Crosslinguistic variation in the processing cost of aspectual coercion

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

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(joint work with Fritz Hamm)

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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) $\left[\left[\text{Peter baute das Haus}\right]_{\Gamma} \text{ niemals fertig}\right]_{\Delta}$
$\Gamma \vdash \text{a finished house}$
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Non-Monotonic Updates in Syntactic Processing

(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 when processing *into the box*
- Stressing the analogy: Does stripping off the culmination induce measurable difficulty due to semantic revision?
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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)

- Sustained anterior negativity

Two hypotheses:

- Monotonic extension of the discourse model in all four conditions
- Recomputation in S4 but not in S1–S3
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]_Γ in zwei Jahren
[The architect built the house]_Γ in two years

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

Subtractive Coercion

Γ) Accomplishment: Preparation – culmination – result state

in) Accomplishment ⇒ Accomplishment with a preparatory process that took two years

for) Accomplishment ⇒ Preparatory process ⇒ Process 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 built the monument within two years . . .

- Superficially similar contrast between (4-a) and (4-b) 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-c) 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

(4-c) The architect was building the monument for two years . . .
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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 clear processing cost.

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

▷ Cross-linguistic variation in processing cost of non-culminating (simple form) accomplishments: Hard in English, easy/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 was carried off the running track.
  - Non-culminating, *for*-modification
       The athlete ran the marathon *for three hours*, then he was 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 it follow from the sentence that the athlete completed the marathon?*

- 40 items from Exp. 2, plus 40 fillers

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- Unmodified accomplishments receive perfective interpretation
- *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 built-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 × 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 definite object NPs
- 64 fillers
- Latin Square design
- Self-paced reading with moving window presentation
- Judgment after each sentence:
  - 12 items: Did the culmination happen?
  - 8 items: Is 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 anfertigen, 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?

<table>
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<th>Conditions</th>
<th>Yes</th>
</tr>
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<tbody>
<tr>
<td><em>In</em> conditions</td>
<td>86%</td>
</tr>
<tr>
<td><em>For</em> conditions</td>
<td>57%</td>
</tr>
</tbody>
</table>
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 or rather habitual 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-*for* = short-*in* \( (p_{1/2} \geq .20) \)
- Non-culminating accomplishments as easy as culminating ones
- long-*for* = mismatch
- Iteration is difficult

Following region:

- Only mismatch is slow

- **Canceling of a culmination inference 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:

$RT(1) \approx RT(2) < RT(3)$, 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 the three levels of ASPECT indicate that they were all acceptable.

<table>
<thead>
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<th>Description</th>
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<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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Results – Reading Times

**SVO–Adv conditions**

**SV–Adv–O conditions**

- **Aspects X 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**

Oliver Bott (Uni Tübingen) Subtractive coercion – Crosslinguistically TELIC 2017 29 / 36
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 (DU)

**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]_{DU1} [when her friend spilled coffee on the paper]_{DU2}

- Start with the empty model.
- DU1: There is a time $t$ before now at which the girl is engaged in an activity of letter writing. Closed world reasoning: This process is finished at some time $t'$ after $t$ by a finish event. After $t'$ there is a complete letter.
- DU2 is interpreted in the minimal model for DU1 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 DU1 (for times $t''$ with $t \leq t'' \leq t'$ we get \texttt{HoldsAt(write, t'')} \land \neg \texttt{HoldsAt(write, t''')} , a contradiction). This in turn triggers recomputation for $[DU1 + DU2]$. 
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German Accomplishments Modified by *For* and English Progressive *For*

(2) \[ \text{The architect was build-imperfective the monument for two years]_{DU1} \]

- Start with the empty model
- DU1: 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 $t'' = t' + 2 \text{ years}$. Thus, the activity is stopped before the culmination is reached.
(2) [The architect built the monument for two years]\(_{DU1}\)

- Start with the empty model
- DU1: 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 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 accomplishment 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 Bar-el et al. 2005)?
- Do German non-culminating accomplishments become difficult if for-adverbials are made part of a separate discourse unit?
  The architect build-past the monument. He did so for/in two years.
- What are the linguistic constraints governing non-culminating construals of accomplishments?
  - For verbs such as *aufessen* (*eat up*) the culmination inference seems to take the form of an entailment.