Surprised by locality: An eye-tracking study of Danish double-object constructions

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Sentence processing

- Sentence comprehension affected by multiple factors: givenness, pronominality, definiteness, animacy, length/locality
- Length/locality (Hawkins 2004, Gibson 1998)
  - local syntactic relations easier to process
  - preference for adjacent heads
- Surprisal/anti-locality (Hale 2001, Levy 2008)
  - Processing cost for change in probability
  - Measured through entropy of probability distribution of parses at word n relative to distribution at word $n-1$
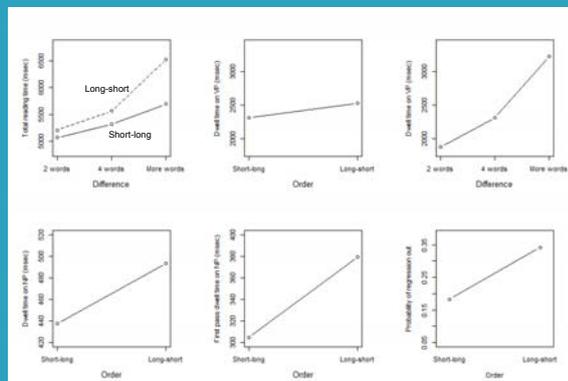
Difference	Order		
		Short-before-long	Long-before-short
2 words		Butiksindehaveren$_S$ gav$_V$ [en brudepige]$_{NP1/IO}$ [en kjole fra Italien]$_{NP2/DO}$	Butiksindehaveren$_S$ gav$_V$ [en brudepige fra Italien]$_{NP1/IO}$ [en kjole]$_{NP2/DO}$
		[The shopkeeper]$_S$ gave$_V$ [a bridesmaid]$_{NP1/IO}$ [a dress from Italy]$_{NP2/DO}$	*[The shopkeeper]$_S$ gave$_V$ [a bridesmaid from Italy]$_{NP1/IO}$ [a dress]$_{NP2/DO}$*
4 words		Butiksindehaveren$_S$ gav$_V$ [en brudepige]$_{NP1/IO}$ [en meget flot kjole fra Italien]$_{NP2/DO}$	Butiksindehaveren$_S$ gav$_V$ [en meget flot brudepige fra Italien]$_{NP1/IO}$ [en kjole]$_{NP2/DO}$
		[The shopkeeper]$_S$ gave$_V$ [a bridesmaid]$_{NP1/IO}$ [a very good-looking dress from Italy]$_{NP2/DO}$	*[The shopkeeper]$_S$ gave$_V$ [a very good-looking bridesmaid from Italy]$_{NP1/IO}$ [a dress]$_{NP2/DO}$*
> 4 words		Butiksindehaveren$_S$ gav$_V$ [en brudepige]$_{NP1/IO}$ [en meget flot kjole fra Italien der lige var ankommet]$_{NP2/DO}$	Butiksindehaveren$_S$ gav$_V$ [en meget flot brudepige fra Italien der lige var ankommet,]$_{NP1/IO}$ [en kjole]$_{NP2/DO}$
		[The shopkeeper]$_S$ gave$_V$ [a bridesmaid]$_{NP1/IO}$ [a very good-looking dress from Italy that had just arrived]$_{NP2/DO}$	*[The shopkeeper]$_S$ gave$_V$ [a very good-looking bridesmaid from Italy that had just arrived]$_{NP1/IO}$ [a dress]$_{NP2/DO}$*

Predictions

- **Length/locality account:** adjacent heads = local relations → **faster processing globally for short-before-long, increasing with difference**
- **Surprisal account:** longer NP1 = NP2 more expected = smaller change in probability → **faster processing of NP2 for long-before-short, increasing with difference**

Method

- 15 sets of 6 stimulus sentences using same lexical material. Each set manipulated
  - Order: Short-before-long vs. long-before-short
  - Length difference: 2 vs. 4 vs. more words
- Split on two lists: 3 versions of a sentence set per list
- All target sentences followed by coordinated main clause to reduce wrap-up effects
- 71 sentences: 45 stimulus items, 3 training items, 22 fillers
- Ten filler items followed by two-choice comprehension question
- Participants: 30 students at Copenhagen Business School
- Eyetracking using Eyelink 1000
- Analysis with lme4 (Bates et al. 2014) and lmerTest (Kutznesova et al. 2014)

Global reading time

- Reading of entire sentences: interaction order * length difference: order effect only significant for difference > 4
- Dwell time on VP (V, NP1, NP2): main effects of order and length difference

Faster processing for local relations → support for length/locality

Local reading time: dwell time, first pass dwell time & regressions out of NP

- No interaction, no effect of length difference on dwell time and first pass dwell time
- Main effect of order: short-before-long always faster than long-before-short for reading of NP

No support for surprisal account, compatible with length/locality

Surprisal only on verb in verb-final?

- Anti-locality/surprisal effects in literature: for verbs in verb-final languages German (Konieczny 2000; Konieczny & Döring 2003) and Hindi (Vasishth & Lewis 2006)
- Verbs are special
  - more restricted by arguments than vice versa
  - must be anticipated in verb-final languages (Van Besien 1999)
- Surprisal effects occur here because
  - The verb may/must be anticipated
  - The longer the verb has been anticipated, the better the prediction

Good-enough parsing?

- Parser sacrifices depth for speed under difficult circumstances (Ferreira & Patson 2007)
- Three results support this
  - Short-before-long advantage across the board for VP dwell time, only for biggest length difference in total reading time (parser can reduce depth to compensate for difficulties, but only up to a point)
  - Number of regressions out of an NP lowest when other NP is long
  - Information-structural preferences neutralized in dispreferred long-before-short context (Kizach & Balling 2013)

References

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