Expectations and prediction in sentence comprehension: German particle verbs as a test case

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1. Research question

Does **strong expectation** entail **prediction** of specific lexical items?

2. Introduction

- Accumulation of contextual **constraint strengthens expectation** for syntactic and lexical properties of downstream words, **speeding up** their reading (Hale 2001, Levy 2008).
- Evidence for the **prediction of specific words** is **not yet conclusive** (Wicha et al., 2004; De Long et al., 2005; Van Berkum et al., 2005; Husain et al., 2014; cf. Safavi et al., 2016; Nieuwland et al., 2017).
- We tested whether the crystallisation of **strong expectations** into **specific predictions** in **constraint-matched sentences** depends on the number of particles licensed by a particle verb.

3. Hypotheses/predictions

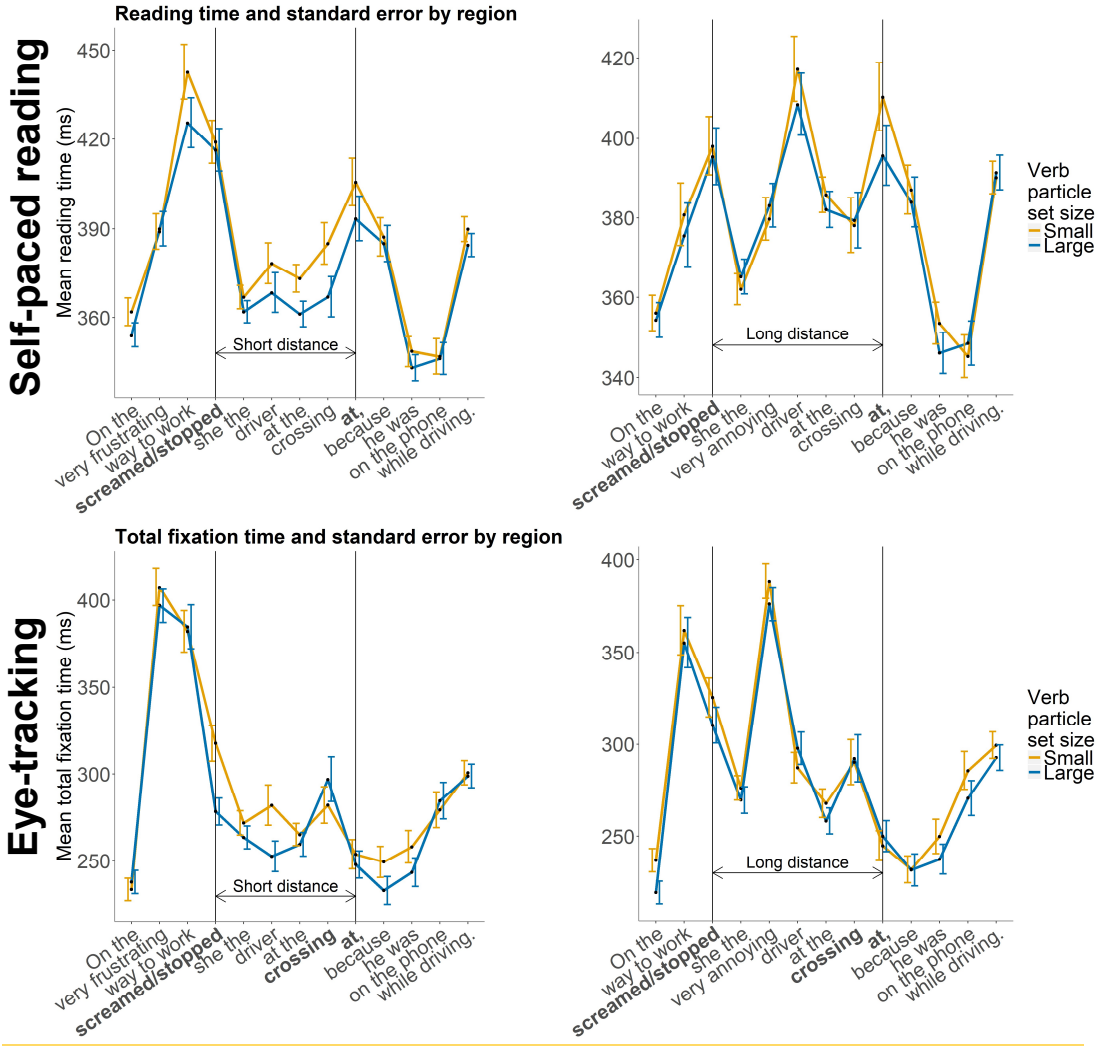
- **German particle verbs** comprise a **base verb** and **separable, downstream particle.**
- **Strong expectations** for a particle are **generated by verbs** with **both large and small sets** of particles, e.g. [durch/auf/ab/mit/ein/an/fest/frei/…]-halten vs. [nieder/zusammen/an/auf]-schreien.
- However, **only a small set** of particles may allow **prediction of a specific particle**.
- Therefore, **small set verb particles** should be read **faster** than large set verb particles.

4. Experiment design

Small set/short distance:
Auf dem sehr unangenehmen Arbeitsweg **schrie** sie den Fahrer an der Kreuzung **an**, weil
Small set/long distance:
Auf dem Arbeitsweg **schrie** sie den sehr unangenehmen Fahrer an der Kreuzung **an**, weil
Large set/short distance:
Auf dem sehr unangenehmen Arbeitsweg **hielt** sie den Fahrer an der Kreuzung **an**, weil…
Large set/long distance:
Auf dem Arbeitsweg **hielt** sie den sehr unangenehmen Fahrer an der Kreuzung **an**, weil…
*On the very frustrating way to work **screamed/stopped** she the very annoying driver at the crossing **at**, because…*

5. Results

- **Cloze probability** large set: M=0.53, SD=0.33; small set: M=0.57, SD=0.36.
- **Frequency** per million tokens large set: M=7.40, SD=12.16; small set: M=2.55, SD=3.84.
- **Self-paced reading**: **Large set** particles read **faster** than small set particles, $\hat{\beta}$ **=** -12 ms, Pr(β<0): 0.98, CrI: [-24, 0 ms].
- **Eye-tracking**: **Large set** particles read **faster at short distance** but **slower at long distance**, $\hat{\beta}$ **=** 25 ms, Pr(β>0): 0.98, CrI: [1, 49 ms].



6. Discussion

- Unexpectedly, **small set particles were read slower**; the slow-down **began at the verb**.
- We speculated that:
  a) in the **short distance/small set condition,** the **additional material before the verb** may have **increased constraint/time**, contributing to prediction of the target particle;
  b) making a **prediction** may allow **deeper semantic analysis** of **downstream material** and/or require **resources to maintain the prediction**, accounting for slowed reading after the verb.

References. Hale (2001) *Proceedings NAACL*; Levy (2008) *Cognition*; Wicha et al., (2004) *J Cog Neurosci*; De Long et al. (2005) *Nat Neurosci*; Van Berkum et al., (2005) *J Exp Psych*; Husain et al. (2014) *Plos One*; Safavi et al. (2016) *Front Psych*; Nieuwland et al. (2017) doi:10.1101/111807; Piai et al. (2013) *Brain & Lang*