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An eye-tracking study of Swedish filler-gap dependencies: Processing relative clause extractions

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Method
Eyetracking While Reading (Eyelink 1000 tower mount)

Materials
Eighty-long-distance FGD sentence items (constructed using the Korp corpus), each appearing in four structural variants (Structure) (3-6) and salty distractor items rotated over four lists.

Eyetracking while reading experiment

Introduction
Complex noun phrases involving relative clauses (1) are standardly treated as instances of “strong islands” structural configurations into which a filler-gap dependency (FGD) cannot be formed between the filler (those kinds of flowers) and the gap (3) (Ross, 1967, den Dikken & Szaboloci, 2002). This constraint is widely assumed to be universal.

Unexpectedly, Swedish and the other Mainland Scandinavian languages allow relative clause extractions (RCEs) (2) (Engdahl & Ejerhed, 1982; Ejerhed-Shir, 1973), thus presenting a challenge to the universality of island constraints.

Existing accounts for the Swedish data
• Discourse-organizational factors (Ejerhed-Shir & Lapin, 1979)
• Island obliation by way of covert resumption (Cirque, 1989)
• Structural reanalysis during parsing (Kush et al., 2013)

Unfortunately, none of these accounts stands up under closer scrutiny (see Christensen & Nyvad, 2014; Engdahl, 1997; Heimat & Wiklund, 2015; Lindahl, 2015; Maller, 2015). Thus, what does the apparent futility of Swedish RCEs remain undetermined.

Approaching the question via processing

• No on-line processing data exists for Swedish.
• Not clear whether processing patterns track intuitive well-formedness.

First step:
• look for basic differences in processing between Swedish RCEs and other FGDs at the embedded verb (tvättade) and the following PP region (bensinmacken) (see examples 3-4) where integration is presumed to occur, while controlling for the possible influence of non-structural factors (e.g., working memory), which might affect the processing of FGDs.

Second step:
• Two studies suggest that in acceptability judgments and in online processing, only non-islands should show any modulating effects from plausibility and working memory on any primary manipulation.
• Spruce et al. (2012) found no evidence that acceptability-based island-effects show any modulation from individual differences in general processing resource capacity, as measured via two Working Memory Span (WM) tasks and grammaticality judgement data (cf. Hofmeister & Sag, 2010).
• Traxler and Pickering (1996) demonstrated via eyetracking that manipulations to the plausibility of a filler as a continuation of a verb only affected integration for non-island structures, with no differences being found for island structures.

If correct, the presence of an interaction between structural and non-structural factors on Swedish RCEs could then serve as a positive heuristic for non-island status. This would help to confirm that processing of such structures is in-line with their intuitive acceptability.

Research goals and predictions

Use eyetracking to test whether:
• Swedish RCEs elicit processing costs similar to those of illicit long-distance FGDs at the embedded verb (tvättade) and the following PP region (bensinmacken).
• Any basic structural differences are modulated by non-structural factors (e.g., plausibility, pragmatic fit, and working memory).

Possible outcomes:
• Swedish RCEs will pattern more like non-islands, in line with their intuitive acceptability. Such a finding would leave us with at least two possible interpretations:
  • Swedish RCEs do not involve island structures, and thus a structural account is still needed.
  • True variation exists in island constraints.

• Swedish RCEs, although intuitively acceptable will pattern more like island structures. Such a finding would disfavor “deep variation” in the island constraints themselves (see Phillips, 2013).

The eyetracking methodology used here follows Framework Processing (e.g., Carbonell & Engdahl, 2007). The experiment was programmed using E-Prime 2.0 (Schneider et al., 2002) and run on a Dell computer with a 24-inch monitor with a resolution of 1920 pixels by 1200 pixels. The experiment was approved by the Lund University Ethics Committee. All participants gave written informed consent, and they were paid for their participation. The data from 48 native Swedish participants were analyzed (24 females, 24 males, age range 20-30 years; 20 left-handed). The results were analyzed using R (R Core Team, 2013) and Rstudio (RStudio Team, 2015). The R code is available at https://osf.io/np4np/.

Conclusions
Early measures:
• RCE and TCE show similar facilitation relative to nRCE in early measures (First Fixation and Gaze Duration) at the verb (Region 1). This similarity was also present in one early measure (Gaze Duration) at the PP (Region 2). In Region 1, RCE also showed additional facilitation against the nRCE control as OS and Prag increased.

Late measures:
• For both late measures of processing in Region 1, and for Total Durations in Region 2, RCEs were processed with more ease than nRCEs, patterning more similarly to TCEs as both OS and Prag increased. In Region 1 Total Durations, nRCE also showed some facilitation against the prCCE control as Prag increased, but this could just be reflective of a late repair mechanism.

Interpretation: Swedish RCEs are processed more similarly to non-island TCEs during late stages of integration.

Summary:
• RCEs appear to be easier to process than nRCEs. Facilitation is dependent in part on non-structural factors (working memory span and pragmatic fit).
• Our study thus provides novel evidence that Swedish RCEs are not processed like syntactic islands, in line with offline intuitions.

References

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