How exhaustive are you? An ERP study on *it*-Clefts, *only*-Foci, and Scalar Implicatures

The issue: While it is widely acknowledged in the theoretical literature that not only the truth-functional focus particle *only*, but also *it-clefts* convey exhaustiveness, the nature and source of exhaustiveness effects with *it*-clefts remain contested. Based on an event-related brain potentials (ERPs) study on *only*-foci and *it-clefts*, we provide (indirect) experimental evidence that the violation or cancellation of exhaustive readings induce distinct processing costs. Additionally, we present ERPs on the generation and cancellation of *scalar implicatures* in similar structures and show that these structures induce quite different processing patterns.

Theoretical background and aim of the study: The exhaustiveness effect with *it*-clefts +has been variously analyzed as truth-functional (Atlas & Levinson 1981, É. Kiss 1999), a conventional implicature (Halvorsen 1976), a presupposition (Delin 1992), or a generalized conversational implicature (Horn 1981). A presupposition account is compatible with syntactic analyses of *it*-clefts as involving a covert definite determiner (Percus 1997), whereas deriving exhaustiveness with *it*-clefts as a conversational implicature captures the fact that it is not mandatory and licenses additive focus markers (Prince 1978). In this paper, we compare the ERP-patterns in the processing of (marked) violations of exhaustiveness with German *es*-clefts (B), as opposed to (i.) their unmarked exhaustive counterparts (A), (ii.) to semantically exhaustive *only*-foci (C, D), and (iii.) to (cancellations of) scalar implicatures in clefts (E, F).

(A) Es ist Maria, die das Klavier spielen kann und außerdem noch <u>die Geige</u>, sagte... [***it-cleft***]
(B) Es ist Maria, die das Klavier spielen kann und außerdem noch <u>Luise und Jana</u>, sagte...
    *It is Mary that plays the piano and, besides, the violin [**+exh**]/ Luise & Jana [**- exh**], said*

(C) Nur Maria kann das Klavier spielen und außerdem noch <u>die Geige</u>, sagte... [***only-focus***]
(D) Nur Maria kann das Klavier spielen und außerdem noch <u>Luise und Jana</u>, sagte...
    *Only Mary can play the piano and, besides, the violin [**+exh**]/ Luise & Jana [**-exh**]*, said

(E) Es ist Peter, der zwei Zeitungen gelesen hat. Und er hat sogar <u>ein Kreuzworträtsel</u> gelöst, sagte...
(F) Es ist Peter, der zwei Zeitungen gelesen hat. Und er hat sogar <u>drei Zeitungen</u> gelesen, sagte ...
    It is Peter that read two papers. He even solved a crossword [**+cancel**]/ read three papers [**-cancel**],

Experimental results: Our experiment used the event-related potentials (ERPs) paradigm and focused on the processing of structures like, A-F. The following ERP patterns measured from the onset of the critical phrase (<u>underlined</u>) up to 1200ms have been found: **1)** Fig. 1 shows that the 'marked' condition (B) induced a negativity after 400ms (N400) compared to condition (A). **2)** Fig. 2 shows a centro-parietal positivity starting around 550ms (P600) for the 'marked' condition (D) compared to condition (C). **3)** The comparison of the implicatures-conditions (E and F) shows a globally distributed positive going wave for condition (F) starting around 250ms (Fig. 3).
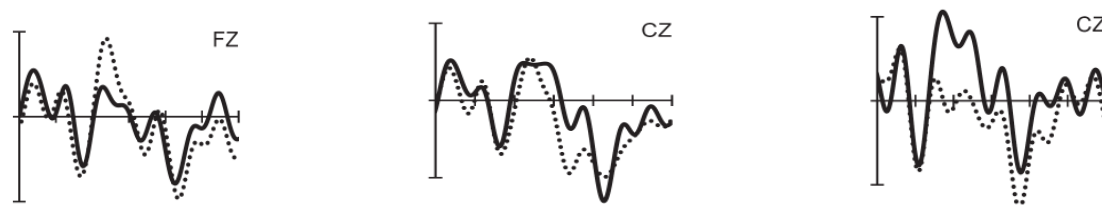

Figure 1 (left). ERP effects on *die Geige* 'the violin' and *Luise und Jana* 'Luise and Jana' from the onset up to 1200ms there after at the FZ electrode. Negativity is plotted upwards. Solid line = *[+exh]* cleft structure (A); Dotted line = *[-exh]* cleft structure (B).

Figure 2 (centre). ERP effects on *die Geige* 'the violin' and *Luise und Jana* 'Luise and Jana' from the onset up to 1200ms there after at the CZ electrode. Negativity is plotted upwards. Solid line = *[+exh]* only-focus (C); Dotted line = *[-exh]* only-focus (= logical contradiction !) (D).

Figure 3 (right). ERP effects on *drei Zeitungen* 'three newspapers' and *ein Kreuzworträtsel* 'a crossword' from the onset up to 1200ms there after at the CZ electrode. Negativity is plotted upwards. Solid line: 'unmarked' structure (E); Dotted line: structure with cancelled implicature (F).

Discussion/Interpretation: Most importantly, the processing of the 'marked' conditions (B, D, E) compared to their 'unmarked' counterparts (A, C, F) reflect distinct patterns on the critical phrases (cf. Figure 1-3) in the waveforms of the grand average ERPs. Statistical analysis reveals a significant difference between conditions (A vs B) in the time window 400 – 600ms, caused by a negativity by condition (B), which is usually identified as N400 and interpreted as an indicator of (semantic) integration in language processing research (Kutas and Hillyard 1980a). The other two comparisons show quite different patterns. In the *only*-focus condition (C vs D) we find a late positivity (550 – 1000ms), which has been interpreted as a reflex of reanalysis processes (Osterhout & Holcomb 1992, Friederici 1995, 1999) and, more recently, as an indicator of pragmatic reanalysis (Drenhaus et al. 2006). The scalar implicature comparison (E vs F) shows an early positivity for condition (F) compared to (E), which can be seen as a process for checking an unexpected event upon its veridicality; namely, a P3b (similar, van Herten et al. 2005). It has been shown that this component is an indicator for the actualisation and updating of a mental model (Donchin & Coles, 1988).

From a theoretical perspective, the data suggest that the exhaustiveness effects with *only*-foci and *it*-clefts are of a different nature, as their violation incurs different processing patterns (B vs D). This is in line with recent experimental findings on Hungarian and German (Onea & Beaver 2009). Second, the difference in patterns (B vs F) indicates that exhaustiveness with *it*-clefts is not a scalar implicature either. All this suggests that the phenomenon of exhaustiveness is not reducible to a single factor, say, a general EXH-operator, but that there are different ways of generating exhaustive interpretations in natural language: truth-conditional operators (*only*), scalar implicatures, or, as may be the case with *it*-clefts, interpretation in minimal models (Kratzer 2009). In particular, it may the fact that *it*-clefts present the non-clefted part as presupposed background information that facilitates the identification of such minimal situations.

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