Crosslinguistic variation in the processing cost of aspectual coercion:

Reading time evidence from non-culminating accomplishments in German and English

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Structure of the Talk

1. Incrementality, aspectual coercion and non-culminating accomplishments
2. Pretest: Assessing the (German) readings
3. Experiment 1: Non-culminating accomplishments in German
4. Experiment 2: More on German accomplishments
5. Experiment 3: Non-culminating accomplishments in English
6. Two kinds of defeasible inferences with different processing costs
Incrementality and (Non-)Monotonicity

(1) Peter baute das Haus... niemals fertig
    Peter build-past the house... without ever completing it

   (1) gives rise to the inference of a complete house
   Culmination ‘gets lost’ in the continuation of the sentence
   However, (1) does not feel contradictory at all

Non-Monotonicity

Incremental interpretation seems to involve non-monotonic updates of the semantic representation

**Monotonicity:** If $\Gamma \vdash \phi$ and $\Gamma \subseteq \Delta$ then $\Delta \vdash \phi$

(1) $[[\text{Peter baute das Haus}]_{\Gamma} \text{ niemals fertig}]_{\Delta}$
    $\Gamma \vdash \text{a finished house}$
    $\Delta \not\vdash \text{a finished house}$
Incrementality and (Non-)Monotonicity

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    $\Gamma \vdash \text{a finished house}$
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(2) Put the frog on the napkin\(\Gamma\) . . . into the box\(\Delta\)
\(\Gamma\): **VP attachment** of *on the napkin*
\(\Delta\): Revise VP to NP attachment of *on the napkin*

- Revision of the syntactic representation does not proceed smoothly
- Garden-path effect while processing *on the napkin*
- Stressing the analogy: Does stripping off the culmination induce measurable difficulty due to semantic revision?
Non-Monotonic Updates in Syntactic Processing

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Baggio et al. (2007 & 2008)

Processing consequences of the imperfective paradox (lit. from Dutch)

S1) The girl was writing letters when her girlfriend coffee on the tablecloth spilled.

S2) The girl was writing letters when her girlfriend coffee on the paper spilled.

S3) The girl was writing a letter when her girlfriend coffee on the tablecloth spilled.

S4) The girl was writing a letter when her girlfriend coffee on the paper spilled.

- Baggio et al. (2007): Probe selection task
  - Positive: *The girl has written a (S1/2: several) letter(s)*
  - Negative: *The girl has written no letter*

- Baggio et al. (2008): ERP study with probe selection task
Baggio et al. (2007 & 2008)

Probe selection task:

- ERPs: S3 vs. S4 on spilled (no difference between S1 and S2)

Two hypotheses:

- Monotonic extension of the discourse model in all four conditions
- Recomputation in S4 but not in S1–S3

Sustained anterior negativity
Baggio et al. (2008): Strength of the inference modulates the observed negativity

- Negativity (S4 vs. S3) correlated with how often participants chose negative probes for S4 relative to S3
Open Questions

- Baggio et al. (2007 & 2008) employed a discourse manipulation, do we also find evidence for recomputation costs within the sentence domain?

- What is the role of the aspectual system of a language for how costly these operations are?

- Are coercion operations the same cross-linguistically?
Lexical Aspect and Adverbial Modification – From Discourses to Sentences

(3-a)  [Der Architekt errichtete das Haus] in zwei Jahren  
[The architect built the house] in two years

(3-b)  [Der Architekt errichtete das Haus] zwei Jahre lang  
[The architect built the house] for two years

Subtractive Coercion

Γ) Accomplishment: Preparation – culmination – result state

in) Accomplishment ▸ Accomplishment with a preparatory process that went on for two years

for) Accomplishment ▸ Process ▸ Process that went on for two years
The Interaction of Lexical and Grammatical Aspect

(4-a) The architect built the monument for two years after the city council finally had provided the money for it.

(4-b) The architect was building the monument for two years . . .

(4-c) The architect built the monument within two years . . .

- Superficially similar contrast between (4-a) and (4-c) in English to the one in the German examples (3-a) and (3-b)
- However, the English example in (4-a) ‘feels’ more contradictory than the German example (3-a)
- In English, (4-b) is the preferred way to express the meaning of (4-a), whereas German has no grammaticalized progressive
- Strengthening of simple form, weakening of progressive form
Hypothesizing about Cross-Linguistic Variation

- **English**: Due to pragmatic competition with the progressive form, an accomplishment in the simple past will be strengthened to a perfective interpretation. Defeating this inference – if possible at all – should lead to processing cost.

- **German**: Underspecified with respect to grammatical aspect. Therefore, if the linguistic context requires, an accomplishment is immediately interpreted imperfectively.

> Cross-linguistic variation in processing cost of non-culminating (simple form) accomplishments: Hard in English, easier in German
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Pretest: Assessing the (German) readings
Did the culmination happen? A rating experiment

- **Three conditions (+ iterative coercion, cf. Exp. 2)**
  - Baseline, unmodified
    1. Der Athlet lief den Marathon
       The athlete ran the marathon
  - Control, *in*-modification
    2. Der Athlet lief den Marathon *in drei Stunden*, dann wurde er
       von der Bahn getragen.
       The athlete ran the marathon *in three hours*, then he had to
       be carried off the running track.
  - Non-culminating, *for*-modification
    3. Der Athlet lief den Marathon *drei Stunden lang*, dann wurde
       er von der Bahn getragen.
       The athlete ran the marathon *for three hours*, then he had to
       be carried off the running track.
Did the culmination happen? A rating experiment

- 44 German participants judged whether it follows from the sentence that the culmination happened:
  
  *Does the sentence say that the athlete completed the marathon?*

- 40 items from Exp. 2, plus 40 fillers

- Internet questionnaire

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- For-modification shifts towards imperfective interpretation
- Culmination inference can be canceled
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Experiment 1: Non-culminating accomplishments in German
Design

(1) Johann errichtete das Haus zwei Jahre lang trotz finanzieller Probleme.
John build-past the house for two years in spite of financial problems.

(2) Johann errichtete das Haus in zwei Jahren trotz finanzieller Probleme.

(3) Johann errichtete zwei Jahre lang trotz finanzieller Probleme das Haus . . .

(4) Johann errichtete in zwei Jahren trotz finanzieller Probleme das Haus . . .

- $2 \times 2$ within design: Factors **ADVERBIAL** and **OBJECT POSITION**
- Incremental recomputation predicts interaction in reading times of the adverbial phrase: $RT(1) > RT(2)$, but $RT(3) = RT(4)$
Method

- 20 items in four conditions
- Accomplishments* with agentive subjects and quantized objects
- 64 fillers
- Latin Square design

- Self-paced reading with moving window presentation
- Judgment after each sentence:
  - 12 items: *Did the culmination happen?*
  - 8 items: *Was this an acceptable sentence?*

- 32 native German participants

* VPs: Haus errichten, Roman verfassen, Menü verspeisen, Futter verschlingen, Code entschlüsseln, LKW entladen, Dieb überführen, Lauf absolvieren, Plan erstellen, Stadt zerstören, Fluss durchqueren, Gipfel besteigen, Falle postieren, Nuss öffnen, Fehler beheben, Protokoll verfertigen, Maschine fertigen, Schwein zerlegen, Skulptur erschaffen, Duft kreieren
Results – Offline Judgments

- Less culmination inferences for *for* - than *in*-conditions (GLMER: \(z = 2.3\))
- *For* - and *in*-conditions equally acceptable

Does the sentence say that the culmination happened?

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<td><em>In</em> conditions</td>
<td>86%</td>
</tr>
<tr>
<td><em>For</em> conditions</td>
<td>57%</td>
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Results – Reading Times

SVO–Adverbial order

SV–Adverbial–O order

- No main effect of ADVERBIAL \( (F_{1/2} < 1) \)
- No interaction between ADVERBIAL and OBJECT POSITION \( (F_{1/2} < 1) \)
- Non-culminating accomplishments as easy as culminating ones
Open Questions

- Conclusion crucially depends on interpreting a null effect
- Rather few items
- Only 160 data points per condition
- Danger of a type II error
Experiment 2: More on German accomplishments
Design

(1) Der Arbeiter | belud | die Schubkarre | fünf Minuten lang | ...  
   *The worker* | *load-past* | *the wheelbarrow* | *for five minutes* | ...  

(2) Der Arbeiter | belud | die Schubkarre | in fünf Minuten | ...  

(3) Der Arbeiter | belud | die Schubkarre | fünf Jahre lang | ...  

(4) Der Arbeiter | belud | die Schubkarre | in fünf Jahren | ...  

- 2 × 2 within design: Factors **ADVERBIAL** and **DURATION** (e.g., *five minutes* in (1/2) vs. *five years* in (3/4))
- Design includes an iterative coercion condition (3), and an implausible condition (4)
- The latter two conditions were expected to incur clear processing costs
Method

- 40 items in four conditions
- Accomplishments with agentive subjects and quantized objects
- 80 fillers (40 nonsensical)
- Latin Square design
- Self-paced reading with moving window presentation
- Acceptability judgment after each sentence
- 40 native German participants
Results – Reading Times

Adverbial:
- Short-\textit{for} = short-\textit{in} ($p_{1/2} \geq .20$)
- Non-culminating accomplishments as easy as culminating ones
- long-\textit{for} = mismatch
- Iteration is difficult

Following region:
- Only mismatch is slow

- Defeating culmination inferences is not taxing in German
Experiment 3: Non-culminating accomplishments in English
Design

(1) The architect | built | the monument | within two years | after | the city | had finally provided | the money for it.

(2) The architect | was building | the monument | for two years | after | . . .

(3) The architect | built | the monument | for two years | after | . . .

(4) The architect | built | within two years | the biggest monument | in recent | history.

(5) The architect | was building | for two years | the . . .

(6) The architect | built | for two years | the . . .

3 × 2 within design: Factors ASPECT and OBJECT POSITION

Expected interaction wrt. RT of the adverbials:

\[ RT(1) \approx RT(2) < RT(3), \text{ but } RT(4) \approx RT(5) \approx RT(6) \]
Method

- 48 items in six conditions
- Accomplishments with agentive subjects and quantized objects
- 110 fillers (40 nonsensical)
- Latin Square design
- Self-paced reading with moving window presentation
- Acceptability judgment after each sentence
- 30 native American English participants
Acceptance ratings for all three ASPECT conditions indicate that they were all acceptable

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptance Rating</th>
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<tbody>
<tr>
<td>Simple within conditions</td>
<td>78%</td>
</tr>
<tr>
<td>Progressive for conditions</td>
<td>71%</td>
</tr>
<tr>
<td>Simple for conditions</td>
<td>70%</td>
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Is the sentence acceptable? Yes
Results – Reading Times

**SVO–Adv conditions**

- simple for
- simple within
- progressive for

**SV–Adv–O conditions**

- simple for
- simple within
- progressive for

- **ASPECT × OBJECT POSITION interaction of the predicted form**
  \( F_1(2, 58) = 7.7, p < .01; F_2(2, 94) = 3.2, p < .05 \)

- **Non-culminating English accomplishments in the simple past are difficult**
Two kinds of defeasible inferences differing in cost
What we have to account for . . .

   - **Processing difficulty** when disabling condition is introduced in subsequent discourse unit
2. German accomplishments (Exp. 1/2), and English progressive accomplishments (Exp. 3)
   - **No difficulty** when *for*-adverbial is part of the same discourse unit
3. English simple past accomplishments (Exp. 3)
   - **Difficulty** when *for*-adverbial is part of the same discourse unit
Sketch of an Explanation

Two different ways to derive non-culminating accomplishments:

**Imperfective:**
- Hamm & van Lambalgen’s (2005) analysis of progressive accomplishments in terms of minimal models:
  - In the absence of disabling conditions: culmination
  - In the presence of disabling condition (e.g., *stop* event due to *for*): no culmination
- In both cases, smooth model update
- Model update: always before moving to a new discourse unit

**Perfective:**
- Perfective accomplishments along the lines of Hamm & van Lambalgen (2005)
- Preparation and culmination are both constitutive parts
- Incompatible with *for*: Model update results in a contradiction (▶ difficulty)
- Way out, reanalysis of perfective accomplishments as a perfective activities

(1) [The girl was writing a letter]_{\Gamma} [when her friend spilled coffee on the paper]_{\Delta}

- Start with the empty model.
- $\Gamma$: There is a time $t$ before now at which the girl is engaged in a letter-writing process. Closed world reasoning: This process is finished at some time $t'$ after $t$ by a finish event. After $t'$ there is a complete letter.
- $\Delta$ is interpreted in the minimal model for $\Gamma$ by adding a spill-coffee-on-paper event at $t$. World knowledge tells the processor that spilling terminates writing. This is in conflict with the model computed for $\Gamma$ (for times $t''$ with $t \leq t'' \leq t'$ we get $\text{HoldsAt}(\text{write}, t'') \land \neg \text{HoldsAt}(\text{write}, t'')$, a contradiction). This in turn triggers recomputation for $[\Gamma + \Delta]$. 

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- \(\Gamma\): There is a time \(t\) before now at which the girl is engaged in a letter-writing process. Closed world reasoning: This process is finished at some time \(t'\) after \(t\) by a finish event. After \(t'\) there is a complete letter.
- \(\Delta\) is interpreted in the minimal model for \(\Gamma\) by adding a spill-coffee-on-paper event at \(t\). World knowledge tells the processor that \textit{spilling} terminates \textit{writing}. This is in conflict with the model computed for \(\Gamma\) (for times \(t''\) with \(t \leq t'' \leq t'\) we get \(\text{HoldsAt}(\text{write}, t'') \land \neg\text{HoldsAt}(\text{write}, t'')\), a contradiction). This in turn triggers recomputation for \([\Gamma + \Delta]\).
German Accomplishments Modified by *For* and English Progressive *For* 

(2) [The architect was build-imperfective the monument for two years]"Γ

- Start with the empty model
- Γ: There is a time $t$ before now at which the architect is engaged in a building activity. This activity started at some time $t'$ before $t$ and holds on until stopped at some later time $t'' = t' + 2$ years. Thus, the activity is stopped before the culmination is reached.
(2) [The architect built the monument for two years] \( \Gamma \)

- Start with the empty model
- \( \Gamma \): There is a time \( t \) before now at which the complex accomplishment event – including the preparation and the culmination – happened. Therefore, a finish event happened at the right boundary \( t' \) of interval \( t \). Due to the \textit{for}-adverbial, there is also a stop event at \( t' \) ending building and we therefore derive \( \text{Happens}(\text{finish}, t') \land \neg \text{Happens}(\text{finish}, t') \), a contradiction. Reanalyze the perfective accommodation as a perfective activity and recompute the discourse model.
Questions for Future Research

- Do accomplishments in the progressive really trigger a default inference to a culmination (see, e.g., the discussion in e.g. Bar-el et al. 2005)?
- Do German non-culminating accomplishments become difficult if \textit{for}-adverbials are made part of a separate discourse unit?
- What are the linguistic constraints governing non-culminating construals of accomplishments?