

## Introduction

In linguistics a mismatch seems to exist between syntactic structure and phonological structure. Syntactic phrases display recursivity, whereas this recursivity is assumed not to play a role in phonology. However, in music - of which the sound structure is rather similar to phonological structure - recursive phrase structures are quite common, and this made us wonder why linguistic prosody would behave differently from syntax. Thus we investigated whether or not edge-marking processes, such as early pitch accent placement, can be applied recursively to phonological phrases that are embedded in larger phonological phrases.

## Theoretical background

- Syntax:** Recursive rules are capable of repeated application in generating a sentence. An infinite set of sentences can be generated from a finite set of rules
- Phonology:** Iterative rule application is limited
- Strict Layer Hypothesis**
- a prosodic category of one level is exhaustively pursued into constituents of the next-lower level;
  - those next-lower level constituents are all of the same type
- **prosodic structure is not recursive**
- mismatch between syntactically recursive constituent structure and the linearly segmented structure in prosody

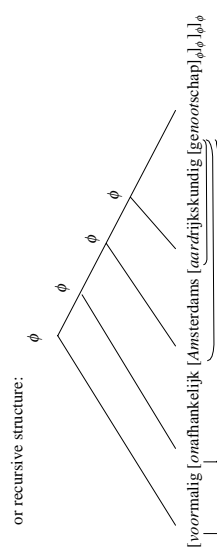
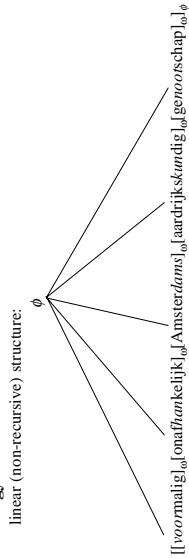
## Hypothesis

Edge-marking processes such as **early pitch accent placement** (Phrasal Rule) can be applied recursively to phonological phrases

**Syntax:** [voornalig [onafhankelijk [Amsterdams [aardrijkskundig genootschap] NP]NP]NP]NP

'Previously independent Amsterdam geographical society'

**Phonology:** linear (non-recursive) structure:



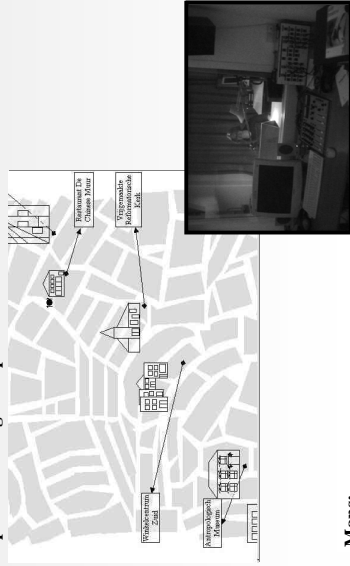
Maartje Schreuder & Dicky Gilbers

## Experiment

**Some data** (Dutch)

- (Amsterdams) *aardrijkskundig genootschap* '(Amsterdam) geographical society'
  - (internationale) *diplomatieke organisaties* '(international) diplomatic organizations'
  - (algemene) *regionale dagbladen* '(general) regional daily paper press'
  - (progressieve) *socialistische partij* '(progressive) socialist party'
  - (academisch) *psychiatrisch ziekenhuis* '(academic) psychiatric hospital'
- (/ = phrasal main stress, \ = phrasal secondary stress, **Bold** = Early Pitch Accent position)

## Experiment design: Map task



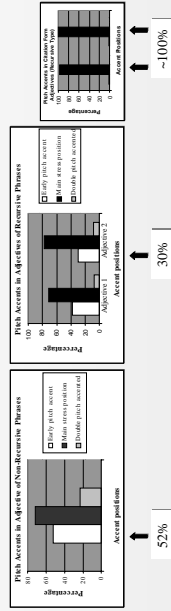
## Maps:

- Each map: 1 syntactically recursive phrase landmark [Adj Noun] and 1 non-recursive, non-corresponding phrase landmark [Adj Noun]
- 100 phrases in total
- Each subject: 10 recursive and 10 non-recursive phrases (= 10 maps)
- about 550 spoken phrases in total

## Subjects:

- 24 Dutch subjects
- 10 men, 14 women (aged 19 to 28)

## Results

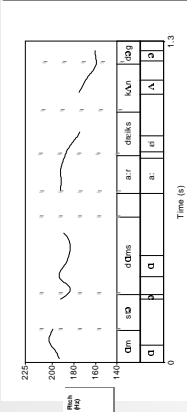


## Pearson Chi-Square tests:

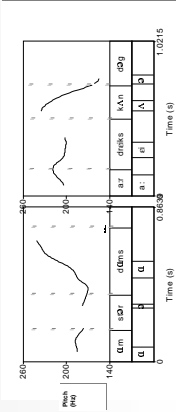
Proportions of early pitch accents and main stress positions in the phrase and in citation form are significantly different ( $\chi^2$  (df 1) = 122.524,  $p < 0.001$ ).

Also the difference between the proportions of corresponding adjectives of the non-recursive and recursive phrases is highly significant ( $\chi^2$  (df 1) = 12.326,  $p < 0.001$ ).

Pitch contour of phrase *amsterdams aardrijkskundig genootschap*



Pitch contours of the words *amsterdams* and *aardrijkskundig* in citation form



The results confirm our hypothesis that these syntactically recursive phrases can also be recursive prosodically.

## Conclusions

- The prosodic recursion-hypothesis holds: recursion does exist in prosody.
- Early Accent Placement** is a strong tendency, but accenting the **main stress** syllable is strongly preferred.
- Maximal phonological phrases are early accented significantly more often than embedded phonological phrases. Clearly, there is a lot of **optionality** involved.
- The results confirm the observation that there is **no one-to-one mapping from syntax to prosody**, because optionality in syntactic structure would not be an option.

This is evidence for a more prominent place for recursion in phonology

## Paper:

Schreuder, Maartje and Dicky Gilbers (2004). Recursive Patterns in Phonological Phrases. To appear in the *Proceedings of Speech Prosody 2004*, Nara, Japan.