



# Semantic-context effects on lexical stress and syllable prominence

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## INTRODUCTION

- successful speech communication even when the phonetic signal in the segmental or suprasegmental domain is ambiguous
- hearer makes use of all cross-modally available, contextual information (signal-internal and signal-external) to decode current phonetic input
- word identification depends on semantic context of utterance (Warren & Sherman 1976)
- prominence defined as the extent to which a syllable is perceived as standing out against the surrounding ones
- prominence perception depends on signal-internal (e.g. f<sub>0</sub>, intensity) and signal-external factors (e.g. meta-knowledge of grammatical categories)

But does prominence perception also depend on the SEMANTIC CONTEXT?

## Research Questions

1. Does semantic context affect the perception of lexical stress? More specifically, does a name/month context support lexical-stress and higher prominence on the first/second syllable on AUGUST, resp.
2. Is the semantic context effect stronger if the phonetic cues to prominence and lexical stress in the target syllable are ambiguous?

Bibliography: Niebuhr, O. (2009). F<sub>0</sub>-based rhythm effects on the perception of syllable prominence. *Phonetica*, 66, 95 – 112.  
Warren, R.M. & Sherman, G.L. (1976). Phonemic restorations based on subsequent context. *Perception Psychophysics*, 16, 150 – 156.

## METHOD

- 7-STEP DURATION CONTINUUM FROM AUGUST (NAME) TO AUGUST (MONTH)
- resynthesized stimuli differing only in the duration ratio of the first vowel /aʊ/ to the second vowel /a/ (cf. Figure 1 and Table 1, f<sub>0</sub> was kept constant with a slight decline for phrasal and rhythmic reasons)
- stimuli appended to one 'month' and one 'name'-list consisting of various orders of the two different words *Juli* (July) and *Friedrich* (a German name)
- two criteria for establishing a context that triggers either one of the two meanings: (1) one context word outnumbers the other and (2) the context word is or is not adjacent to the stimulus (e.g. month lists *Friedrich-Juli- Juli* or name list *Juli-Friedrich-Friedrich*)
- lists contained either 3 or 5 context words to make the position of the target word unpredictable

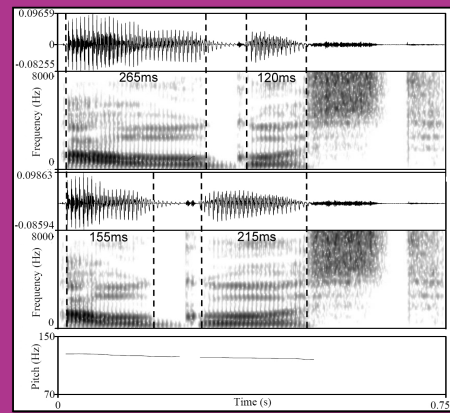


FIGURE 1: Oscillograms and spectrograms showing the contrast in vowel duration between the extreme stimuli of the created continuum from AUGUST (top) to aUGUST (middle). The bottom panel displays the constant f<sub>0</sub> decline of all stimuli.

TABLE 1: Vowel durations of the stimuli from the continuum.

Stimulus (Semantics)	Vowel duration [ms]		Duration ratio V <sub>1</sub> /V <sub>2</sub> (in %)
	V <sub>1</sub>	V <sub>2</sub>	
1 (name)	265	120	69/31
2	237	144	62/38
3	224	156	59/41
4	210	168	56/44
5	197	180	52/48
6	183	192	49/51
7 (month)	155	215	42/58

- 14 lists à 3 context words x 10 repetitions and 28 lists with 5 contexts x 5 repetitions = 280 tokens presented in randomized order together with filler lists
- 18 Standard German listeners (9 female) aged between 18 to 56
- 2 alternative forced choice identification task: name or month?

## RESULTS

### ANALYSIS

1. repeated measures ANOVA with two within-subject factors Context (two levels: name vs. month) and V<sub>1</sub>/V<sub>2</sub> Duration Ratio (7 levels: stimuli 1 -7) as independent variables and 'month' response as the dependent variable
2. calculation of category boundaries using probit analysis

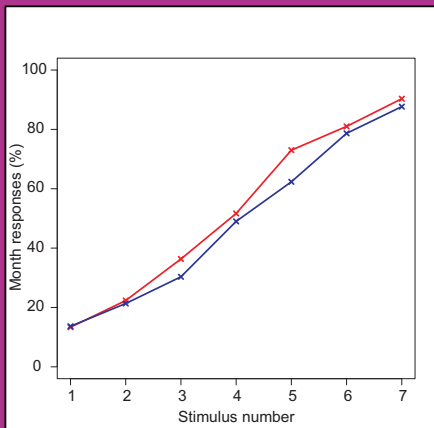


FIGURE 2: Percentage of 'month'-responses as a function of decreasing V<sub>1</sub>/V<sub>2</sub> ratio (stimulus number) to the month list (red) and the name list (blue).

- clear shift in perceived lexical stress from V<sub>1</sub> to V<sub>2</sub> (cf. Figure 2)
- 14 % month responses for Stimulus 1 in both contexts
- 90% and 87% month responses in the month and name list context, resp.
- Repeated measures ANOVA: significant effects for V<sub>1</sub>/V<sub>2</sub> Duration Ratio ( $F(6,84) = 94.041, p < 0.001$ ) and Context ( $F(1,14) = 5.5263, p < 0.05$ ), but no significant interaction for Context\*V<sub>1</sub>/V<sub>2</sub> Duration Ratio
- mean category boundaries (cf. Figure 3)
  - in month context: 3.7
  - in name context: 4.1
- paired t-test revealed no significant difference between the category boundaries in the month vs. name context ( $t = -1.4812, df = 14, p = 0.1607$ )

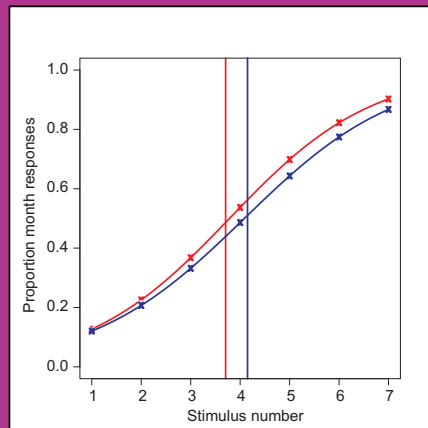


FIGURE 3: Regression curves derived from the identification functions of 'month'-responses to the month list (red) and the name list (blue). The vertical lines indicate mean category boundaries in the AUGUST-aUGUST continuum following the month list (red) and the name list (blue)

## DISCUSSION

- ✓ Research question 1: Responses to stimuli are affected by semantic context
- ✗ Research question 2: semantic context affects all stimuli irrespective of whether the V<sub>1</sub>/V<sub>2</sub> duration ratio is ambiguous or clear
- V<sub>1</sub>/V<sub>2</sub> duration ratio is a strong acoustic cue to lexical stress in German
- fundamental meaning relationships are also used as cues to lexical stress and hence prominence perception
- prominence as a perceptual phenomenon with a considerable top-down momentum
- robustness against local phonetic cues as a characteristic of *meaning based* context effects
  - *meaning based* effects may affect directly language processing (like the lexical stress position)
  - *pattern based* effects (e.g. rhythmic context, Niebuhr, 2009) may affect the interpretation of the phonetic cues, which then provide the basis for language processing