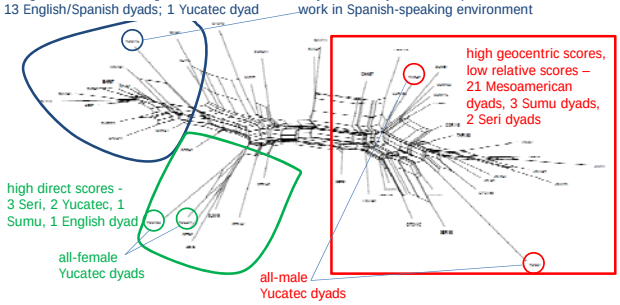


Figure 36. *Neighbornet plot of the 53 dyads (Chacoma Tseltal (CHA) – only three dyads included here; Meseño Cora (COR); Juchiteco Zapotec (JCH); San Ildefonso Tultepec Otomí (OTO); Seri (SER); Sumu-Mayangna (SUM); Purhépecha (TAR); Yucatec (YUC); Barcelonan (BAR) and Nicaraguan Spanish (NIC); American English (AE) (pilot study))*

- most of the 53 dyads cluster by language
  - suggesting that native language is a strong factor influencing reference frame selection in discourse

Study II: spatial reference frames (cont'd)



- 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

Study II: spatial reference frames (cont'd)

- 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

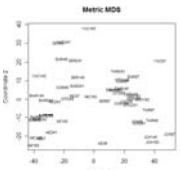


Figure 37. *MDS plot of the 53 dyads*

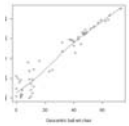


Figure 38. *Correlation between geocentric frequency and dimension 1 of Figure 37*

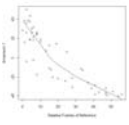


Figure 39. *Correlation between relative frequency and dimension 1 of Figure 37*

Study II: spatial reference frames (cont'd)

- 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

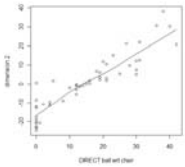


Figure 40. *Correlation between direct frequency and dimension 2 of Figure 37*

Study II: spatial reference frames (cont'd)

- 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

Study II: spatial reference frames (cont'd)

– 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

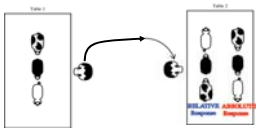


Figure 41. *Layout of the AIAR memory recognition task*

» minor differences: the toy animals used; the number of trials; …

- 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

Study II: spatial reference frames (cont'd)

- 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 dominant type)*

Age group	Gender	Predominant response type				Total
		geocentric	egocentric	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

- 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, $p > .5$)

Study II: spatial reference frames (cont'd)

– 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 3 - *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
		geocentric	egocentric	non-aligned	wrong order	wrong animal	
< 30	Male (N=2)	7	5	0	0	0	12
	female(N=4)	17	1	3	2	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

Study II: spatial reference frames (cont'd)

- discussion
  - spatial reference frames vary greatly across languages
  - reference frame use for linguistic and nonlinguistic tasks tends 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

Study II: spatial reference frames (cont'd)

– why language

- frame types must be at least to some extent learned cultural knowledge
  - this is particularly obvious in the case of geocentric frames

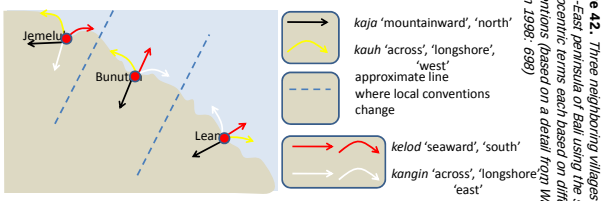


Figure 42. *Three neighboring villages on the North-East peninsula of Bali using the same set of geocentric terms each based on different local conventions (based on a detail from Wassman & Dasen 1998: 698)*

- 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

Overview

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

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?

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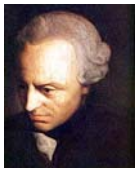
Discussion: domain specificity (cont'd)

- a hypothetical explanation
  - both spatial and temporal cognition have an innate basis
  - in the case of time
    - the innate basis is sufficient to support d-models that are language-independent
    - because the cognitive processing of time is itself comparatively rudimentary
      - extracting only a single dimension
  - in the case of space
    - the innate basis is not sufficient to spell out specific reference frame types
    - cognitive processing of space thus relies on learned cultural knowledge
    - moreover, translation between frames is computationally more costly



http://en.wikipedia.org/wiki/Immanuel_Kant

Figure 43. *Wink-wink, nudge-nudge*

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Overview

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

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