Hitting playfully and kissing angrily: A self-paced reading study on force inferences

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1. Modification
   - Event Semantics
   - Inferences
2. Questionnaire Study
3. Self-Paced-Reading Experiment
   - Pilots and Stimuli
   - Design
   - Analysis and Results
   - Discussion and Open Questions
4. Summary
Modification: Event Semantics

• (Neo-Davidsonian) events (Parsons, 1990):
  Mary kissed John lovingly on the lips.
  $\exists e [\text{kiss}(e, \text{Mary}, \text{John}) \land \text{lovingly}(e) \land \text{on-the-lips}(e)]$
  $\rightarrow$ event $e$ provided by verb

• Manners (Piñón, 2007):
  Rebecca wrote illegibly.
  $\rightarrow$ form-manner $m$ provided by adverb and dependent on event type (needs writing by hand)

• Schäfer (2013):
  distinction between pure manner (loudly, slowly) and agent-oriented manner (intelligently, skilfully)
Modification: Inferences

- Adverbs have a lexical meaning, but some of them also trigger an inference on the force dimension of hit-verbs (not extensively discussed yet, though see Maienborn & Schäfer, 2011).
  1. Nancy hit Oliver playfully. → lightly
  2. Nancy hit Oliver angrily. → hard

- Test: (denial-of-expectation with “but”, Lakoff, 1971)
  3. ✓ Nancy hit Oliver playfully, but still rather hard.
  4. ✓ Nancy hit Oliver angrily, but still rather lightly.

- Compare:
  5. ? Nancy hit Oliver playfully, but still rather lightly.
  6. ? Nancy hit Oliver angrily, but still rather hard.

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Modification: Inferences

- two types of adverbs:
  a) **multi-attribute adverbs** (e.g. playfully, angrily) trigger an inference on the verb’s force dimension in addition to their lexical meaning
  b) **single-attribute adverbs** (e.g. hard, lightly) directly modify a verb’s force dimension

- These types cross-cut other distinctions between adverbs, such as those established by Schäfer (pure manner adverbs, agent-oriented manner adverbs, mental-attitude adverbs, resultatives and subject depictives).

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Questionnaire Study

- 38 Dutch native speakers
- 7 sentences of the format “playfully, but still rather hard”
- 5 sentences of the format “playfully, but still rather lightly”
- 2 contradictory control sentences (“lightly, but still rather hard”)

<table>
<thead>
<tr>
<th>scale</th>
<th>1 – clearly bad</th>
<th>2 – maybe bad</th>
<th>3 – maybe good</th>
<th>4 – clearly good</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lightly, but hard</td>
<td>playfully, but lightly</td>
<td>playfully, but hard</td>
<td>---”---&quot;</td>
</tr>
</tbody>
</table>

- 3 participant excluded
- 1 sentence excluded

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Experiment: Pilots & Stimuli

• Verbs: 15 verbs of contact (e.g. hit, kiss, push, throw, pinch, grab)
• Adverbs: manner, mental attitude, etc.
  - multi attribute: playfully, cheerfully, angrily, painfully
  - single attribute: hard, forcefully, lightly, gently

• (7) S: Jet sloeg Harry speels, maar toch vrij hard, op zijn schouder.
  Jet hit Harry playfully, but still rather hard, on his shoulder.
• (8) C: Jet sloeg Harry licht, maar toch vrij hard, op zijn schouder.
  Jet hit Harry lightly, but still rather hard, on his shoulder.

• No empirical evidence that the processing of a contradiction is faster/slower than cancelling an inference
Experiment: Pilots & Stimuli

• (9) S: Jet sloeg Harry speels, en niet zachtjes, op zijn schouder. Jet hit Harry playfully, and not softly, on his shoulder.

(10) C: Jet sloeg Harry hard, en niet zachtjes, op zijn schouder. Jet hit Harry hard, and not softly, on his shoulder.

(11) Jet sloeg Harry licht, en niet zachtjes, op zijn schouder. Jet hit Harry lightly, and not softly, on his shoulder.

• Control sentences were rejected due to being tautological

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(13) S: Jet sloeg Harry speels, en tegelijk vrij hard, op zijn schouder. Jet hit Harry playfully, and simultaneously rather hard, on his shoulder.

(14) C: Jet sloeg Harry boos, en tegelijk vrij hard, op zijn schouder. Jet hit Harry angrily, and simultaneously rather hard, on his shoulder.


• Inference triggered, time to compute, cancellation + spillover
• Contrast in “vrij” + simultaneity through “tegelijk”
Experiment: Design

- Self-paced reading experiment (moving window)
- Latin square design
- 15 stimuli, 15 control, 60 fillers per list

7 sentences in trial round:
 sentence → rating → control question

| 1: clearly bad | 2: maybe bad | 3: maybe good | 4: clearly good |
Experiment: Design

• 3 rounds of 30 sentences:
  sentence $\rightarrow$ rating ($\rightarrow$ 25% chance control question)

• Semi-randomized: no more than 2 subsequent items of same type

• Types: increase, control increase, decrease, control decrease, + 3 filler types

• exit questionnaire

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Analysis: Hypotheses

• H0: no significant reading time differences between stimuli & control (in critical area)
• H1: stimuli sentences are read significantly slower than controls (in critical area)

• prediction reading times: control < decrease stimuli < increase stimuli

• force increase stimuli are expected to be read slower due to prototypicality effects

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Analysis: Data clean-up

- 91 participants: 45 list 1 & 46 list 2
  Excluded participants: 11 list 1; 8 list 2
  Total number left: 34 list 1; 38 list 2 = 72

- 1 item excluded: particle verb (aandrukken)
  → recomputation (particle at the end of sentence)
  → 4 words in spillover instead of 3

- Observations excluded: (cf. Wehlan, 2008)
  < 100 ms
  > 5000 ms (rt 1), > 2000 ms (rt 2 & 3), > 6500 ms (rt 4)
Analysis: Overview Reading Times

Rt 1: hard/zacht
Rt 2: op
Rt 3: zijn
Rt 4: schouder

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Analysis: increase condition

Rt 1: zacht  Rt2: op  Rt3: zijn  Rt 4: schouder

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Analysis: decrease condition

Rt 1: hard  Rt 2: op  Rt 3: zijn  Rt 4: schouder

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Analysis: Statistics

- linear mixed effects model in R:
  - random effects: participants, items
  - fixed effects: condition

<table>
<thead>
<tr>
<th>Decrease</th>
<th>Rt 1 (hard/zacht)</th>
<th>Rt 2 (op)</th>
<th>Rt 3 (zijn)</th>
<th>Rt 4 (schouder)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.a.</td>
<td>p = 0.015</td>
<td>---</td>
<td>p = 0.032</td>
<td>---</td>
</tr>
<tr>
<td>Increase</td>
<td>p = 0.017</td>
<td>---</td>
<td>p = 0.009</td>
<td>p = 0.017</td>
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</table>

In all instances except one (rt 1, decrease), the stimuli condition was read slower than the control condition. Table gives p-values for significant differences.
Analysis: Open Questions

1. Why is the second adverb (critical area rt 1) read slower in CDECR (control condition, decrease) than in any other condition?
   → We really don’t know. And a boxplot of rt 1 split over condition didn’t tell us much either.

2. Why is the final word of the sentence (rt 4) read so much slower in INCREASE (stimuli condition, increase) than in any other condition?
   → We suspect it could have to do with wrap-up effects and the pending rating task (contradiction/prototypicality?). (see next slide)
Analysis: The Rating Task

• We are in the progress of running a general linear mixed effects model over the rating data. → nothing to report yet, but mostly data seem to conform to expectations

• Fun fact: people read significantly slower towards the end of the sentence when they give a “maybe” rating compared to when they give a “clearly” rating (effect for INCREASE, previous slide?)

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Theoretical Implications

- Certain adverbs, when combined with verbs of contact, trigger an inference on the force dimension! (so strong that it shows up in online processing)

- Questions:
  1. Does the inference really exist in both force directions? 
     \(\Rightarrow\) ratings for “angrily, but still rather lightly” mostly lower than for “playfully, but still rather hard” (statistics pending) 
     \(\Rightarrow\) maybe a contradiction instead of force increase inference, or prototype effects?

  2. How to analyse multi-attribute adverbs? (one attempt: Goldschmidt et. al., 2015)
Thank you for listening!
References


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### Appendix: Verbs

<table>
<thead>
<tr>
<th>Dutch</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>slaan</td>
<td>to hit</td>
</tr>
<tr>
<td>kussen</td>
<td>to kiss</td>
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<tr>
<td>stoten</td>
<td>to hit</td>
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<tr>
<td>plaatsen</td>
<td>to place</td>
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<tr>
<td>duwen</td>
<td>to push</td>
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<tr>
<td>gooien</td>
<td>to throw</td>
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<tr>
<td>knijpen</td>
<td>to pinch</td>
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<tr>
<td>hameren</td>
<td>to hammer</td>
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<tr>
<td>prikken</td>
<td>to prick</td>
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<tr>
<td>trekken</td>
<td>to pull</td>
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<tr>
<td>grijpen</td>
<td>to grab</td>
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<tr>
<td>stompen</td>
<td>to punch</td>
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<tr>
<td>wrijven</td>
<td>to rub</td>
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## Appendix: Adverbs

<table>
<thead>
<tr>
<th></th>
<th>Increase</th>
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<tbody>
<tr>
<td><strong>multi</strong></td>
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<td></td>
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<td>lieflijk</td>
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<td></td>
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