Path in language and cognition

• how much spatial information gets represented in language?
  – test case: motion paths

Path in language and cognition (cont.)

• how much spatial information is represented in the mind?
  – assumption I: at least two systems of internal representation in central cognition
    • one symbolic, with algebraic structures similar to those of natural language syntax, and directly interfacing with it
    • one iconic and image-schematic, directly interfacing with the perceptual systems
      – such as Jackendoff’s Spatial Structure (SpS)

Overview

• Path in language and cognition
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Path in language and cognition (cont.)

– assumption II: the representation of spatial information at SpS is much richer than that at CS
  • iconic systems have an inherent advantage over symbolic ones when it comes to encoding space

FROM ([Place AT ([Tree]))
VIA ([Lake])
TO ([Hill])

Figure 1. Moverb Paths L2 via CS

Figure 2. Referential grounds and path functions

Figure 3. Mental architecture according to Jackendoff 2002

Figure 4. Aspects of path information codable at CS vs. SpS
Path in language and cognition (cont.)

- assumption III: any kind of spatial information encoded at CS must also be interpreted at SpS
  - because as spatial information, it must by definition be interpretable to the visual system and the motor systems
- whereas the opposite does not hold
  - e.g., a great deal of shape and manner-of-motion information is apparently not interpreted at CS

- questions
  - what information is encoded at SpS only and what information is duplicated at CS?
- which aspects of SpS and CS are used for spatial memory and reasoning
  - and which merely serve as conduits to the peripheral systems, i.e., language, perception, and motor representations?
- to what extent is the division of labor between CS and SpS universal
  - and to what extent does it vary with language and culture?

Path in language and cognition (cont.)

- Jackendoff's (1983) position
  - path functions must be encoded at CS
  - argument I: cognitive necessity
    - this argument became obsolete with the addition of SpS to central cognition in Jackendoff 1987
  - argument II: linguistic necessity – path functions must be encoded at CS because they are expressed in English
    - Jackendoff recognizes the possible alternative of a state change semantics for motion descriptions
      - e.g., Miller & Johnson-Laird 1976; Dowty 1979
  (1.2) a. The ball rolled to the hill
    b. \(\text{[\text{Event} \text{GO} ([\text{Thing} \text{BALL}],[\text{Path} \text{TO} ([\text{Place} \text{AT} ([\text{Thing} \text{HILL}])])])]}\)
    c. \(\text{[\text{Event} \text{INCH} ([\text{State} \text{BE} \text{LOC} ([\text{Thing} \text{BALL}],[\text{Place} \text{AT} ([\text{Thing} \text{HILL}])])])]}\)

Path in language and cognition (cont.)

- the case advanced in Bohnemeyer (in press)
  - Jackendoff's arguments for path semantics are convincing for English
  - however, they do not carry over to Yucatec Maya
  - Yucatec motion descriptions systematically have a state change semantics
  - conjecture, supported by indirect evidence: Yucatec speakers do not encode path at CS
    - relying instead on SpS for reasoning about motion
    - implication: path functions are not universals of CS
  - what by the TRH is a core component of CS may nevertheless be language-specific

Path in language and cognition (cont.)

- this study
  - we further explore one of those sources of indirect evidence drawn on in Bohnemeyer (in press)
  - we compare descriptions of animated motion videos in the L2 Spanish of L1-Yucatec speakers
    - to L2 Spanish descriptions by L1-English speakers and to L1 Spanish descriptions
    - a pilot study shows transfer of state change semantics for L1-Yucatec speakers
    - while L1-English speakers have no difficulties mastering the path semantics of Spanish
  - we argue that the difficulties L1 Maya speakers have with expressions of path functions in Spanish
    - are reflection of their not being accustomed to encoding path functions at CS

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Jackendoff’s arguments for path at CS

- the linguistic arguments for path at CS
  - **route** path functions aren’t easily decomposed
    - in state change terms
      - since they involve location of the Figure/Theme, not at the beginning or end of the event, but in between
    (2.1)
      a. The eagle soared *across the canyon*
      b. The train went *through the tunnel*
      c. The expedition *crossed the river*
      d. The horse jumped *over the fence*
  - Bohnemeyer (in press): a similar point can be made wrt. complex paths
    - in which both source and goal (and/or via) are specified
    (2.2)
      The ball rolled *from the tree to the hill*
      - this does not appear to happen in state change descriptions
        unless motion metaphors are involved
    (2.3)
      The lights went *from green to red*

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**The case against a path semantics for Yucatec**

- **Background**
  - Mayan
    - Yucatecan branch
      - along w/ Lakandón, Itzá, Mopan
    - 759,000 speakers age 5+ in Mexico in 2005
      - http://www.inegi.gob.mx
    - polysynthetic
    - verb-initial, “VOS”
    - split-intransitive
      - or ‘active-inactive’
    - field work JB since 1991
  - **figure/ground**
    - argument/oblique that dominates the ground
    - 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**

<table>
<thead>
<tr>
<th>loc</th>
<th>3.1</th>
<th>a. The cart is <em>in the box</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>goal</td>
<td>3.2</td>
<td>a. El carro <em>estaba en la caja</em></td>
</tr>
<tr>
<td>source</td>
<td></td>
<td>b. El carro <em>entra en la caja</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. El carro <em>sale de la caja</em></td>
</tr>
</tbody>
</table>

**V-framed: Spanish**

<table>
<thead>
<tr>
<th>loc</th>
<th>3.1</th>
<th>a. The cart is <em>in the box</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>goal</td>
<td>3.2</td>
<td>a. El carro <em>estaba en la caja</em></td>
</tr>
<tr>
<td>source</td>
<td></td>
<td>b. El carro <em>entra en la caja</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. El carro <em>sale de la caja</em></td>
</tr>
</tbody>
</table>

- **conjecture:** no encoding of path functions at CS
  - plausibility argument: thinking for speaking
  - indirect evidence: no spatial metaphors for temporal connectives
  - anecdotal evidence: widespread L1 transfer in motion descriptions in L2 Spanish

- **Fictive Motion** metaphors (Talmy 1996, 2000)
  - involve path functions in state descriptions
  (2.4)
    a. The highway extends *from Denver to Indianapolis*
    b. The house faces *away from the mountains*
    c. The firehouse is *across the street from the library*
    (Jackendoff 1983: 167-172)
  - we take these to robustly demonstrate path semantics in English motion descriptions
    - but as shown in Bohnemeyer (in press), they do not carry over to Yucatec
The case against a path semantics for Yucatec:

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

(3.2) a. Le=kàaro-na’=o’ $\rightarrow$ ýaa $\rightarrow$ îch / ti’ le=kàaha=ao’
   DET=cart=D2  PREP=EXIST(B3SG)
   ‘The cart, it is in the box’

b. Le=kàaro-na’=o’ h-ðok
   DET=cart=D2  PREV-enter(B3SG)
   ‘The cart, it entered (lit. in) the box’

c. Le=kàaro-na’=o’ h-ðok’
   DET=cart=D2  PRV-exit(B3SG)
   ‘The cart, it exited (lit. in) the box’

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

The case against a path semantics for Yucatec: – 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 6

– out of context, (3.3) would be felicitous
  - as a description of this scenario:

(3.3) #Le=bòola=ao’=h-ðok te=síirkulu=ao’.
   DET=ball=D2  PRV-enter(B3SG)  PREP=DET=circle=D2
   ‘The ball, it entered the circle.’ (ENTER_EXIT 03 EMB)

The case against a path semantics for Yucatec: – Yucatec motion descriptions are compatible with non-figure-motion scenarios

- location change verbs that 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

The case against a path semantics for Yucatec: – compatibility w/ such scenarios suggests

- location change verbs do not entail motion of the figure
  along a path (or even motion of any entity)

- the source of this cline seems to be that
  the verbs on the right presuppose stationary grounds
The case against a path semantics for Yucatec (cont.)

- Jackendoff’s arguments and Yucatec
  - location change involves a locative state plus some description of how it changes during the event
  - routes cannot without “oversimplification” be reduced in this manner
  - but Yucatec descriptions of location change involving routes seem to show just this oversimplification
    - one single location change root - ‘máan’ ‘pass’ - is used to describe location change vis-à-vis all route grounds

(3.8) \( Tún: \) bin u=balak=e'\( e; \)

\[ \text{PROG:A.3 go} A3=roll=TOP \]

'\( \text{The ball} \) was going rolling,'

\( káa=máan \) t-u=béel \( l-e=tréen=e' ... \)

\( \text{CON=PRS} v-pas\pres{B3SG}) \text{ PREP:A.3=way} \text{ DET=trans=D2} \)

'(and) it passed along/across/over the railroad tracks...' (M1and M1 NMP & RMC)

The case against a path semantics for Yucatec (cont.)

- a maximally densely packaged description of the clip in Figure 10 is illustrated in (3.10)

(3.10) \( Le=chan \) sirkulu chak=a'\( o; \)

k-u=tsik='ul u=balak'

\( \text{DET=DIM circle=red} \text{B3SG}\) D2 \text{ IMPF:A.3=leave-INC} A3=roll

'The little circle, it left rolling'

\( y=nkán \) le=chan kwaa=dadto dásas=a'\( o; \)

k-u=máan u=balak'

A3=at \text{ DET=DIM square} \text{ blue} \text{B3SG}\) D2 \text{ IMPF:A.3=pass} A3=roll

'at the little blue square; it passed rolling'

\( xan \) y=pök'a le=chan che' kán=a'\( o; \)

y=nkán al also A3=ron \text{ DET=DIM wood} \text{ yellow} \text{B3SG}\) D2 \text{ IMPF:A.3=reach-INC}

'also on the little yellow plank; it reached'

\( u=balak \) ti te'f\( y=nkán \) le=chan tríángulo=a'\( o; \)

A3=roll LOC there A3=at \text{ DET=DIM triangle=D2}

'rolling there at the little triangle.' (ECOM B4 EMB)

The case against a path semantics for Yucatec (cont.)

- 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 Vol. 1: 138-139

(3.11) The road extends from Señor via Tixcacal to Yaxley

(3.12) \( Le=béle' \) he=t'a';

k-u=hóok='ol Señor; \text{ DET=way} \text{ PRSV=D1} \text{ IMPF:A.3=exit-INC Señor} k-u=tró'b\pres{D\text{ of/for}};

\text{ IMPF:A.3=end-INC} \text{TOP} \text{ Tixcacal; \ k-u=máan Tixcacal; \ IMPF:A.3=arrive-INC} \text{Yaxley; \ k-u=n'éch='ul Yaxley; \ IMPF:A.3=end-INC} \text{TOP}

'This road here, it exits Señor; then [lit. that having ended] it passes [through] Tixcacal; then [lit. that having ended] it arrives [in] Yaxley.'

The case against a path semantics for Yucatec (cont.)

- conjecture: no path encoding at CS
  - just because path functions aren’t expressed in Yucatec does not mean they are not encoded at CS
    - in the mind of Yucatec speakers
  - a plausibility argument: thinking for speaking
    - along the lines of Slobin (1996, 2003)
    - assumption (Jackendoff): CS encodes linguistic meaning
    - it follows that a Yucatec observer of an event who derives a CS representation with a path semantics
      - would be unable to express this representation linguistically
    - no first translating it into a state change representation
    - so the presence of path functions in the CS of Mayan would actually present an obstacle to event description

The case against a path semantics for Yucatec (Cont.)
The case against a path semantics for Yucatec (cont.)

– indirect evidence: 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 (1997, 1998, 2002)—e.g., instead of (3.14), one gets (3.15):

  (3.14) Everyday after Pedro writes a letter, he smokes a cigarette

  (3.15) Pedro=‘ sáansamal=e’ le=k-u=ts’i=k-ol
        Pedro=TOP RED:tomorrow=TOP DET=IMPF=A3=end-INC
        u=ts’i=t-k
        IMPF=A3=suck-INC(B3SG)
        k-u=ts’u=ts’ik
        one-CL.IN cigarette

          ‘Pedro, every day, it being finished his writing a letter, he smokes a cigarette.’

• interim summary
  – direct evidence for the absence of path encoding in Yucatec
  – indirect evidence for the absence of path encoding in the CS of Yucatec speakers

The L2 evidence

• and now: a pilot study probing the L2 evidence
• rationale
  – if native speakers of Yucatec are unaccustomed to expressing path functions at CS
    • they should have greater difficulties processing path expressions in L2 Spanish
      – compared to L2 speakers who routinely express path functions in their native language (cf. Slobin 1996: 89-91)
  – conversely, if Yucatec L1-speakers are used to representing path functions at CS
    – and merely do not map these into language
  • there is no obvious reason why they should find it significantly harder to master Spanish path expressions
    – than L2 speakers whose native language expresses path

The case against a path semantics for Yucatec (cont.)

– anecdotal 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

  (3.16) 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?’

  (3.17) 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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The L2 evidence (cont.)

• background on bilingualism in Quintana Roo
  – Spanish dominates public life in the centers of the larger cities and Yucatec does everywhere else
  – in rural communities, Spanish is restricted to communications with outsiders
    • and to school, church, and much of the mass media
  – the first three grades of primary school are bilingual
    • after that formal education is exclusively in Spanish
  – literacy is largely restricted to Spanish
  – males age 70 and older, and many much younger women, tend to be functionally monolingual
• our test populations
  – six L1-Yucatec speakers, five males and one female, in their 30s through 60s
    • recorded by JB in the field in Quintana Roo in June-July 2008
    • all grew up in a rural village where Yucatec dominates in most settings in public and at home
    • all had little exposure to Spanish until they entered school
  – four L1-English speakers, two males and two females, in their 20s through 30s
    • recorded by RRM in Mexico City in March of 2009
    • American students at the Universidad Nacional Autónoma de México

• the stimuli: the Motion verbs (Moverbs) clips
  – 96 computer-animated digital video clips
    • created by Steve Levinson (2001)

• featuring a variety of location change scenarios varied according to
  – geometry of grounds and spatial relations (place functions) involved
  – figure motion vs. ground motion
  – figure teleportation vs. ground teleportation
  – perspective (toward/away from observer vs. neutral)
• Figures 1 and 6-8 above illustrate
  – we collected descriptions of three subsets of the clips
    • Enter-Exit (21 clips total)
    • Figure-Ground (24 clips total)
    • Paths (16 clips total)
  – in the following analysis, we disregard the clips featuring teleportation ("beaming")
    • the analysis is based on target set of 46 clips

• design
  – the participants watched each clip as many times as they desired
  – interpretations of unfamiliar entities would be negotiated

• coding
  – Spanish path verbs and Yucatec location change verbs are extensionally broadly equivalent
  – we focused instead on the prepositions and satellites (adverbs) used in combination with the Spanish verbs
    • in monolingual Spanish, these reflect the path function encoded
• response types
  • illustrated here with examples produced by L1-Yucatec speakers
  – bounded path encoding
    (4.1)  Se metió la canica dentro
            inserted itself the marble inside(ALL)
            ‘The marble inserted itself into it’
        (Enter-Exit 12 MEP)

• all had lived in Mexico City for 1-2 years at the time of recording
  – three L1-Spanish speakers, two females and one male, in their 30s
    • recorded by RRM in Mexico City in March of 2009
    • the women have lived in Mexico City all their lives; the man is from the state of Sonora

• general assessment of the Spanish skills of the L2 speakers
  – both populations showed mastery of basic Spanish clause structure
  – both populations frequently produced typical L2 production errors
    • especially errors in gender and number marking in agreement and pronominalization
  – the Mayans made what impressionistically seem more L1-Spanish-like lexical choices than the Americans

• preposition/satellite used non-L1-like and apparently path-neutrally
  (4.2)  Empezó rodando, started rolling
          salió en medio
          exited in the middle
          de las maderitas
          of the wood pieces(DIM)
          ‘It started rolling, it exited in the middle of the little wooden things’ (Enter-Exit 19 SME)
  (4.3)  La pelota ... rueda y sube
          the ball ... rolls and ascends
          sobre la tabla redonda
          on the round board
          ‘The ball ... rolls and ascends on the round board’
        (Figure-Ground 04 FEE)
The L2 evidence (cont.)

- indeterminate descriptions
  - the preposition or satellite used has both path and locative uses in L1 Spanish
    - so it is impossible without further evidence to determine whether a given L2 use does or does not encode path

  (4.4) *La crayola entra en un tunel*
  the crayon enters in a tunnel
  ‘The crayon enters in(to) a tunnel’
  (Enter-Exit 16 RMC)

- no ground phrase

  (4.5) *Se baja rodando*
  itself lowers rolling
  ‘It rolls down’ (Paths 09 MNP)

The L2 evidence (cont.)

- distribution - multi-clausal descriptions, one clause encoding location of the figure or of some event
  - and another either unbounded motion or location change wrt. an implicit (unexpressed/anaphoric) ground

  (4.8) *Sale la pelota ... rodando*
  exits the ball rolling
  y se para fuera del corral
  and stops itself outside of the corral
  ‘The ball exits ... rolling and stops outside of the corral’ (Enter-Exit 02 NMP)

The L2 evidence (cont.)

- place-denoting adverbial clauses
  - the ground is described by a clause headed by *dónde* ‘where’
    - which unlike in L1-Spanish is not marked for the path function

  (4.9) *El circulo corrió y se metió dónde está la canica*
  the circle ran and inserted itself where the marble is
  ‘The circle ran and inserted itself where the marble is’ (Enter-Exit 03 MEP)

The L2 evidence (cont.)

- non-motion descriptions
  - location change of figure vis-à-vis ground is framed in non-motion terms

  (4.10) *Vino el, la rodaja arrimando un poco* the(M) the(F) slice approaching a little
  y acaparó la-la pelotita
  and captured the-the ball(DIM)
  ‘The, the onion ring came approaching a little and captured the-the little ball’ (Enter-Exit 12 SME)

The L2 evidence (cont.)

- ground phrase is direct object

  (4.6) *Sobre el puente se desplaza la bola*
  above the bridge itself dislocates the ball
  y cruza el río
  and crosses the river
  ‘The ball moves over the bridge and crosses the river’ (Paths 03 EMB)

- unbounded/ataelic description

  (4.7) *Gira a la orilla del muro*
  turns on the edge of the wall
  ‘It rolls along the wall’ (Paths 08 RMC)

The L2 evidence (cont.)

- ‘other’ in Figure 11 conflates all response types except for ‘bounded path encoding’
  - and ‘path-neutral or non-L1-like’
The L2 evidence (cont.)
- the L1-English speakers produced bounded-path descriptions 3 times as frequently as the Mayans
  - in 32.6% of their descriptions (60 tokens) to the L1-Yucatec speakers' 9.1% (25 tokens)
- the Yucatec speakers produced path-neutral or L1-like descriptions 3 times as often as the Americans
  - in 27.2% of their descriptions (75 tokens) to the L1-English speakers' 8.2% (15 tokens)

- problems
  - inductive statistics difficult to apply in view of uneven number of observations
  - very large 'other' category
    - large differences across the populations especially in the use of unbounded descriptions, distribution strategy

Summary and implications
- motion is systematically framed as state change in Yucatec
  - path functions are not encoded
    - evidence: path-neutral ground phrases; compatibility with non-figure-motion scenarios
  - Jackendoff's arguments for the necessity of a path semantics for English do not apply to Yucatec
    - no fictive motion metaphors; descriptions of motion with respect to route grounds are drastically underspecified
  - indirect evidence for absence of path functions from the CS of Yucatec speakers
    - lack of temporal connectives expected to be based on path metaphors

L2 evidence as a window onto CS
- Yucatec speakers frequently transfer their path-neutral motion semantics to L2 Spanish utterances
  - anecdotal data provided initial evidence for this, which has been corroborated by the pilot study presented here
  - by conjecture this reflects a difficulty in processing the path semantics of Spanish expressions
    - stemming from lack of habituation to path encoding at CS
      - if Yucatec speakers were accustomed to expressing path at CS
        - there would be no obvious reason why Spanish path expressions should present a significant challenge to them
  - much independent evidence is needed to validate and calibrate the use of L2 data
    - as evidence in research on the language-cognition interface

Summary (Cont.)
- implications for the architecture of cognition
  - the encoding of path information at CS, as opposed to SpS, may be language-specific
    - via the Thematic Relations Hypothesis, this entails language-specificity of a core component of CS
  - implications for language evolution
    - Jackendoff's (2002: 231-264 and elsewhere) scenario
      - CS predates language, is shared among all higher animals
      - language evolves as a system of external representations for CS
      - language-specificity of core parts of CS supports an alternative scenario
        - on which CS coevolved with language as an interface between language and SpS
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Acknowledgments

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