Processing Temporality in Language – A Question of Domain Size

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Outline

1. Facets of Temporality: Aktionsart and Tense
   - Aktionsart
   - Hypotheses

2. A Question of Domain Size

3. Brain Signatures elicited by Violations of Tense and Aspect

4. General Discussion
Temporality in language - a complex system

(3) By the time the storm broke out, the mountaineer had reached the top

Tense
the whole situation is situated in the past (had vs. has)

Aspect
have reached is perfect (focussing on the result state)

Aktionsart
reach the top encodes a situation with a punctual reach event
(3) **By the time the storm broke out, the mountaineer had reached the top**

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Two components: Tense vs. Aktionsart

Tense
Tense relates the temporal location of a situation to some other temporal reference point.

Aktionsart
Aktionsart is concerned with the structural properties of the situation itself or, more precisely, with different ways of viewing the internal temporal constituency of a situation.
Aktionsarten: ontological primitives

**Activities:** processes involving continuous change (swim, push a cart, ...)

**States:** states that are extended in time (be sad, resemble one’s mother, ...)

**Achievements:** punctual events that change the state of affairs (reach the top, arrive, ...)

**Accomplishments:** processes ending with a finishing event (build a house, drink a bottle of wine, ...)

→ The same aspectual classes are found across languages

→ Categories also important in intuitive physics (e.g. accomplishments relate to causality)
Achievements: "reach the top"

- Achievements express a discrete change of state.
- This change is marked by a punctual event (culmination).
- Cannot be modified by for-adverbials
  
  (4a) *John reached the top for two hours.
- Can be modified by ago-adverbials
  
  (4b) John reached the top two hours ago.
Aktionsart: a suprалexical semantic phenomenon

(6) For two hours, *a visitor/visitors arrived.
(7) For many years, this athlete won *the marathon/marathons.

- Aktionsart depends not only on the verb
- If the subject is bare plural (6) expresses an activity
- The semantics of the object is important, too.

→ Aktionsart is determined at the sentential level
Two questions about processing temporality

- When is Aktionsart computed at the earliest?
- How do the different components of the temporal system interact?
When is Aktionsart computed at the earliest?

**Incremental Aspectual Interpretation Hypothesis**
Aktionsart is computed incrementally, on a word-by-word basis.

**Late Aspectual Interpretation Hypothesis**
Aktionsart is not computed before a verb has all its arguments.

→ reading times
How do different aspects of temporality interact?

**Interaction Hypothesis**
A temporal profile is computed all at once, Aktionsart and tense are taken into consideration simultaneously.

**Independence Hypothesis**
The different components of the temporal system contribute their temporal information independently of each other.

→ ERPs
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| mismatch | der Förster entdeckte die Falle fünf Min. lang im Wald |
| control  | der Förster entdeckte die Falle vor fünf Min. im Wald |

- Two kinds of adverbials:
  - *for*-adverbials need a process => aspectual mismatch
  - *at* time-*adverbials* serve as controls

- The adverbial is applied to a verb with all its arguments
A question of domain size – ”late adverbials”

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### A question of domain size – ”late adverbials”

<table>
<thead>
<tr>
<th>MM-OE</th>
<th>Der Förster</th>
<th>entdeckte</th>
<th>fünf Min. lang</th>
<th>im</th>
<th>Wald</th>
<th>die Falle ...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>the ranger</td>
<td>discovered</td>
<td>for five min.</td>
<td>in</td>
<td>woods</td>
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- **Object Extraction (OE):** mismatch effect at the adverbial before object has been encountered?
- **Subject Extraction (SE):** adverbial intervenes between VP and subject
A question of domain size – methods

- Self-paced reading using moving window presentation
- 30 items + 75 fillers
- The reported experiments were part of two larger studies (also testing aspectual coercion)
- Experiment 1 (30 participants): word order (two levels: SVO–Adv vs. SV–Adv–O) x adverbial (two levels: mismatch vs. control)
- Experiment 2 (42 participants): OV–Adv–S (mismatch vs. control)
Mismatch effect at adverbial and spillover region only in the SVO-Adv order
Aspectual mismatch slows down reading pace

But only when the adverbial modifies complete verb-argument structure

→ Reading times provide evidence for late aspectual interpretation:

**Late Aspectual Interpretation Hypothesis**

Aktionsart is not computed before a verb has received all its arguments.
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ERP experiment "Aktionsart" – design

- **Adverbial**: mismatch vs. control
- **Critical segment**: participle (*entdeckt*)
- **Apart from the first word physically identical stimuli**
- **Processing difficulty must be due to semantic context**
ERP experiment "Tense" – design

- **Adverbial:** future vs. past
- **Critical segment:** past tense verb (*rannte*)
- **Verb hasn’t received any arguments yet**
- **Mismatch effect at the verb indicates differences in processing domain (tense vs. Aktionsart)**

<table>
<thead>
<tr>
<th>violation</th>
<th>Morgen</th>
<th>früh morning</th>
<th>rannte</th>
<th>der Junge</th>
<th>in die Schule.</th>
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<tr>
<td></td>
<td>Tomorrow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>Gestern</td>
<td>früh morning</td>
<td>rannte</td>
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<td>in die Schule.</td>
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<tr>
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<td></td>
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ERP study – methods

- Sentences presented word by word (800 ms per word)
- *Did the sentence make sense?* judgment after each trial (time limit 4s)
- Aktionsart: 120 items (mismatch vs. control vs. coercion); Tense: 80 items (mismatch vs. control) + 100 distractor sentences
- Latin square design
- 24 participants

- EEG continuously recorded using a standard montage with 29 scalp electrodes
- Referenced to linked mastoids
- Only artefact free trials
Both mismatch conditions elicit a P600

Tense violations are detected immediately at the verb

The verb without any arguments is sufficient to compute tense
"Aktionsart": the P600 effect
"Tense": the P600 effect
P600 indexes the breakdown of semantic interpretation in both aspectual mismatch and tense violations.

Tense can be computed on the basis of the verb alone.

Evidence for the independence hypothesis:

**Independence Hypothesis**

The different components of the temporal system contribute their temporal information independently of each other.
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ERP study - discussion

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The experiments provide evidence for ...

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**Independence Hypothesis**
The different components of the temporal system contribute their temporal information independently of each other.
The online construction of a temporal model

(11) Gestern um fünf Uhr erreichte ...

[Diagram showing a timeline with yesterday, today, and 5 pm marked]
The online construction of a temporal model

(11) Gestern um fünf Uhr erreichte der Bergsteiger ...
(11) Gestern um fünf Uhr erreichte der Bergsteiger den Gipfel

...