Syntactic adaptation to short-term cue-based distributional regularities

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Syntactic adaptation to short-term exposure has been documented with both single-trial priming and cumulative priming paradigms [1-3]. These studies usually involve repeated exposure to the same structure (e.g. reduced relative clauses), and therefore it remains open whether people can track context-dependent regularities through short-term exposure. In the current study, we investigate context-dependent adaptation by establishing a relationship, in the exposure phase, between the animacy feature of the subject NP (animate vs. inanimate) and the corresponding parse of the verb following the subject NP. Results from the testing phase suggest that people can track and adapt to cue-based distributional regularities, but only when the short-term regularities are consistent with the long-term ones existent in their native language (English).

Procedure. In a self-paced-reading experiment (n=373 total), we examined whether and how the garden-path ambiguity of a reduced-relative (RR) vs. a main-verb (MV) parse changes after a short-term exposure phase. The experiment consists of two blocks. **Block 1 (Exposure block)** manipulated the co-occurrence statistics between the animacy feature on the subject-NP and the RR/MV parse on the verb following the subject-NP. In a between-participant design (as in (1)): *Group A* (n=122) read 20 RR sentences with animate subjects and 20 MVs with inanimate subjects; this mapping is inconsistent with the long-term regularities present in English; in contrast, *Group B* (n=126) read 20 RRs with inanimate subjects and 20 MVs with animate subjects; consistent with their general long-term experience. *Group C* (n=125) is the control group and participants read 40 filler sentences. In **Block 2 (Testing block)** (as in (2)), all participants read 8 ambiguous RRs and 8 unambiguous RCs (4 animate and 4 inanimate for both types).

Results: Linear mixed-effect models on log RTs were performed on the disambiguating and the spill-over regions of **Block 2** (Figure 1). Our report here focuses on whether the garden-path ambiguity cued by subject animacy in Group A or B differs from the control Group C. For the **B vs. C comparison**, no effects were found on the disambiguating region. On the spill-over region, for **Group B only** (model 1), there is an Animacy x Ambiguity interaction (β=0.02, p<.01), with the ambiguity effect significantly reduced for trials with the inanimate but not the animate subjects. No such interaction was found for Group C (β=0.007, p=0.33). However, we did not find an Animacy x Ambiguity x Group interaction (β=0.005, p=0.24) when the data from B and C are considered together (model 2). We speculate that the lack of three-way interaction could be due to the low statistical power. A post-hoc power analysis targeting the three-way interaction (using the SIMR package [4]) showed that with a small effect size (~20ms), 250 participants are needed for each group (500 in total for B plus C) to achieve 80% power. For the **A vs. C comparison**, no relevant effect was detected on either the disambiguating or the spill-over region.

Discussion and Conclusion: Participants can track and adapt to cue-based (animacy) context-dependent short-term regularities, but in a constrained fashion: adaptation only took place when the short-term regularities are consistent with participants' long-term knowledge. This casts questions on proposals based on previously observed inverse-frequency effect [5], which suggests more unexpected exposure can lead to larger learning effect.

(1) Sample stimuli Block 1 ("/" indicates SPR regions)

- Group A:
  The defendant/ examined/ by the lawyer/ turned out/ to be/ unreliable. [Animate -> RR]
  The hypothesis/ examined/ the factors/ that/ affected/ hearing. [Inanimate -> MV]
- Group B:
  The defendant/ examined/ the testimony/ carefully/ yesterday. [Animate -> MV]
  The hypothesis/ examined/ by the scientist/ was not/ widely known. [Inanimate -> RR]

(2) Sample stimuli Block 2 ("/" indicates SPR regions; critical and spill-over regions underlined)
The patient/ examined/ by the doctor/ was diagnosed/ with diabetes. [Ambiguous]
The patient/ that/ was/ examined/ by the doctor/ was diagnosed/ with diabetes. [Unambiguous]

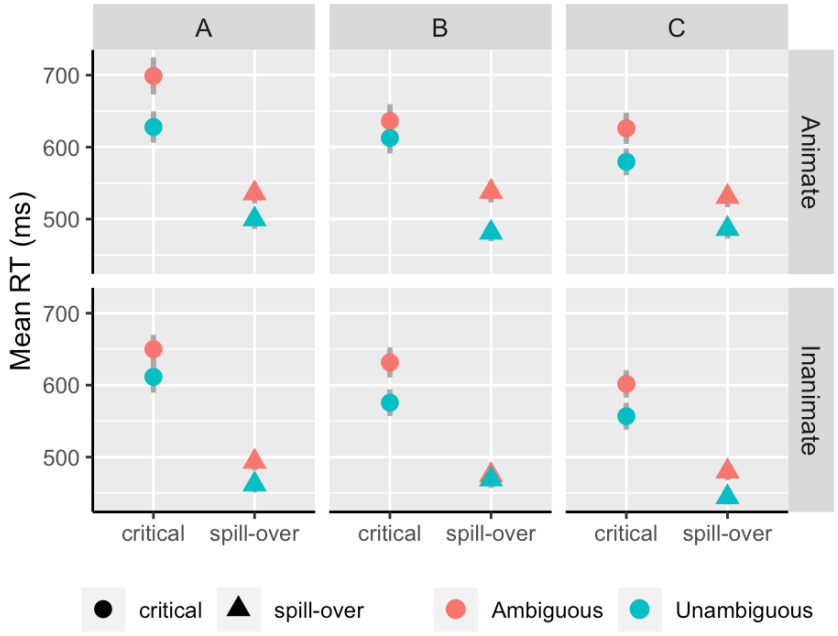

Figure 1. Reading times for each participant group from Block 2 (the testing block).

Model 1. Regression model for each individual group.
logRT ~ logRT.previous.region + Word.length + Ambiguity*Animacy
+ (1+Ambiguity*Animacy|Subj) + (1+Ambiguity|Item)
Model 2. Regression model with group contrasts for A vs. C and B vs. C.
logRT ~ logRT.previous.region + Word.length + Ambiguity*Animacy*Group
+ (1+Ambiguity*Animacy|Subj) + (1+Ambiguity*Group|Item)

References

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