The effects of prosodic cues on word segmentation in an artificial language learning task

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Prosodic cues such as pauses, durational adjustments and changes in pitch play a crucial role for the perception and cognitive processing of words in an otherwise continuous stream of speech. They increase the salience of certain sound elements ('figures') in relation to a less salient ground, and can serve as syntactic boundary cues. Facilitating word segmentation and word learning, they play an important role in language acquisition and language processing (Fletcher 2010). Still, cognitive linguistic research has so far focussed on prosody only rarely, and particularly the relative importance of the different boundary cues has not been explored in much detail.

We pitted various prosodic boundary cues against each other to measure their effects on word segmentation. We predicted pauses to be more salient cues for listeners than durational cues or pitch cues, as the pauses' high decrease in signal amplitude makes them the most prominent breaks in the speech stream (Tyler & Cutler 2009).

We present results of an artificial language learning experiment, inspired by Saffran et al. (1996), in which 200 German native speakers were exposed to a continuous speech stream consisting of sequences of artificial trisyllabic words. There were different transitional probabilities between word internal syllables and syllables at word boundaries, and these already provided some statistical cues for segmenting the stream into words (control condition). To test the effects of various prosodic cues, we enhanced the transitional probability cues with prosodic cues on the final syllable of each artificial word. This yielded five different test conditions, in which the final syllables were either a) followed by a pause, b) lengthened, c) shortened, d) changed to a lower pitch, or e) changed to a higher pitch. In a subsequent lexical decision task, the participants classified stimuli as either words or non-words of the artificial language, and we compared the effects of the different cues on their performance.

We found that participants could distinguish words from non-words with statistical cues only, though their performance remained moderate. Having the final syllables additionally followed by a pause, lengthened or lowered in pitch increased the participants' performance, whereas a higher pitch on the final syllables did not have any effect. Interestingly, shortening the final syllables had a negative influence on the correct segmentation of words, which implies that statistical frequency cues can be overridden by conflicting prosodic cues.

In contrast to our predictions, durational lengthening and pitch lowering served as boundary cues equally well as pauses. This might be related to the fact that pauses can be quite rare in normal speech events, and only occur at major syntactic boundaries. This is especially true of fast speech (Fletcher 2010). Other cues, such as final lengthening or pitch lowering, might compensate for the lack of pauses and serve as boundary signals instead. As these cues therefore occur more frequently and more consistently than pauses in everyday speech, people might attend to them at least as much as to pauses, despite their lower acoustic salience (e.g. Bybee 2007).

References

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