The Role of Impliedness in Investigating the Interplay of Word Order and Information Status

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In languages with free word order, non-canonical structures generally increase processing costs compared to canonical ones (e.g. [1], [2], [3]). Given information reduces processing costs when it appears earlier in a sentence, following the 'given-before-new' principle (e.g., [4], [5], [6]). When combined, the cost of object-first structures can be mitigated if the object is given rather than new (e.g. [2], [7]). However, sometimes new information is implied or context-related rather than entirely new, which may affect these cost modulations.

In our study in German, we investigated the interplay between Word Order (WO) preferences (SOV over OSV) and different Information Status (IS) (Given – explicitly mentioned vs. Implied – inferable from the context vs. New – unmentioned and unrelated to the context), as illustrated in Example 1, with the focus on investigating the behavior of Implied information as compared to the other two status. To examine the effect of IS on both NP1 and NP2, 12 conditions were created. The IS of NP2 was fully counter balanced according to that of NP1.

Analyses were conducted in Julia by fitting Linear Mixed-Effect Models using the MixedModels package. Models included a covariate of Word Length (centered and scaled to a range between -1/2 and 1/2) and fixed effects for WO (-1/2, 1/2) and IS. Contrasts for the factor IS were comparing Implied trials to Given trials (1/2, -1/2, 0) and New trials (0, -1/2, 1/2) respectively. The results (see Fig.1 and Table 1) showed effects of WO only on NP1, such that Object-first structures led to longer reading times (RTs) compared to Subject-first structures. IS showed effects for both comparisons such that Implied NPs were taking an intermediate position between Given (fastest) and New NPs (slowest). No interactions between WO and either IS comparison were observed. In the NP2 region, an interaction between WO and the contrast comparing Given-first with Implied-first structures was observed, indicating that an NP following a Given NP1 was read faster than such NPs following either an Implied or New NP1 only in Object-first structures.

Taken together, the results suggest that effects of WO and IS are of an additive nature on NP1, indicating that a violation of either Given-first or Subject-first expectations lead to increased processing difficulties. At the same time, implied information can still be processed faster than entirely new information, underlining that differentiation between new and implied entities is critical. The interaction observed on NP2 is in line with earlier findings that object-first difficulties are reduced when the object is given ([2], [7]).

Our results, thus, are in line with previous ERP studies (e.g., [8]) indicating that implied information is more accessible than entirely new information, leading to lower retrieval costs, but still requires integrating a new discourse referent.

These results will further be investigated by conducting an ERP study on the same stimuli utilized in this experiment. We expect modulations in the P600 time-window to pattern with our RT results presented here (as RTs have been shown to be sensitive to integration rather than retrieval costs [9]). We further expect N400 effects in line with gradually increasing retrieval costs as a function of accessibility of the presented entities.

References
[1] Bader & Meng (1999), J. Psycholinguist. Res.; [2] Kaiser & Trueswell (2004), Cognition; [3] Bornkessel & Schlesewsky (2006), J. Ger. Linguistics; [4] Arnold et al., (2013), Wiley Interdiscip. Rev. Cogn. Sci.; [5] Primus (2017), Syntax; [6] Krifka, & Musan (2012), De Gruyter Mouton; [7] Yano & Koizumi (2018), Lang. Cogn. Neurosci.; [8] Burkhardt (2006). Brain Lang; [9] Aurnhammer et al. (2021), PloS One.

Example 1:

Ein Bäcker ging auf ein Konzert.
(A baker went to a concert.)

Canonical word order (SOV):
  a. Ich habe gesehen, dass der Bäcker [G] dort gestern den Musiker [I] / einen Piloten [N] …
     (I saw that the baker [SUBJ / G] there yesterday the musician [OBJ / I] / a pilot [OBJ / N] ...)
  b. Ich habe gesehen, dass der Musiker [I] dort gestern den Bäcker [G] / einen Piloten [N] ...
     (I saw that the musician [SUBJ / I] there yesterday the baker [OBJ / G] / a pilot [OBJ / N] ...)
  c. Ich habe gesehen, dass ein Pilot [N] dort gestern den Bäcker [G] / den Musiker [I] ...
     (I saw that a pilot [SUBJ / N] there yesterday the baker [OBJ / G] / the musician [OBJ / I ...)
Non-Canonical word order (OSV):
  d. Ich habe gesehen, dass den Bäcker [G] dort gestern der Musiker [I] / ein Pilot [N] …
     (I saw that the baker [OBJ / G] there yesterday the musician [SUBJ / I] / a pilot [SUBJ / N] ...)
  e. Ich habe gesehen, dass den Musiker [I] dort gestern der Bäcker [G] / ein Pilot [N] ...
     (I saw that the musician [OBJ/Implied] there yesterday the baker [SUBJ / G] / a pilot [SUBJ / N] ...)
  f. Ich habe gesehen, dass einen Piloten [N] dort gestern der Bäcker [G] / der Musiker [I] ...
     (I saw that a pilot [OBJ/New] there yesterday the baker [SUBJ / G] / the musician [SUBJ / I ...)
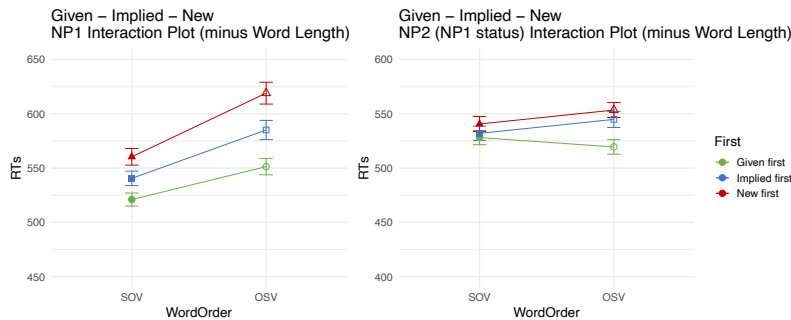
G – Given ; I – Implied ; N – New ; WO – Word Order

Fig.1 – Regression based Interaction plots of effects in NP1 and NP2 regions with Word Length effects removed.

	Word Length	Word Order	I vs. G	I vs. N	WO * IvG	WO * IvN
NP1	***	***	***	***	–	–
NP2	***	–	**	–	*	–

– - no effect , * - p < 0.05 , ** - p < 0.01 , *** - p < 0.001 ; G – Given ; I – Implied ; N – New ; WO – Word Order

Table 1 – Results.