Roots and Event Structure I

Experimental Approaches to Verb Meaning

Lecture 2
Verb Roots and Interpretation

Manner Verbs

• Highly idiosyncratic information
  – Waltz – very specific (from Dowty, involving 3 steps in a particular configuration).
  – vs. Dance – more vague.

• Unspecified object:
  – Mary danced.

• Non-subcategorized object:
  – Mary danced the floor on fire.

Result Verbs

• (Highly) idiosyncratic information
  – Disintegrate – very specific (break up into very small parts).
  – vs. Break – more vague.

• Unspecified object:
  – *John broke.

• Non-subcategorized object:
  – *John broke his leg bloody.
Association with Event Structures

Manner Verbs
• \( \lambda x \lambda e_1 [ \text{DO}(e_1, x) \& \text{root}(e_1) ] \)
  • Verbal root modifies DO.
    – No object required.
    – Non-subcategorized objects require other licensors.

Result Verbs
• \( \lambda x \lambda e_1 [ \exists e_2 [ \text{BECOME}(e_1, e_2) \& \text{root}(e_2, x) ] \)
  • Verbal root is an argument of BECOME.
    – Blocking unspecified or non-subcategorized objects.
Meaning Component Entailments

Manner Verbs

• #Denial of entailed manner:
  – Mary scrubbed the bathtub, #but not by scrubbing it.
• Denial of implied result:
  – Mary scrubbed the bathtub, but it didn’t get any cleaner.
• #Expression of manner outside of verb
  – Mary scrubbed the bathtub #by scouring/scrubbing it.
• Expression of result outside of verb:
  – Mary scrubbed the bathtub sterile/clean.

Result Verbs

• Denial of implied manner:
  – Mary cleaned the bathtub, but not by scrubbing it.
• #Denial of entailed result:
  – Mary cleaned the bathtub, #but it didn’t get any cleaner.
• Expression of manner outside of verb:
  – Mary cleaned the bathtub by scouring/scrubbing it.
• #Expression of result outside of verb:
  – Mary cleaned the bathtub #sterile/clean.
Manner/Result Complementarity

• **Lexicalization Constraint**: A [verbal] root can only be associated with one primitive predicate in an event schema, as either an argument or a modifier.

• A constraint on how much meaning a verb root can lexicalize.

Rappaport Hovav & Levin (2010)
Aside 1: Manner of Death Verbs?

• Manner of death verbs appear to lexicalize both a manner (i.e. the way the death occurred) and a result (i.e. the death itself)
  – which include *behead, crucify, hang, drown, electrocute, strangle, immolate, guillotine, etc.*

• Aspectual issues:
  – John was #killed/#guillotined/strangled for 30 seconds.
  – John was #killed/#beheaded/electrocuted to death.

Koontz-Garboden & Beavers (2011)
Aside 1: Manner of Death Verbs?

• This argument relies heavily on a claim about what constitutes a “lexicalized” meaning.
  – According to Dowty (1991), lexicalized components are meanings that are entailed regardless of the context.
  – Are both manner and result meanings entailed by manner of death verbs?
Aside 1: Manner of Death Verbs?

**Bachelor**: Unmarried adult male human who hasn’t been married before and could get married.

- Is Jessie a bachelor?
  - No, he’s married to Clare.
  - #No, he’s a five year old!
  - #No, Jessie’s a girl!
  - #No, he’s a humpback whale!
  - #No, he’s a divorcée!
  - #No, he’s the catholic priest!

- Jessie’s not a bachelor.
  - He’s married to Clare.
  - #He’s a five year old!
  - #Jessie’s a girl!
  - #He’s a humpback whale!
  - #He’s a divorcée!
  - #He’s the catholic priest!

Only the ‘unmarried’ component is asserted. Other components are presupposed.
Aside 1: Manner of Death Verbs?

- Was Cicero decapitated?
  - No, he was stabbed.
  - #Yes, he was killed.

- Socrates was not decapitated.
  - He was poisoned.
  - #He didn’t die.

- The manner component of manner of death verbs is entailed while the result component is actually presupposed.
MANNER/RESULT IN PSYCHOLINGUISTICS
‘Lexical’ Complexity

- Manner Verb:
  \[ \lambda x \lambda e_1 [ \text{DO}(e_1, x) \& \text{root}(e_1) \] \]

- Result Verb:
  \[ \lambda x \lambda e_1 [ \exists e_2 [ \text{BECOME}(e_1, e_2) \& \text{root}(e_2, x) \] \]

- Result verbs have a more complex event structure compared to manner verbs.
Complexity and Processing

• Linking Hypothesis
  – Differences in the time it takes to perform a task is an index of the complexity of that task.
  – **Response Times (RTs):** The time from the onset of a stimulus to the onset of the response to that stimulus.

• Mental Chronometry (Donders, ~1860s)
  – “the study of the time course of information processing in the human nervous system” (Posner 1978)
Componential Analysis

Repeat
When you hear “ki”, you must repeat it by saying “ki”.

• Requires
  – Perception and motor stages

Go/No Go
You may hear “ki” or “ka”, and you must only respond to “ki” by producing “ki”, otherwise say nothing.

• Requires
  – Perception and motor stages
  – Discrimination stage

Choice
You may hear “ki” or “ka”, and you must produce the corresponding response (e.g., “ki” for “ki”, “ka” for “ka”).

• Requires
  – Perception and motor stages
  – Discrimination stage
  – Choice stage

< < RT
Verbs in the lexicon: Why is hitting easier than breaking?

GAIL MCKOON AND JESSICA LOVE*

Ohio State University

Abstract

Adult speakers use verbs in syntactically appropriate ways. For example, they know implicitly that the boy hit at the fence is acceptable but the boy broke at the fence is not. We suggest that this knowledge is lexically encoded in seman-
Lexical Decision

Manner: 1 subevent
\[ \lambda x \lambda e_1 \left[ \text{DO}(e_1, x) \& \text{root}(e_1) \right] \]

\[ \Lambda x \lambda e_1 \left[ \exists e_2 \left[ \text{BECOME}(e_1, e_2) \& \text{root}(e_2, x) \right] \right] \]

McKoon & Love (2011)
Caveats: Lexical Decision

• Factors that affect Lexical Decision RTs

<table>
<thead>
<tr>
<th></th>
<th>Manner</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word length (letters)</td>
<td>4.4</td>
<td>4.8</td>
</tr>
<tr>
<td>Word length (syllables)</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Verb use frequency</td>
<td>29.1</td>
<td>33.6</td>
</tr>
<tr>
<td>Imagability</td>
<td>4.2</td>
<td>4.3</td>
</tr>
<tr>
<td>Number of verb senses</td>
<td>5.1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

McKoon & Love (2011)
F1(1,24) = 8.4, p = .008 (by Subjects); F2(1,15) = 6.5, p = .022 (by Items)

McKoon & Love (2011)
Sentence Acceptability

• The king **slapped** the rebel.  
  Manner
• The king **crushed** the protest.  
  Result

• The lawyer believed the client.  
  Acceptable
• The ceiling smiled the day.  
  Unacceptable
• The building jumped black.  
  Unacceptable

McKoon & Love (2011)
Caveats: Sentence Acceptability

- Factors that affect Sentence Acceptability RTs (in addition to lexical factors)

<table>
<thead>
<tr>
<th></th>
<th>Manner</th>
<th>Result</th>
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</thead>
<tbody>
<tr>
<td>Transitivity probability</td>
<td>0.88</td>
<td>0.83</td>
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<tr>
<td>Sentence imagability</td>
<td>4.4</td>
<td>4.2</td>
</tr>
<tr>
<td>Sentence plausibility</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Subject-verb relatedness</td>
<td>2.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Verb-object relatedness</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Subject-object relatedness</td>
<td>2.7</td>
<td>2.7</td>
</tr>
</tbody>
</table>

McKoon & Love (2011)
F1(1,31) = 10.0, p = .003 (by Subjects); F2(1,10) = 7.2, p = .023 (by Items)
Stop-Making-Sense Judgments

McKoon & Love (2011)
F1(1,21) = 7.3, p = .013 (by Subject); F2(1,10) = 9.2, p = .013 (by Items)

89 msec

51 msec

McKoon & Love (2011)
Summary

• Lexical decision response time for result verbs were longer than those for manner verbs.
  – Same for sentence acceptability times.

• These effects emerge at the verb itself in self-paced reading.
Complexity and Processing

• Additional Linking Hypothesis
  – Differences in learnability and learning bias can be an index of the complexity of that task.
  
  – Caveat: This with interact with other structural properties.
Research Article

MOTION-VERB GENERALIZATIONS IN ENGLISH AND SPANISH: Influences of Language and Syntax

Letitia R. Naigles¹ and Paula Terrazas²
¹University of Connecticut and ²Stanford University

Abstract—English and Spanish speakers differ in the ways they talk about motion events, but how have these different modes of expression become instantiated as differing generalizations—as syntactic rules, variety of motion events, whereas in Spanish, the canonical lexicalization pattern is most consistently observed in descriptions of motion events that highlight the moving object’s final location or its traversal
Conflation in Motion Events

• English conflates manner with the verb.
  – run, walk, skip, jump
  – Tend to occur in intransitive clauses

• Romance conflates path with the verb.
  – salir ‘exit’, entrar ‘enter’, cruzar ‘cross’
  – Tend to occur with path prepositions a ‘to’ and de ‘from’
Learning task

Woman skips towards tree

“Look, she’s kraddling.”

“See, she’s kraddling.”

Woman skips towards tree

“Hey, she’s kraddling.”

Woman skips towards tree

“Look, they’re different now.”

“Where’s she kraddling?”

Woman skips away from tree

“Where’s she kraddling?”

Woman skips away from tree

Naigles & Terrazas (1998)
## Experiment 1

<table>
<thead>
<tr>
<th>Original Event</th>
<th>Manner Change</th>
<th>Result Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woman skips towards tree</td>
<td>March towards tree</td>
<td>Skip away from tree</td>
</tr>
<tr>
<td>Man spins around table</td>
<td>Jump around table</td>
<td>Spin back and forth on top of table</td>
</tr>
<tr>
<td>Woman walks across bridge</td>
<td>Leap sideways across bridge</td>
<td>Walk in front of bridge</td>
</tr>
<tr>
<td>Woman crawls into tent</td>
<td>Crab-walk into tent</td>
<td>Crawls around outside tent</td>
</tr>
</tbody>
</table>

Naigles & Terrazas (1998)
Naigles & Terrazas (1998)
<table>
<thead>
<tr>
<th>Manner Frame</th>
<th>Path Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woman skips towards tree</td>
<td>She’s kraddling towards the tree.</td>
</tr>
<tr>
<td></td>
<td>She’s kraddling the tree.</td>
</tr>
<tr>
<td>Ella está mecando hacia el árbol.</td>
<td>Ella está mecando al árbol.</td>
</tr>
<tr>
<td>Man spins around table</td>
<td>He’s blicking around the table.</td>
</tr>
<tr>
<td></td>
<td>He’s blicking the table.</td>
</tr>
<tr>
<td>El está filando alrededor de la mesa.</td>
<td>El está filando a la mesa.</td>
</tr>
<tr>
<td>Woman walks across bridge</td>
<td>She’s zubbing across the bridge.</td>
</tr>
<tr>
<td></td>
<td>She’s zubbing the bridge.</td>
</tr>
<tr>
<td>Ella está bechando a través del puente.</td>
<td>Ella está bechando el puente.</td>
</tr>
<tr>
<td>Woman crawls into tent</td>
<td>She’s pimming into the tent.</td>
</tr>
<tr>
<td></td>
<td>She’s pimming the tent.</td>
</tr>
<tr>
<td>Ella está klitando hacia la carpa.</td>
<td>Ella está klitando a la carpa.</td>
</tr>
</tbody>
</table>

Naigles & Terrazas (1998)
Naigles & Terrazas (1998)
English

• Strong preference for manner interpretation in neutral bias sentences.

• Strong preference for manner interpretation in manner-bias sentences.

• No preference between manner/path interpretation in path-bias sentences.

Spanish

• Strong preference for manner interpretation in neutral bias sentences.

• No preference in between manner/path interpretation in manner-bias sentences.

• Strong preference for path interpretation in path-bias sentences.

Naigles & Terrazas (1998)
Manner/Result Polysemy

• The explorer climbed. (manner)
  – Requires a ‘clambering’ manner to be attributed to the explorer.

• The prices climbed. (result)
  – No ‘clambering’ manner attributed to the prices.

Mateu & Acedo-Matellán (2012)
Structures for Manner/Result

**Manner**
- Verbal root adjoins to $v_{(DO)}$.

**Path (Result)**
- Verbal root incorporates with $v_{(BECOME)}$.

Manner/result complementarity results from a syntactic constraint.

Mateu & Acedo-Matellán (2012)
Manner/Result Polysemy

• The explorer climbed. (manner)
  – Requires a ‘clambering’ manner to be attributed to the explorer.

• $[_{vP} [_{DP} \text{the explorer }] [_{v} v_{\text{climb}} v ] ]$

• The prices climbed. (result)
  – No ‘clambering’ manner attributed to the prices.

• $[_{vP} v+V_{\text{climb}} [_{SC} [_{DP} \text{the prices }] v_{\text{climb}} ] ]$

Mateu & Acedo-Matellán (2012)
Structurally Conditioned Polysemy

• The presence of a directional preposition forces a manner interpretation.

• The explorer climbed down the mountain. (manner)

• \[
  \text{[vp} [v \text{climb v }] [sc [dp the explorer] [pp down the cave]]]
\]

• ?? The prices climbed down the market.
Affectedness

• Direct object is unaffected
  – The explorer climbed the mountain. (manner)
  – $[v_P [DP \text{ the explorer } ] [v [v \sqrt{climb} v ] [DP \text{ the mountain } ] ] ]$
  – ?? The prices climbed the market.

• Direct object is affected
  – ?? The explorer broke the mountain.
  – The prices broke the market. (result)
  – $[v_P [DP \text{ the prices } ] [v [v+\sqrt{break} ] [SC [DP \text{ the market } ] \sqrt{break} ] ] ]$
English

- Strong preference for manner interpretation in neutral bias sentences.

- Strong preference for manner interpretation in manner-bias sentences.

- No preference between manner/path interpretation in path-bias sentences.

- Manner-biased sentences
  - Path-denoting prepositions, *towards*, occupied the result argument and required the verb to adjoin to *v*.
  - \([vP [v k\text{raddle} v] [sc [dp she] [pp towards the tree] ] ]\)

- Path-biased sentences
  - Manner or path depended on whether participants considered the action to have a change-of-state, leading to a mixed result.
Result Conflation in Romance

• An old woman limped in from the back. (English)
• Une vieille femme arriva en boitant de l’arrière-boutique. (French)
• an old woman arrived in limping from the back-store

• Romance languages require resultative elements (e.g. directionals) to incorporate.
Result Conflation in Romance

- En Joe escalà.
- det Joe climbed
- \([vP [DP en Joe] [v \sqrt{\text{climb} v}] ]\)

- En Joe sortí del túnel escalant.
- det Joe went+out of.the tunnel climbing
- \([vP [v v+\sqrt{\text{fora} P}] [SC=PP [DP en Joe] [P' \text{ fora} P \text{ del túnel} ] ] ]\)

- *En Joe escalà fora del túnel. (non-directional)
- det Joe climbed out of.the tunnel
• No preference for manner-bias as manner and result verbs can appear with prepositions denoting unbounded paths, e.g. *hacia*.

• Path-biased sentences included a ‘general path preposition’ *a* before the direct object, triggering obligatorily incorporation, blocking verb root adjunction to *v*, and giving rise to a small clause result syntax.

• \[v_P [v, v+_v \text{mecando }] [_{SC=PP, DP} \text{ella }] [_{P, v+_v \text{mecando al árbol }]} \]

**Spanish**

• Strong preference for manner interpretation in neutral bias sentences.

• No preference in between manner/path interpretation in manner-bias sentences.

• Strong preference for path interpretation in path-bias sentences.
Neutral frames

• Both English and Spanish preferred manner interpretation in neutral frames.
  – **Possibility 1**: Lack of overt object leads to a bias for manner interpretation (Feist 2010).
  – **Possibility 2**: Subjects always acted as Agents which are arguments of DO predicates. No need for BECOME/small clause leads to a manner interpretation bias.
Summary

• Structural differences between English and Spanish lead to different learning biases.
  – Directionals do not incorporate in English, leaning to a strong manner-bias in manner-biased sentences.
  – Directionals must incorporate in Spanish, leading to a strong path-bias in path-biased sentences.
Conclusions

- Verb roots can take on manner or result/path interpretations.
  - Lexical bias of a verb affects lexical decision, sentence acceptability, and self-paced reading
  - Results are slower to processing than manners.

- These interpretations are structurally conditioned.
• Mateu, J., & Acedo-Matellán, V. (2012). The Manner/Result complementarity revisited: A syntactic approach. In M. C. Cuervo, & Y. Roberge (Eds.), The end of argument structure (pp. 209-228). Bingley: Emerald Group