Processing spontaneously spoken language: The interplay between phonetic, syntactic, and pragmatic cues in Estonian

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The aim of this study is to investigate the effects of prosody, syntax, and pragmatics on the perception of the boundaries of spoken language chunks in spontaneous Estonian. The study is based on the assumption that processing language in chunks is due to the capacity limits of working memory (Mauranen 2009, and Carpenter & Just 2013), and that the chunks can be established by their boundaries. Furthermore, the boundaries of language chunks may be cued by various sources of information. These sources include phonetics, syntax, and pragmatics (e.g., Bever et al. 1969, Swerts 1997, and Frazier et al. 2006), which, in turn, can interact with each other (Bögels et al. 2010, and Cole et al. 2010).

The current study sets out to investigate what type of information listeners use for chunking continuous speech flow into units – which we call *processing units* – in Estonian, and whether there are associations between these sources of information.

For that, we test three possible scenarios:

1. The boundary of a processing unit is prosodic, indicated either by a pause, hesitation, segmental lengthening or an intonational boundary tone.
2. The boundary of a processing unit is syntactic in that it coincides with the boundary of a clause, but depends also on the internal structure of a clause.
3. The boundary of a processing unit is pragmatic, so that pragmatic units (e.g., discourse particles) contribute to the perceived boundary.

To test the scenarios, we conducted a speech perception experiment with the native speakers of Estonian, a language of free word order and rich grammatical inventory. For that, 396 spontaneously spoken utterances were drawn from the Phonetic Corpus of Estonian Spontaneous Speech. The length of the utterances varied between 18 and 24 syllables and the duration between 2000 and 4000 ms. 51 speakers (40 females, 11 males, average age 33) listened to excerpts extracted from the corpus and were asked to break the excerpt into chunks.

Based on the number of listeners and the number of boundary marks, each word in the excerpt received a *probabilistic boundary* value. The probabilistic boundary value was then analysed in relation to various variables (e.g., the type of a prosodic break after the word, presence of a clause boundary, number of words in a clause) by using multivariate statistical methods.

The results provide evidence for the great impact of acoustic (e.g., pauses) and syntactic cues (clause boundary) on the determination of the boundary of a processing unit. In addition, the length and the internal structure of a clause are important, as are pragmatic factors as evidenced by the boundaries marked either before or after discourse particles. As such, the results indicate that prosody strongly interacts with clausal and pragmatic factors in the determination of the chunks of a spoken language.

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