

Modelling the headturn preference procedure

Insights from an end-to-end model for speech processing and behaviour generation

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Research Questions

- How can we interpret the results of infant studies?
- Which (implicit) assumptions are made?
- Can we use computational modelling to address experimentally untestable questions?

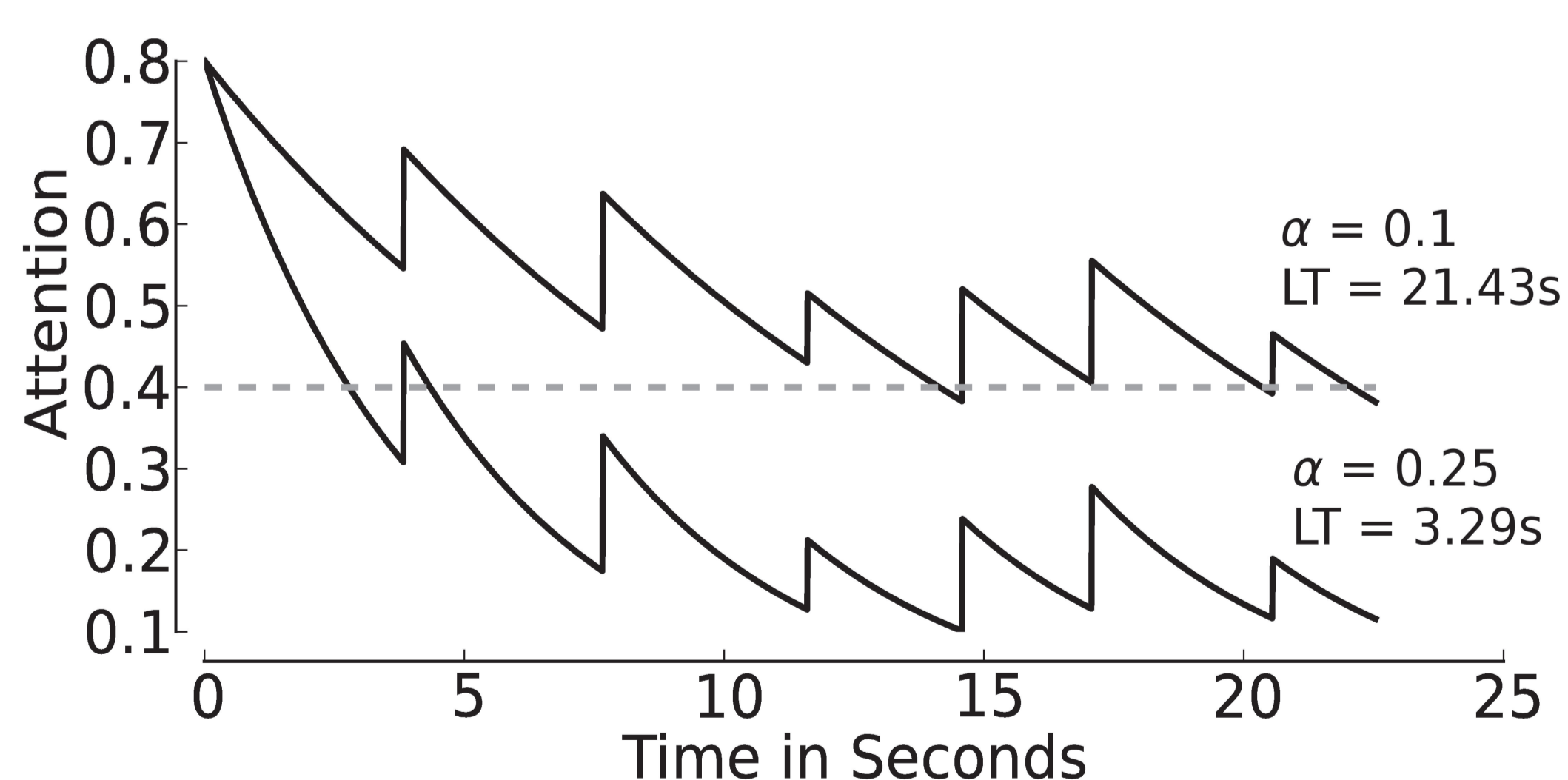
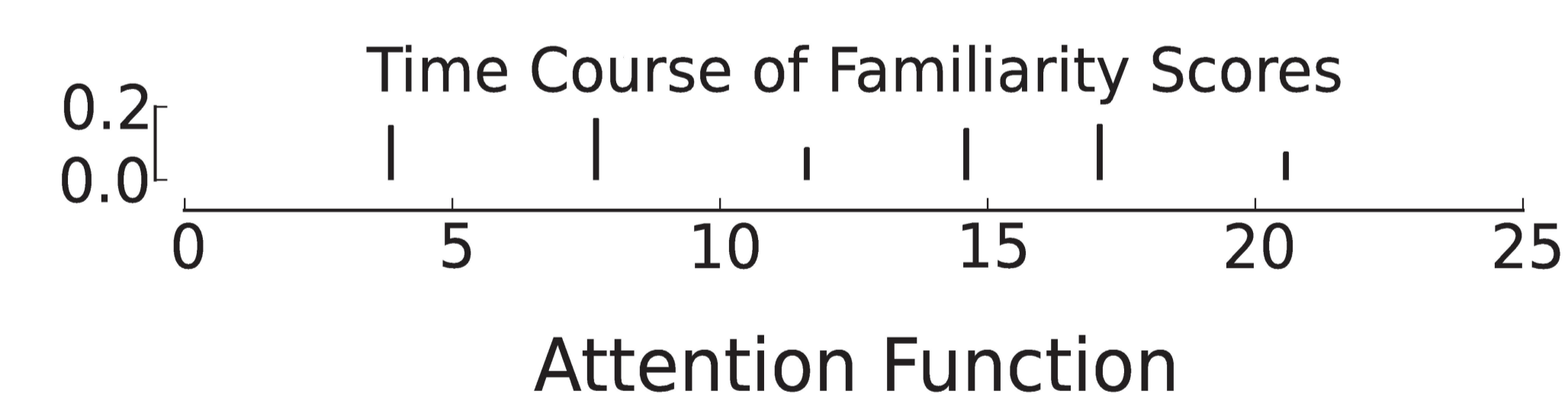
The Headturn Preference Procedure (HPP)

- Widely used method, many results on early speech processing and language development stem from HPP studies
- Measures internal processes via listening preference indicated by headturns [2]

- 1 **Familiarisation** phase: store a word
- 2 **Test** phase: Listen to **sentences** that
 - (A) contain the familiar word
 - (B) contain a novel word
- 3 Compute listening times (LT)
Is there a difference between (A) and (B)?
→ Differences in LT reflect *recognition*

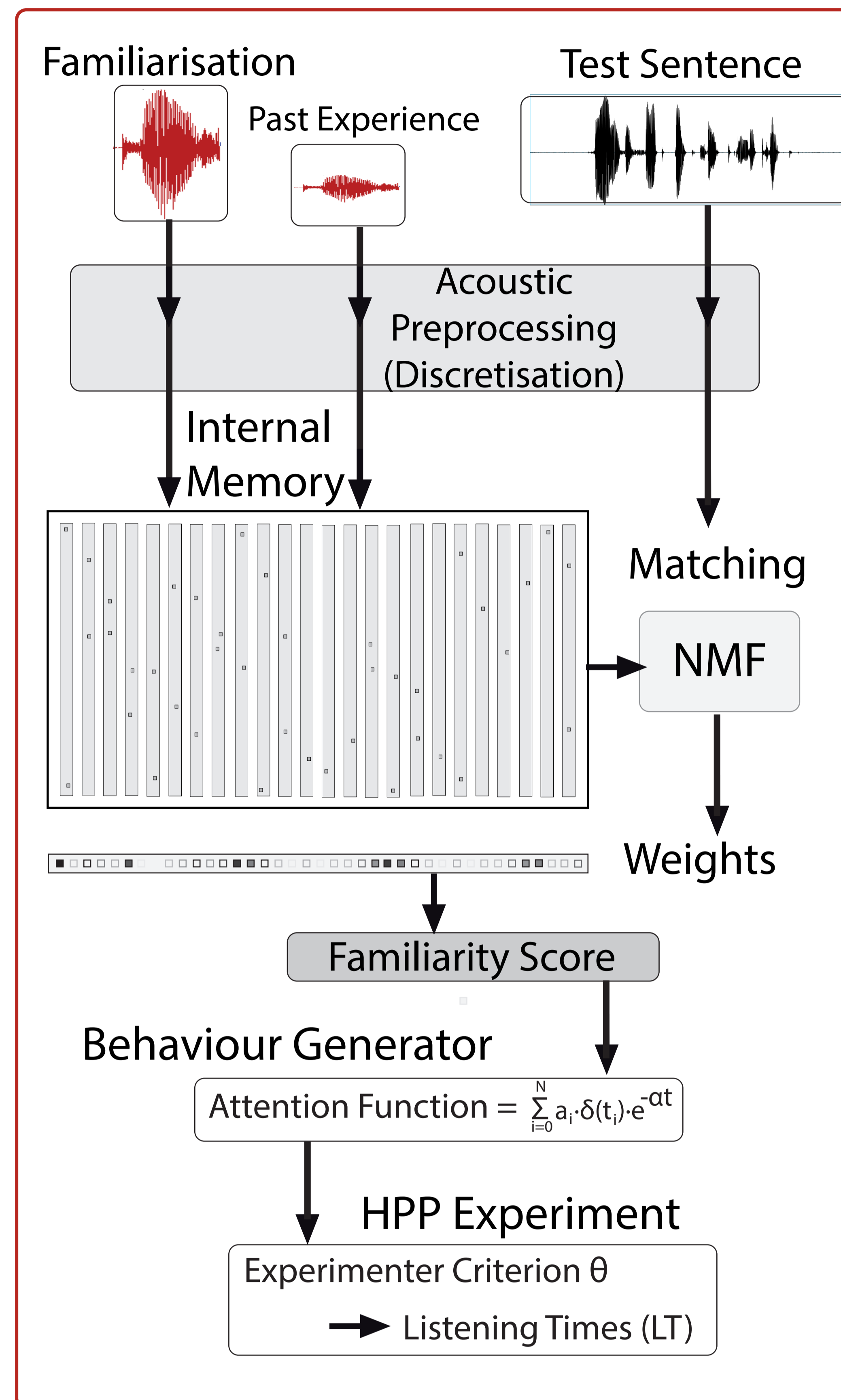
The Model

- Idea: Model test phase of a headturn study
- How many **assumptions** are necessary?
- Link internal processing and overt behaviour
 - Separate module to convert internal processing outcomes into headturns
 - Modulate behaviour based on internal processing and attention span
- Do **not** implement:
 - Language specific speech sounds
 - Segmentation procedure



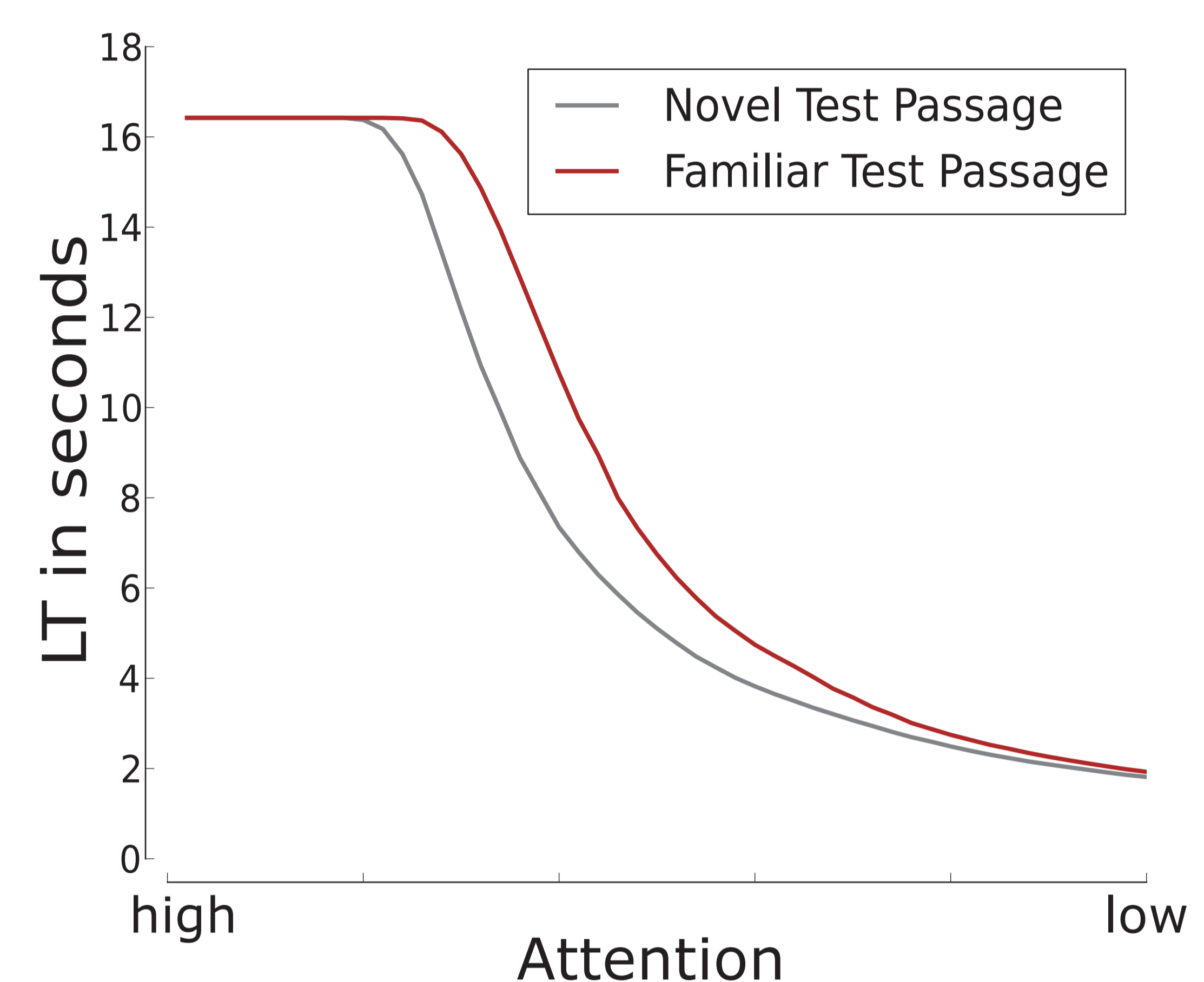
References

- [1] Houston, D.M. & Jusczyk, P.W. (2000). The role of talker-specific information in word segmentation by infants. *Exp Psychol-Hum Percept Perform* 26(5), 1570-82.
[2] Jusczyk, P. W., & Aslin, R. N. (1995). Infants' Detection of the Sound Patterns of Words in Fluent Speech. *Cognitive Psychol*, 29(1), 1-23.
[3] van Heugten, M. & Johnson, E.K. (2012). Infants exposed to fluent natural speech succeed at cross-gender word recognition. *J Speech Lang Hear Res* 55(2), 554-60.



Discussion

- Overall replication of infant data:
We can simulate listening preferences
- Sources of difference between speakers in stimulus material:
 - Model-specific property?
- Differences that can cause the effect:
 - Pronunciation differences
 - Speech rate



Conclusion

- Not all assumptions in HPP warranted:
 - Attention span crucial
 - Segmentation not necessary
 - Acoustic match sufficient
- Further research into the model and infant data needed to clarify role of stimulus material

Case study: Gender effect

- Changes in speaker gender lead to no LT difference [1]
Or do they? [3]
- Results from infant studies mixed!
Possible sources:
 - Different L1?
→ Canadian vs American English
 - Different method?
→ Both HPP
 - Different stimulus material?
→ yes!

Results

- Strongest preference for the same speaker
- Strength of preference dependent on individual speaker
- Direction matters
 - male to female seems harder than vice versa
- Attention span determines strength of LT difference

