

Processing noncanonical word order in Czech

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Abstract

In relatively free word order languages like Finnish and Hindi, when discourse context is not provided, deviating from canonical order results in increased processing difficulty (Hyönä and Hujanen 1997). However, it has been recently shown that in such relatively free word order languages, discourse context can facilitate the processing of noncanonical order (e.g., (Kaiser and Trueswell 2004)). These constraints also seem to apply in languages with not as free a word order, such as English (Altmann and Steedman (1988)). It is nevertheless possible that in languages like Czech, which have even freer word order than Finnish and Hindi, the relatively high frequency of noncanonical orders (Kruijff and Vasishth 2003) could have the consequence that processing is not adversely affected by noncanonical order even without any supporting discourse context. We present a self-paced reading study involving Czech which shows that the absence of discourse context does not necessarily have an adverse effect on noncanonical order processing: a critical cross-linguistic variable is the degree of word order freedom available a priori. Languages with freer word order do not suffer the effects of noncanonical order to the extent that comparatively rigid order languages do.

Introduction

Noncanonical order is harder to process than canonical. The Hyönä and Hujanen (1997) Finnish eye-tracking experiment:

- (1) a. Finally politics destroys the flexibility in decision-making
- b. Finally politics is destroyed by the continuously growing body of non-voters

Greater processing difficulty was observed in object-first sentences than subject-first.

But preceding context can neutralize this difficulty. The Kaiser and Trueswell (2004) Finnish self-paced reading experiment:

Context Sentences:

- (2) Yesterday, Lotta looked for mushrooms in the forest. She noticed a mouse/hare in the grass that was carefully moving forward.

Target Sentences:

- (3) a. The mouse followed the hare and birds were singing
- b. The hare followed the mouse and the birds were singing

“When a discourse was established that satisfied the referential presuppositions of the noncanonical (OVS) structure, reading times for the noncanonical structure were only slightly longer than for the canonical (SVO) version, with the significant effect being limited to the verb.” (Kaiser and Trueswell 2004, 16)

Similar results exist for German (Weber and Neu 2003) and for Hindi (Vasishth 2003a,b).

Does discourse context influence NCO processing even if the frequency of NCO structures is relatively high?

It is possible that the languages studied so far simply do not have enough freedom of word order per se, and that in even freer word order languages – i.e., languages in which noncanonical orders (NCOs) occur relatively frequently – absence of discourse context does not adversely affect NCO processing. We investigated this possibility using Czech, which has a significantly freer word order than German, Finnish, and Hindi.

Self-paced reading experiment

A 1 × 6 design was used: all six permutations of the Agent Patient and Verb strings in a sentence with one embedding.

- (4) Uz mesic se Zdenek knihu snazi najit bez
AGENT PAT V

vysledku

Already for a month himself Zdenek book aims to-find with no result

‘Zdenek has been trying unsuccessfully to find the book for a month already.’

Predictions

Research on Finnish, German, Hindi, etc. suggests that any deviations from the canonical order would result in increased processing load.

On the other hand, the frequency-based view would suggest that at least for Czech (which a priori has very free word order), variation in word order should not have any effect on processing.

Reading time at the main verb immediately following the permuted string was taken as a measure of processing difficulty since the integration of the permuted string into the sentence would occur at that point at the earliest.

Testing for the null hypothesis

In order to argue for the null hypothesis, we did not use the commonly used (for a recent example see (Gordon et al. 2004, 103)) and recommended technique of computing so-called “observed power” along with p-values because this has been shown by Hoening and Heisey (2001) to be an incorrect use of power.

It is a fallacy to assume that, in the face of a null result from a t-test or ANOVA, high power (say, greater than 0.80) provides grounds for accepting the null hypothesis: a nonsignificant p value entails low observed power (see (Hoening and Heisey 2001) for details).

Consequently, we used a statistical technique called equivalence testing (Berger and Hsu (1996)); this is commonly used in the pharmaceutical industry to demonstrate, for FDA approval, effective equivalence of brand-name versus generic drugs.

Equivalence testing (two one-way t-tests)

In equivalence tests (specifically, two one-sided t-tests or TOST), the null hypothesis is treated as the alternative hypothesis, and vice versa.

$$H_0 : d \leq \theta_L \text{ or } d \geq \theta_U \quad (1)$$

$$H_a : \theta_L < d < \theta_U \quad (2)$$

where θ is an equivalence threshold – a range below which any difference d between means amounts to effective equivalence.

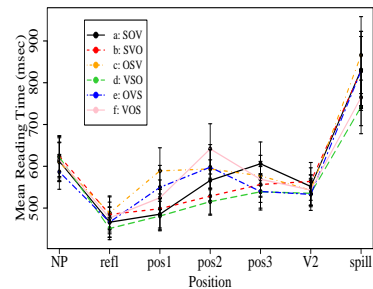
Having defined θ , the following two t-tests are carried out, and if both reject the null hypothesis, we have shown effective equivalence of means.

$$t = \frac{d - \theta}{SE} \quad (3)$$

$$t = \frac{d + \theta}{SE} \quad (4)$$

Results

Assuming that a difference of less than 25 milliseconds (i.e., $\theta = 25$ msec) amounts to effective equivalence, the results show that there is effectively no difference in processing ease at position V2 with agent-before-patient versus patient-before-agent orders (only SVO vs. OVS was inconclusive using TOST).



Discussion

The absence of discourse context does not necessarily have an adverse effect on noncanonical order processing: a critical cross-linguistic variable is the degree of word order freedom available a priori. Languages with relatively free word order do not suffer the effects of noncanonical order to the extent that comparatively rigid order languages do.

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