

# From Structure to Meaning: The Contribution of Prosodic Representation in Reading

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# Introduction

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- Natural prosody (rhythm intonation and stress) helps in understanding speech.

## How?

- Prosody helps the listener by transforming the serial auditory input into structured patterns that help in:
  1. organizing and maintaining information in working memory.
  2. syntactic segmentation (Cutler, Dahan & van Donselaar, 1997).



# The Structural Approach to Reading

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- At an early stage in text processing readers strive to extract the structural organization of the sentence.
- They monitor the text for structural cues (e.g. function words) and these help in extracting the structure of the sentence prior to complete analysis of meaning (Koriat & Greenberg, 1994).
- This structure paves the way for online semantic analysis:
  - It guides the assimilation of words into their appropriate roles.
  - It assists in organizing and maintaining information in working memory so it can be integrated with succeeding components of text (Just & Carpenter, 1987).



# Structural Processing and Reading Prosody

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- Natural reading prosody is produced online during reading.
- Natural reading prosody reflects the structure of the sentence and is relatively indifferent to its meaning (Koriat, Greenberg & Kreiner, 2002).

## These findings suggest –

Natural reading prosody is produced on the basis of the early analysis of structure, possibly prior to complete semantic integration.



## We propose -

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- that prosodic representations are created spontaneously during reading (Exp. 1, 2).
- that they are created on the basis of early structural analysis independent of semantic integration (Exp. 3).
- that these representations help in maintaining the structural organization of the sentence in working memory while semantic integration is performed (Exp. 4).



# Experiments 1 & 2

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## Hypothesis

Prosodic representations are created during reading and maintained as part of the sentence representation in memory.

## Prediction

When participants read a sentence (aloud or silently) applying a specific prosodic pattern, they should recognize this sentence more easily if it is later presented orally with the same prosodic pattern than if it is presented with a different prosodic pattern.



# Sentence Recognition

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target sentence –

***she took a picture of the tourist with the camera.***



reading phase –

*Kate was the only one who had a camera, so **she took a picture of the tourist with the camera.*** 

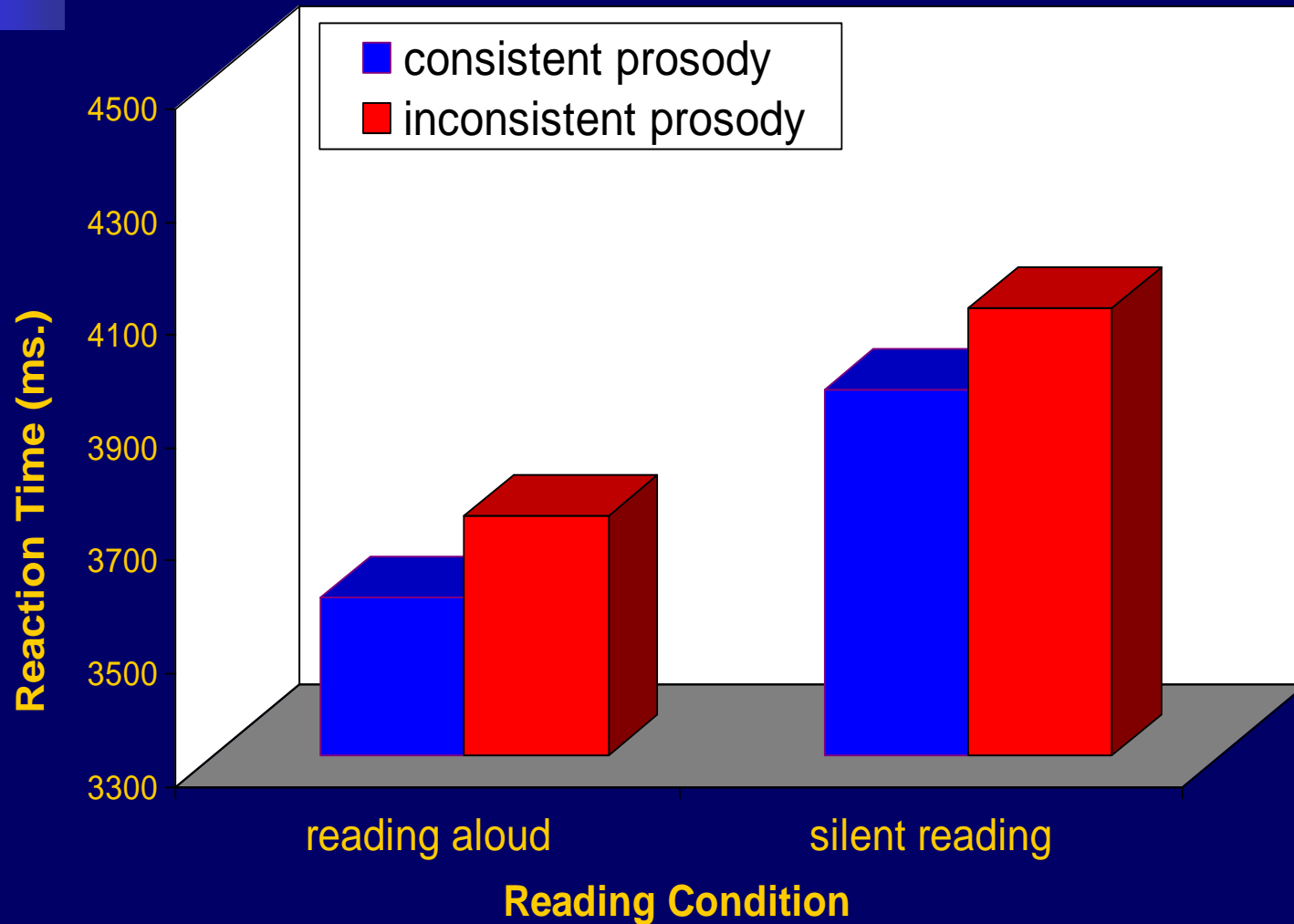
or

*The journalist saw three tourists watching the accident, but **she took a picture of the tourist with the camera.*** 

test phase -

- Old sentences - consistent prosody 
- Old sentences - inconsistent prosody 
- New sentences

# The effect of prosodic consistency on sentence recognition







## Experiment 3

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### Hypothesis

Prosodic representations are created on the basis of early structural analysis, independent of semantic integration.

### Prediction

Prosodic representations should be created and maintained in memory even when reading nonsense sentences.



# Sentence Recognition

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Nonsense target sentences –

***it took a kiss of the hat with the bottle.***

reading phase -

*The table was the only page who had a bottle, so it **took a kiss of the hat with the bottle.***

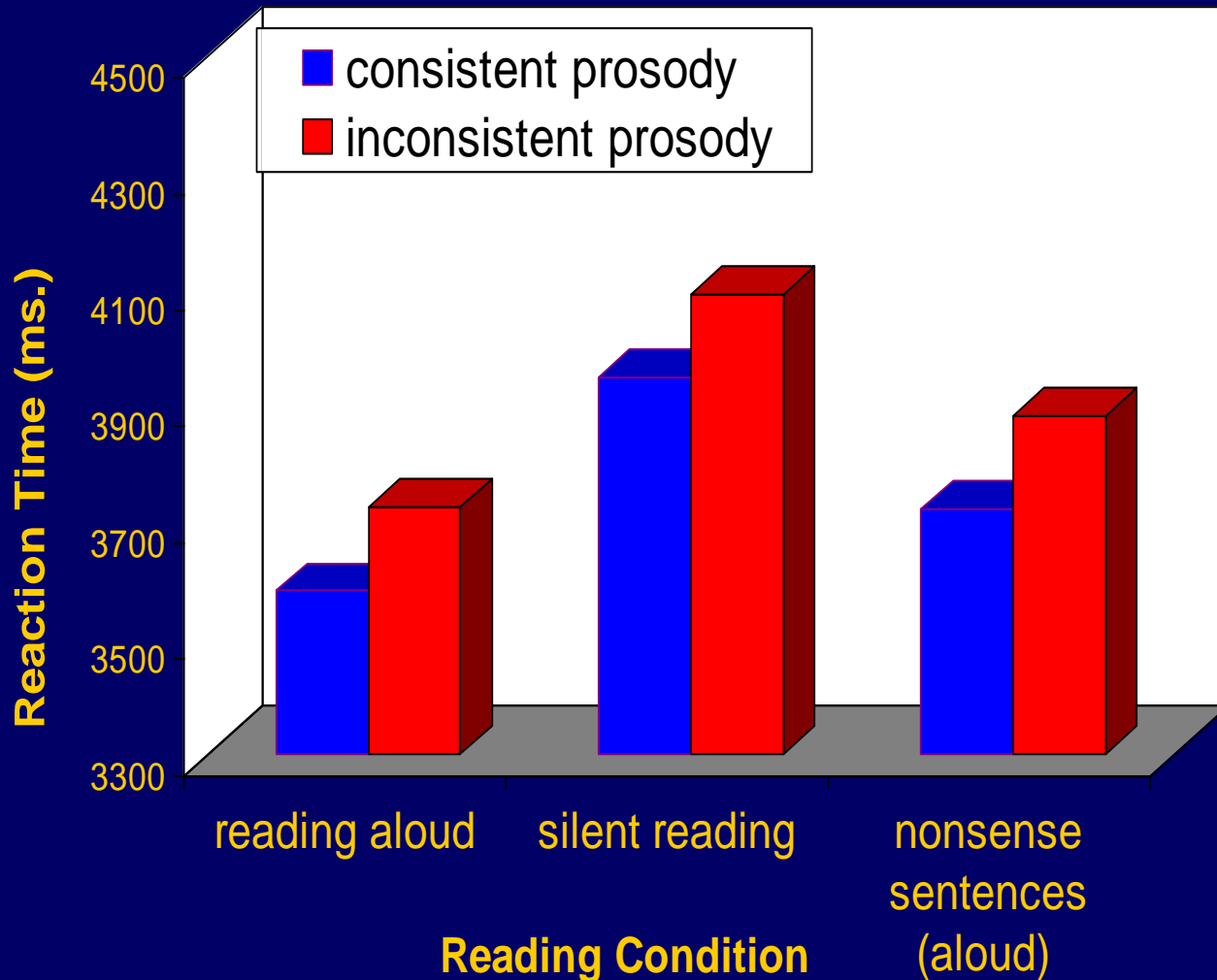
***or***

*The table saw two hats eating the music, but it **took a kiss of the hat with the bottle.***

test phase -

- Old sentences - consistent prosody
- Old sentences - inconsistent prosody
- New sentences

# The effect of prosodic consistency on sentence recognition





# Conclusions

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- A prosodic representation is formed during reading and maintained in memory.
- The prosodic representation is produced even in silent reading, hence it appears to be inherent to text processing and not just a by-product of reading aloud.
- The prosodic representation is produced on the basis of structural processing and appears to be independent of semantic integration.



# Experiment 4

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## Hypothesis:

Natural prosody assists in maintaining sentence content and organization in working memory during reading.

## Prediction:

Impairing natural reading prosody would impair immediate recall of the sentence.



# Immediate recall

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## natural prosody:

meaningful: *The fat cat with the gray stripes ran quickly to the little kitten that lost its way.*

nonsense : *The sad gate with the small eyes went carefully to the happy computer that sang his leafs.*

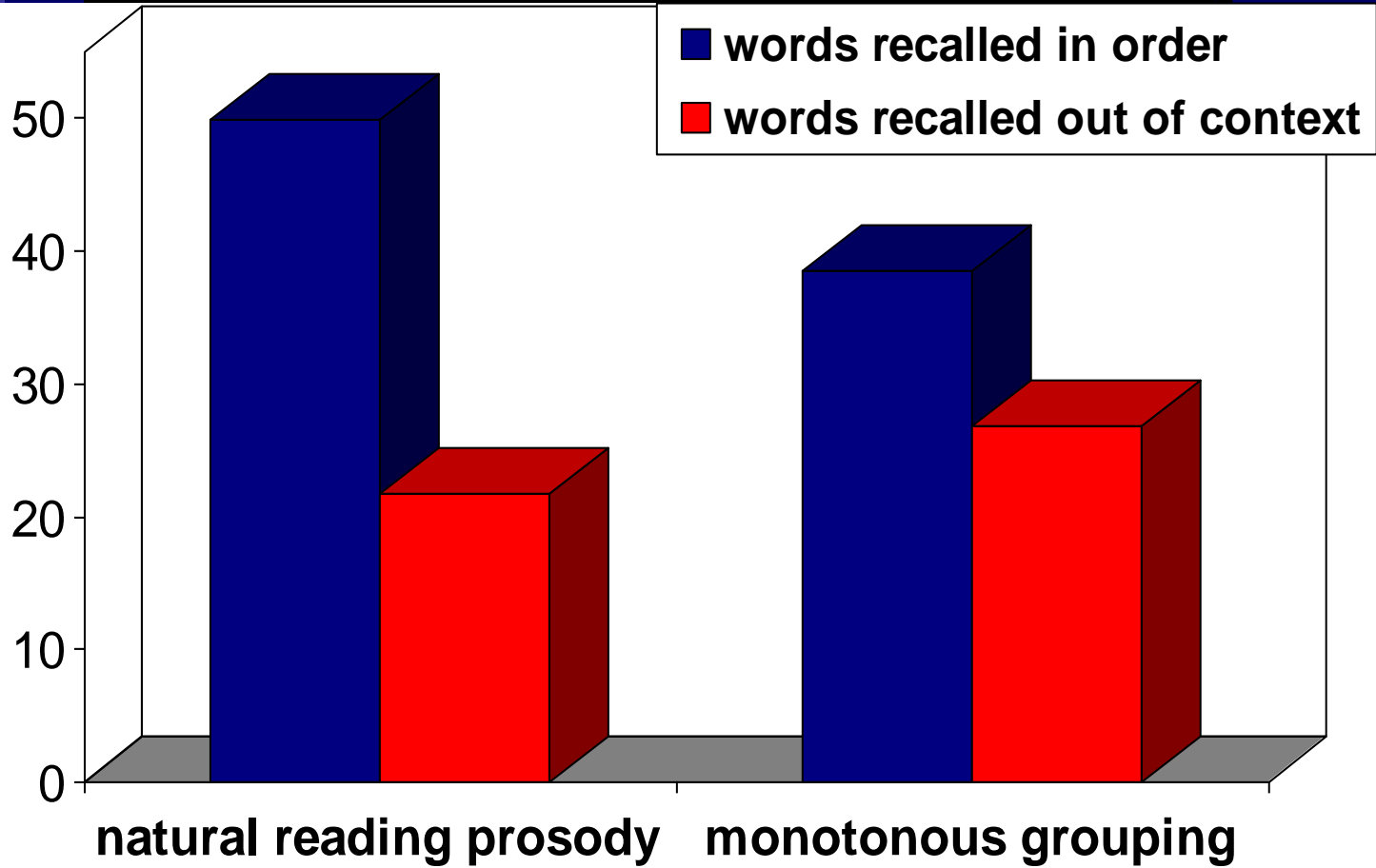
## monotonous grouped prosody:

meaningful : *The fat cat // with the gray // stripes ran quickly // to the little // kitten that lost // its way.*

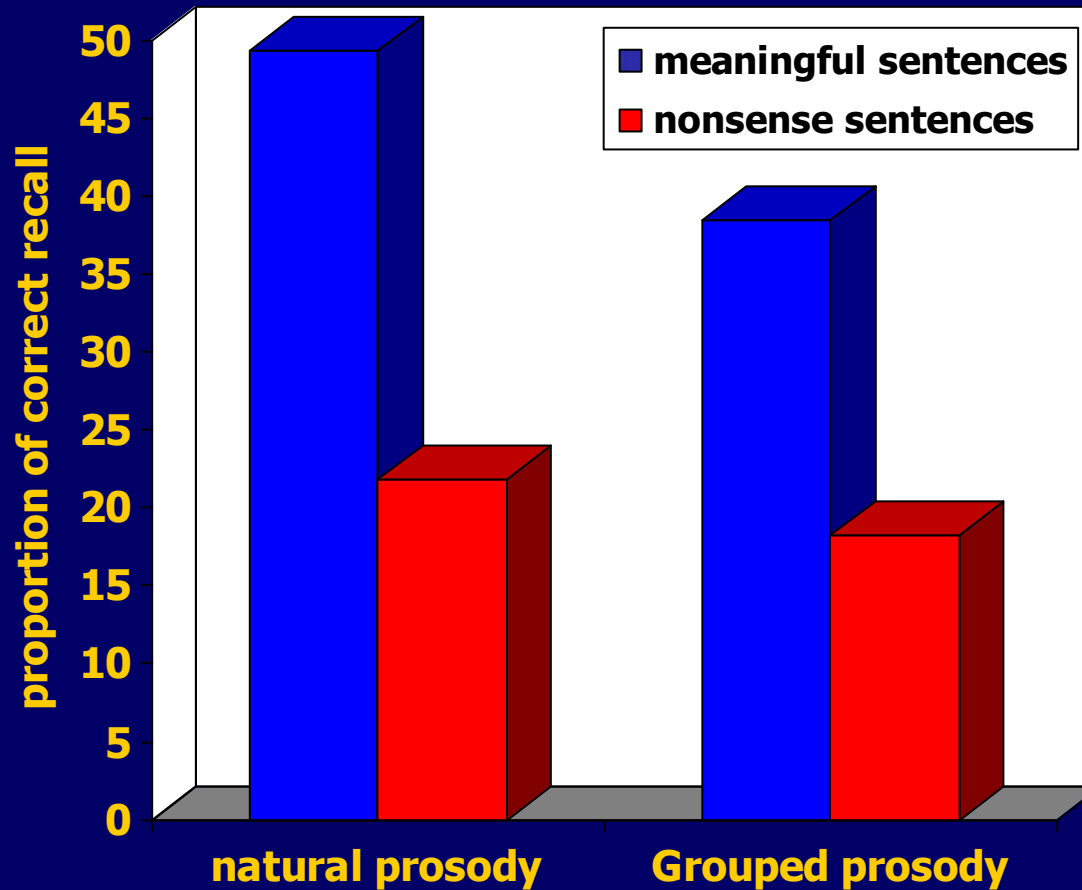
nonsense : *The sad gate // with the small // eyes went carefully // to the happy // computer that sang // his leafs.*



# The effect of reading prosody on immediate recall



# The effect of reading prosody on order recall: meaningful vs. nonsense sentences







## *Conclusions*

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- Natural reading prosody helps in maintaining the organization of verbal information in memory.
- Natural prosody seems to facilitate semantic integration.
- Natural reading prosody assists in maintaining verbal information in memory more than arbitrary grouping, suggesting that natural reading prosody assists because it conveys the structural organization of the sentence.



## Summary

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The findings suggest that prosodic representations created spontaneously on the basis of early structural processing help in maintaining verbal information as a structured pattern that conveys the organization of the sentence and thereby they facilitate semantic integration.

Further research we have conducted attempted to clarify the contribution of these representations to integrative processes underlying reading comprehension (see handout).

# The effect of prosodic consistency on sentence recognition – The puzzle

