Acoustic and respiratory evidence for utterance planning in German

Susanne Fuchs a,*,1, Caterina Petrone a,d,1, Jelena Krivokapić b, Philip Hoole c

a Centre for General Linguistics (ZAS), Berlin, Germany
b Institute of Phonetics and Speech Processing, Ludwig-Maximilians-University Munich, Germany
c Laboratoire Parole et Langage (LPL), CNRS UMR 7398, Aix-en-Provence, France

ABSTRACT

This study investigates prosodic planning in a reading task in German. We analyse how the utterance length and syntactic complexity of an upcoming sentence affect two acoustic parameters (pause duration and the initial fundamental frequency peak) and two respiratory parameters (inhalation depth and inhalation duration). Two experiments were carried out.

In the first experiment, data for twelve native speakers of German were recorded. They read sentences varying in length (short, long) and syntactic complexity (simple, complex). Data were analysed on the basis of the four phonetic parameters. Pause duration, inhalation depth and inhalation duration showed significant differences with respect to sentence length, but not to syntactic complexity. The initial f0 peak was not influenced by variations in length or syntactic complexity.

In the second experiment it was hypothesized that the initial f0 peak is only sensitive to length manipulations of the first constituent. Twenty speakers were recorded reading utterances varying in the length of the first (short, medium, long) and last syntactic constituent (short, long). Results for the initial f0 peak confirmed our hypothesis. It is concluded that the breathing parameters and pause duration are global parameters for planning of the upcoming sentence whereas the height of the fundamental frequency peak is a more local measure sensitive to the length of the first constituent.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

Language production is incremental: utterance generation proceeds in a piecemeal (by “increments”) fashion, with planning at different levels of the linguistic and articulatory processes being interleaved (e.g., Dell, Burger, & Svec, 1997; Ferreira, 1996; Ferreira & Swets, 2002; Keating & Shattuck-Hufnagel, 2002; Levelt, 1989; Meyer, Belke, Häcker, & Mortensen, 2007; Roelofs, 1998; Wheeldon & Lahiri, 1997). However, the issues of how far ahead speakers plan the upcoming sentence, how flexible the units of planning are, and which parameters mirror utterance planning are far from settled. Concerning the units of planning, suggestions have ranged from the prosodic word to the intonational phrase (e.g., Ferreira, 1991; Krivokapić, 2007a; Levent, 1989; Martin, Crowther, Knight, Tamborello, & Yang, 2010; Wheeldon & Lahiri, 1997). Studies assuming fixed units of planning crucially concentrate on different linguistic material (e.g., the number of phonological words, content words, stressed syllables in an utterance) and report their findings in relation to such linguistic variables (e.g., Wheeldon & Lahiri, 1997). Studies assuming more flexible units of planning additionally focus on task-related and speaker-specific behaviour with respect to planning parameters (Ferreira & Swets, 2002; Swets, Desmet, Hambrick, & Ferreira, 2007; Wagner, Jescheniak, & Schriefers, 2010). In the majority of cases the analyses are based on one of a limited number of parameters, such as reaction/response time, initiation time, pause duration or fixation points of eye movements (e.g., Ferreira, 1991; Lashley, 1951; Latash & Mikaelin, 2011; Meyer, 2004; Sterberg, Monsell, Knoll, & Wright, 1978).

In the current work on German we will concentrate on phonetic parameters which we expect to correspond to different aspects of speech planning and thus might be used to capture different scopes of planning. It should be pointed out that, given the incremental nature of speech production, we do not assume that speakers fully plan a sentence before speech onset, and that therefore the parameters we examine reflect only a rough rather than detailed sentence plan (see also Keating & Shattuck-Hufnagel, 2002). Our studies will focus on reading tasks. This task does not involve message generation, lexical retrieval or the selection of the syntactic construction; accordingly, the planning processes we examine differ in some aspects from planning in other styles such as in spontaneous speech. However, reading tasks have been used in many...