Verbal Telicity and Event Structure

Experimental Approaches to Verb Meaning
Transitivity, Telicity, Results

- The artist sketched the picture
- The artist sketched
- The nurse healed the patient
- The nurse healed

Diagram:

- **The artist** sketched the man
- **The nurse** healed the patient

Diagram (syntax trees):

- **The artist** sketched
- **The nurse** healed
Transitivity, Telicity, Results

- The artist sketched the picture in ten minutes.
- The artist sketched *in ten minutes.
- The artist sketched pictures *in ten minutes.
- Artists sketched *in ten minutes.
- The nurse healed the patient in two weeks.
- The nurse healed *in two weeks.
- The nurse healed patients *in two weeks.
- Nurses healed *in two weeks.
Transitivity, Telicity, Results

- The artist sketched the picture in ten minutes.
- The artist sketched *in ten minutes.
- The artist sketched pictures *in ten minutes.
- The foreman scrutinized the plan *in ten minutes.
- *The foreman scrutinized (in ten minutes).
- The forman scrutinized plans *in ten minutes.
- The nurse healed the patient in two weeks.
- The nurse healed in two weeks.
- The nurse healed patients *in two weeks.
- The agent captured the spy in two hours.
- *The agent captured (in two hours).
- The agent captured spies *in two hours.
Transitivity, Telicity, Results

- The foreman scrutinized the plan *in ten minutes.
- *The foreman scrutinized (in ten minutes).
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- The agent captured spies *in two hours.
Summary

- Transitivity alternations can reveal differences in argument alignment.
  - Some surface subjects are derived from internal arguments.

- Telicity depends on properties of the internal argument.
  - Quantized internal arguments license a telic interpretation.

- Some verbs require are obligatorily transitive
  - But their internal argument may not be affected.
EVENT STRUCTURE IN LANGUAGE COMPREHENSION

by

Erin Leigh O’Bryan

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF LINGUISTICS

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA
A mine exploded at the Ripy distillery near Lawrenceburg, disclosed the fact that a number of mines had been planted there to prevent robbery.
The defendant examined by the lawyer turned out to be unreliable.

The defendant who was examined by the lawyer
The defendant examined by the lawyer.
The defendant examined by the lawyer turned...
Reduced Relative Garden-Paths

• The parser initially analyzes the first verb as the main verb of a transitive clause.
  – Disambiguation requires the parser to reanalyze the first verb as the verb of a reduced relative clause.
  – This involves recognizing an underlying internal argument and its silent operator.
Event Structure Processing Hypothesis

• During comprehension, event structure information, accessed in a verb's lexical entry, affects parsing decisions.
  – If the verb is inherently telic the verb will be parsed as having an underlying direct object.

awakened [+telic] by DP

worshiped [+atelic] by DP
Predictions

• Obligatorily transitive verbs require a surface direct object.
  – Ease reanalysis of a reduced relative because an object has already been hypothesized.

• Telic verbs require an internal argument (underlyingly a direct object).
  – Ease reanalysis of a reduced relative because an internal argument has already been hypothesized.

Word Maze

actress

were

them

spotted

by

retrieved

from

killed

the

writer

big

left

chaperoned: +transitive, -telic
spotted: +transitive, +telic
worshiped: ±transitive, -telic
awakened: ±transitive, +telic

Stimuli

The actress **chaperoned/sketched** by the writer left in a hurry. -telic

The actress **spotted/awakened** by the writer left in a hurry. +telic

The actress **who was** **chaperoned/sketched** by the writer left in a hurry. -telic

The actress **who was** **spotted/awakened** by the writer left in a hurry. +telic

**O'Bryan (2003)**

### Table: Sentence Region

<table>
<thead>
<tr>
<th>Factor(s)</th>
<th>embedded verb</th>
<th>by the</th>
<th>noun</th>
<th>main verb</th>
<th>next word</th>
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</thead>
<tbody>
<tr>
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<td>F</td>
<td>p</td>
<td>F</td>
<td>p</td>
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<tr>
<td>Telicity</td>
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<td>n.s.</td>
<td>4.9</td>
<td>&lt; .05</td>
<td>&lt; 1</td>
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<tr>
<td>Transitivity</td>
<td>3.5</td>
<td>0.07</td>
<td>4.4</td>
<td>&lt; .05</td>
<td>2.4</td>
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<tr>
<td>Telicity X Transitivity</td>
<td>4.1</td>
<td>&lt; .05</td>
<td>4.6</td>
<td>&lt; .05</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

**Diagram: Difference in RRE (in milliseconds)**

- Atelic minus Telic
- Optionally Transitive minus Obligatory Transitive

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Reduced Relative - Unreduced Relative (msec)

- Obligatorily Transitive [-telic]
- Obligatorily Transitive [+telic]
- Optionally Transitive [-telic]
- Optionally Transitive [+telic]

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<td>3.3 0.08</td>
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<td>19.5 &lt; .01</td>
<td>9.2 &lt; .01</td>
<td>4 0.05</td>
</tr>
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</table>

Summary

• Telicity and transitivity conspire to reduce reanalysis of temporarily ambiguous reduced relative clauses.
  – Optionally transitive verbs that are +telic immediately ease garden-path recovery.
  – There is, however, a later boggle at the main verb...

• Overall, it appears that verbal telicity is active in online sentence processing.
Processing (the) events: lexical and structural ingredients of inner aspect

Linnaea Stockall · E. Matthew Husband

What is the aspectual representation of verbs and how is that representation used to construct the aspectual interpretation of a sentence during online sentence processing? In this paper we use psycholinguistic techniques to
• Activity/Accomplishment (unspecified)
  Sarah solved/read the puzzle in six minutes.
  Sarah solved/read puzzles *in six minutes.

• Achievements (inherently [+telic])
  Sarah found/noticed the book in two hours.
  Sarah found/noticed books in two hours.

• Activities (inherently [-telic])
  Sarah pushed/pulled the cart *in three minutes.
  Sarah pushed/pulled carts *in three minutes.
Aside: Quantization

<table>
<thead>
<tr>
<th></th>
<th>Quantized</th>
<th>Homogeneous</th>
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<tbody>
<tr>
<td>Individuals</td>
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<td>Mass</td>
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<td></td>
<td>count/quantify</td>
<td>*count/*quantify</td>
</tr>
<tr>
<td>Actions</td>
<td>Telic</td>
<td>Atelic</td>
</tr>
<tr>
<td></td>
<td>endpoint</td>
<td>*endpoint</td>
</tr>
<tr>
<td>Degrees</td>
<td>Closed Scale</td>
<td>Open Scale</td>
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<tr>
<td></td>
<td>maximization</td>
<td>*maximization</td>
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<tr>
<td>States</td>
<td>Existential</td>
<td>Generic</td>
</tr>
<tr>
<td></td>
<td>spatiotemporal</td>
<td>*spatiotemporal</td>
</tr>
</tbody>
</table>

- **Homogeneous**: $P$ is homogeneous iff $P$ is both cumulative and divisive

- **Cumulative**: $\forall x,y \ [P(x) \& P(y) \rightarrow P(x \cup y)]$
  - ($P$ is *cumulative* iff for all $x$ and $y$ with property $P$, the union of $x$ and $y$ also has property $P$.)

- **Divisive**: $\forall x \ [P(x) \rightarrow \exists y \ [P(y) \& y<x] \& \forall x,y \ [P(x) \& P(y) \& y<x \rightarrow P(x-y)]]$
  - ($P$ is *divisive* iff for all $x$ with property $P$ there is a proper part $y$ of $x$ which also has property $P$, and for all $x$ and $y$ with property $P$ if $y$ is a proper part of $x$ then the subtraction of $y$ from $x$ also has property $P$.)

Borer (2005)
## Approaches to the Composition of Events

<table>
<thead>
<tr>
<th>Inherently [-telic]</th>
<th>Unspecified</th>
<th>Inherently [+telic]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scalar</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Open multi-point scale verbs</td>
<td>Closed multi-point scale verbs</td>
</tr>
<tr>
<td><strong>Incremental Themes</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-AddTo verbs (No incremental theme)</td>
<td>+AddTo verbs (Incremental theme)</td>
</tr>
<tr>
<td><strong>AspP</strong>&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>Unspecified verbs</td>
</tr>
</tbody>
</table>

<sup>1</sup>Beavers 2007; Filip 1999; Hay et al. 1999; Kennedy and Levin 2008; Piñón 2008


<sup>3</sup>Borer 2005
Against Inherently [+telic] Verbs

• The punctual nature of certain events drives them to appear inherently telic.
  – *type the letter ‘p’* – ‘p’ appears on the screen instantaneously, but this ignores the underlying process.
    • At what time did you type the letter ‘p’? At noon sharp.
    • ??At what time did you type the memo? At noon sharp.
  – *draw the circle* – if done with a computer program though the press of a single key, then this too can appear to happen instantaneously.
    • At what time did you/the computer draw the circle? At noon sharp.

Verkuyl (1989)
Against Inherently [-telic] Verbs

• The lack of a natural endpoint for events is some fact about the world.
  – push the cart for 5 minutes [durative]
  – push the button for 5 minutes [iterative]
  – push buttons for 5 minutes [durative]

• John heaved the cannon towards the army
  – Linear motion towards the army -> durative
  – Rotational motion towards the army -> terminative

Borer(2005); Schein (2002)
Research Question

• Is telicity actually represented as part of the verbal root?
  – Are verbs like find (or spot) actually [+telic]?
  – Are verbs like push (or worship) actually [-telic]?

• The roadmap:
  – Find a processing correlate for telicity.
  – Use that correlate to examine the behavior of these three verb classes.
Processing Correlates

• Verbs themselves could trigger processing differences.

• Lexical Decision

<table>
<thead>
<tr>
<th></th>
<th>Subject</th>
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<th>Average</th>
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<tbody>
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<td>655</td>
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<tr>
<td>Difference</td>
<td>23</td>
<td>22</td>
<td>22</td>
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The retired musician **built** his second house from scratch. (Event)
The retired musician **loved** his second house from scratch. (State)
Where to Look

- **Hypothesis 1: Verb differences**
  - Not clear what the “prediction” is here...
    - Should inherent verbs be more complex than unspecified?
    - Should [+telic] verbs be more complex than unspecified and [+atelic] verbs?

- **Hypothesis 2: Verb differences followed by argument differences as separable interacting factors.**
  - May expect to see some mismatch between, say, [-telic] verbs with [+Q] DPs, and [+telic] verbs with [-Q] DPs.

- **Hypothesis 3: Verb+argument differences only in composition**
  - Given the compositional nature of telicity, we might expect that principally telicity is not determined until the parser has a VP.
## Predictions

### Experiment 1

**Interaction (Scalar, AspP)**

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<tr>
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**Main Effect (Incremental Theme)**

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### Experiment 2

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Experiment 1

- The expert physicist lost the files on the formation of black holes.  
  Inherently telic, definite plural

- The expert physicist lost files on the formation of black holes.  
  Inherently telic, bare plural

- The expert physicist read the files on the formation of black holes.  
  Unspecified, definite plural

- The expert physicist read files on the formation of black holes.  
  Unspecified, bare plural
Determiner Effect: $z=4.97$, $p<.001$

Interaction: $z=3.15$, $p=.002$
### Predictions

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Experiment 2

- The local horticulturist roamed the gardens in the neighborhood. Inherently atelic, definite plural

- The local horticulturist roamed gardens in the neighborhood. Inherently atelic, bare plural

- The local horticulturist inspected the gardens in the neighborhood. Unspecified, definite plural

- The local horticulturist inspected gardens in the neighborhood. Unspecified, bare plural
Determiner Effect: $z=4.66$, $p<.001$

Determiner Effect: $z=1.75$, $p=.083$
## Predictions

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Summary

• Experiment 1 found the predicted interaction between verbal telicity and internal argument quantity.
  – This empirically established a processing correlate for telicity
  – The interaction was in favor of inherently telic verbs.

• Experiment 2 found only a main effect of argument quantity.
  – The lack of an interaction speaks against inherently atelic verbs.
Conclusion

• Aspectual features are active in online sentence processing.
  – The cost for a reduced relative clause ambiguity is eased by +telic verbs.

• We can try to use psycholinguistic tools to reflect back on empirical differences between theories.
  – We can find a processing correlate that reflects the composition of events.
  – We can then use that correlate to probe the behavior of putative verb classes.


