1. Background

• What factors may give rise to the occurrence of prosodic boundaries?

Prosodic structure

Syntactic structure

(Che et. al., 2014)
1. Background

• Theories on syntax-prosody mapping:
  • Branchingness (Napoli & Nespor, 1979)
  • C-command (Kaisse & Shaw, 1985)
  • The alignment of a word's left or right edge with the left or right edge of a syntactic constituent (Selkirk, 1986)
  • The structural distance between two words (Joel, 1987)
1. Background

• A challenge to theories of syntax-prosody mapping:
  • Rhythmic constraint/prosodic weight/phrase length (e.g., Jun, 2014)

• Example:
  • 中国表示/ "China claims/"
  • 中华人民共和国/表示/ “People’s Republic of China/ claims/”

• Research goal:
  • How does the two constraints interact to affect the prosodic phrasing?
2. Corpus

- A set of 4000 sentences were collected from newspapers

- Two ways of annotation:
  - silent reading
  - speech perception

- Two levels of prosodic units:
  - rhythmic phrases (RP)
  - intonational phrases (IP)
2. Corpus

• Silent reading
  • 130 undergraduate students from Beijing Normal University
  • Each student was assigned 500 sentences.
  • Each sentence was annotated by 12-17 students.
  • In all we have 209195 RP and 93621 IP from silent reading

• Speech Perception
  • 4000 sentences produced by a professional female speaker, Recorded in a sound booth in the Chinese Academy of Science.
  • Listened to and annotated by a professional female annotator.
  • 14699 RP and 5468 IP from speech perception
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- The Stanford Parser, version 3.2.0, was used to parse these sentences and to provide information about:
  - word segmentation
  - POS tagging
  - **Tree structure**
  - dependency relations
3. Experiments and Results

• 3.1. Overall distribution of phrase lengths
• 3.2. Interaction between constraints for rhythmic phrases
• 3.3. Interaction between constraints for intonational phrases
3.1. Overall distribution of the lengths of RP and IP

Figure 1: Overall density of length of RP and IP in terms of syllable count based on text and speech
3.1. Overall distribution of the lengths of RP and IP

RP: the grouping of two words
IP: the split of a sentence

Figure 2: Relationship between phrase length (y-axis) and sentence length (x-axis)
3.2. Interaction between length and syntax for RP

• Question: what caused two words to be separated by a rhythmic phrase boundary?

• Rhythmic constraint: The total length of two words

  • Total length: short
    
    Word 1  Word 2

  • Total length: long
    
    Word 1  \(\text{---}\)  Word 2

• Syntactic constraint: The syntactic juncture between two words

  • Syntactic juncture: tight
    
    Word 1  Word 2 (e.g., ADJP+NP)

  • Syntactic juncture: loose
    
    Word 1  \(\text{---}\)  Word 2 (e.g., NP+VP)
3.2. Interaction between length and syntax for RP

• The first two words
  - no preceding contextual influence

• Balance syntactic constituents
  • By left edge
  • By right edge
  • By both sounds
3.2. Interaction between length and syntax for RP

Figure 3: Influence of the total length of the first two words on the probability of the rhythmic boundary between them with balanced syntactic context.
3.2. Interaction between length and syntax for RP

Figure 4: The probability of a RP boundary (y-axis) in the first two words influenced by the total length of the two words (x-axis) for ADVP and QP junctures based on the right edge (left graph) and the left edge (right graph)
3.3. Interaction between length and syntax for IP

• Question: what caused a sentence to fall apart into several intonational phrases?

• Rhythmic constraint: The total length of the sentence
  • Sentence length: short
    \[
    \text{[ ] } [ ]
    \]
  • Sentence length: long
    \[
    \text{[ ] [ ]}
    \]

• Syntactic constraint: The syntactic complexity of the sentence
  • Syntax: simple
    \[
    \text{[ ]}
    \]
  • Syntax: complex
    \[
    \{[ ] [ ] [( ] ( ) ]}
    \]
3.3. Interaction between length and syntax for IP

1. Depth of the tree,
   - the most deeply embedded nodes

2. Number of inflectional phrase nodes

3. Number of secondary nodes in tree
   - primary splits
3.3. Interaction between length and syntax for IP

Figure 5: Relationship between the count of intonational phrase boundaries within a sentence and the syntactic complexity (syntactic depth, number of IP nodes and number of secondary nodes in the tree) of the sentence
3.3. Interaction between length and syntax for IP

Figure 5: Relationship between the count of intonational phrase boundaries within a sentence and the syntactic complexity (syntactic depth, number of IP nodes and number of secondary nodes in the tree) of the sentence.

Figure 6: Relationship between syntactic complexity and number of IP boundaries for sentences of different lengths.

(a) Depth of the tree

(b) Count of InfP nodes
4. Conclusion

- Rhythmic phrases:
  - mainly 2-5 syllables long, independent of the length of the sentence.
  - whether two words are separated by a RP boundary is affected by:
    - the total length of those two words
    - the nature of syntactic juncture in between

- Intonational phrases:
  - vary widely, dependent on sentence length
  - whether a sentence splits into several IP is affected by:
    - length of the sentence
    - syntactic complexity
Thank you!

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