Length, Ordering Preference and Intonational Phrasing: Evidence from Pauses

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Abstract
This paper reports a speech production experiment in which the effects of surrounding phrase lengths and head-argument distance on intra-sentential pause duration were tested. While the results confirm an effect of phrase length on pausing, this effect is found to be distinctly stronger for long phrases preceding the pause than for long upcoming phrases. The results are discussed with respect to intonational phrasing tendencies and ordering preferences for unequal-sized constituents.

Index Terms: intonational phrasing, pausing, phrase length, phrasal ordering preferences, speech production.

1. Introduction
This study is concerned with intra-sentential pauses in read speech. The purpose of this study is to ascertain the effects of the length of preceding and upcoming material and its syntactic structure on pause duration at a given position within a sentence.

Pauses are an important feature of intonational phrase (IP) boundaries in speech [1, 2]. They are, however, a highly variable phenomenon governed by numerous factors such as speaking style, speaking rate, and the speaker’s emphasis. One factor determining pause distribution and pause duration is the constraint that might override syntactic requirements on long IPs at the end of utterances can be seen as prosodic constraints and might be forced to utter long constituents first.

Two recent studies on pause duration, namely [3] and [5] have scrutinised inter-sentential pause duration as an effect of preceding and following phrase lengths. In their study, Zvonik and Cummins [5] used synchronously read speech. The authors report that inter-sentential pauses shorter than 300ms almost exclusively occur when the preceding and following phrase consists of 10 syllables or less. The probability of a pause being short was shown to rise greatly if both the preceding and following phrase contained only 10 or fewer syllables, suggesting that the two predictors act superadditively.

Krivokapic [3] also used the method of synchronous reading. In her study on inter-sentential pauses, she compared pause length in four conditions, namely short/short, short/long, long/short, and long/long. Krivokapic found significant length effects for both preboundary and postboundary phrases, indicating that, irrespective of the order of the phrases, long phrases induce increased pause duration relative to short ones.

In a recent article, Watson and Gibson [12] have tested the hypothesis that the likelihood for an IP boundary increases with the integration distance between heads and their arguments. In their production experiment, however, they could not find a significant effect.

The present experiment is designed to ascertain the effect of the respective ordering of a long and a short constituent on pause duration between the constituents within German sentences. The syntactic structure of the experimental sentences is systematically varied in order to disentangle the different effects of syntax (i.e. head-argument distance) and constituent length on pause duration.

2. Methods
2.1. Experimental design
A speech production experiment is designed to test the influence of three factors on pause duration in speech production. These are 1) the respective ordering of a short and a long constituent, 2) the direction of the lexical head of the long constituent and 3) the position of the main verb within the sentence. With factors 2) and 3), the integration distance between syntactic heads and their arguments is systematically varied. All factors are two sided and crossed for this experiment.

Reading material is constructed according to the above factors resulting in 8 conditions. Sentences including coordinations are chosen as a test bed for this experiment. These constructions contain a proper name as subject in first position followed by a transitive verb frame with two coordinated objects. One of the object NPs is relatively long (10-15 syllables) and the other short (2-3 syllables). The
Paul wants to paint the river and the tiny clinker-bricked summer house.
4. Discussion

These data confirm that surrounding phrase lengths have an effect on pause duration. Speakers pause longer at the conjunction of two unequal-sized conjuncts when the longer constituent precedes the shorter one. This result suggests that, in these asymmetric coordinations, the duration of the pause is positively correlated with the size of the preceding phrase but not with the size of the upcoming one.

Pauses are among the defining features of IP boundaries. The likelihood and strength of an intonational boundary grows with increasing pause length [1, 2]. The present evaluation of the experiment remains agnostic as to whether the silent intervals coincide with other IP boundary cues such as phrase-final lengthening or boundary tones. A closer examination of these cues would certainly be adequate to verify the results. However, given that items involving hesitation pauses were discarded, it is unlikely that the sentences under scrutiny contain pauses that interrupt intonational phrases. Since the intervals were measured at major constituent boundaries, namely at the conjunction, the dependent variable can be considered a good measure for intonational boundary strength. Therefore, it can be inferred from the result that the boundary strength and thus the likelihood of an IP boundary at the conjunction is higher in sentences with long-short ordering of the constituents than in short-long versions.

The findings of the present experiment complement and qualify Watson and Gibson’s [4] LRB algorithm on IP boundary placement since only an effect of the length of the preceding phrase but not of the upcoming one can be confirmed. This is not to contest the results of Ferreira [16] and others who find that the size of an upcoming constituent is a predictor for pause length. However, it follows from the results here that the size of the preceding phrase is a stronger predictor for IP boundary placement. Watson and Gibson [4] themselves hypothesise that their LRB algorithm might be more successful when the relative influence of the upcoming phrase on boundary placement would be more restricted. This corresponds well with the notion of incrementality in the speech production process: A speaker does not always complete the planning of a constituent before he starts uttering it. Therefore, its ultimate size cannot be determined in advance and thus its influence on pause duration is limited.

The outcome of the experiment is especially interesting against the background of the short-long preference for constituent ordering in German and English [9, 10]. It seems that the violation of this preference has an effect on intonational phrasing. That is, while sentences which obey the preferred constituent order do not show a strong prosodic break, the long-short order tends to result in a more complex prosodic structure with an IP boundary between the unequal-sized constituents (as substantiated by the relatively longer pauses in this condition). A possible interpretation of this is that, when forced to utter the unordered preference, speakers avoid a violation of the short-long preference on IP level by inserting an IP boundary after the long constituent. Thus, the IP can be seen as a domain for the short-long ordering preference.

Given the preference for long-short ordering of constituents in Japanese [17], it would be interesting to set up a similar experiment in that language to compare the effects of pause duration on preferred vs. dispreferred constituent order.

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6. References


