

# Modeling word duration in language production

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## Introduction

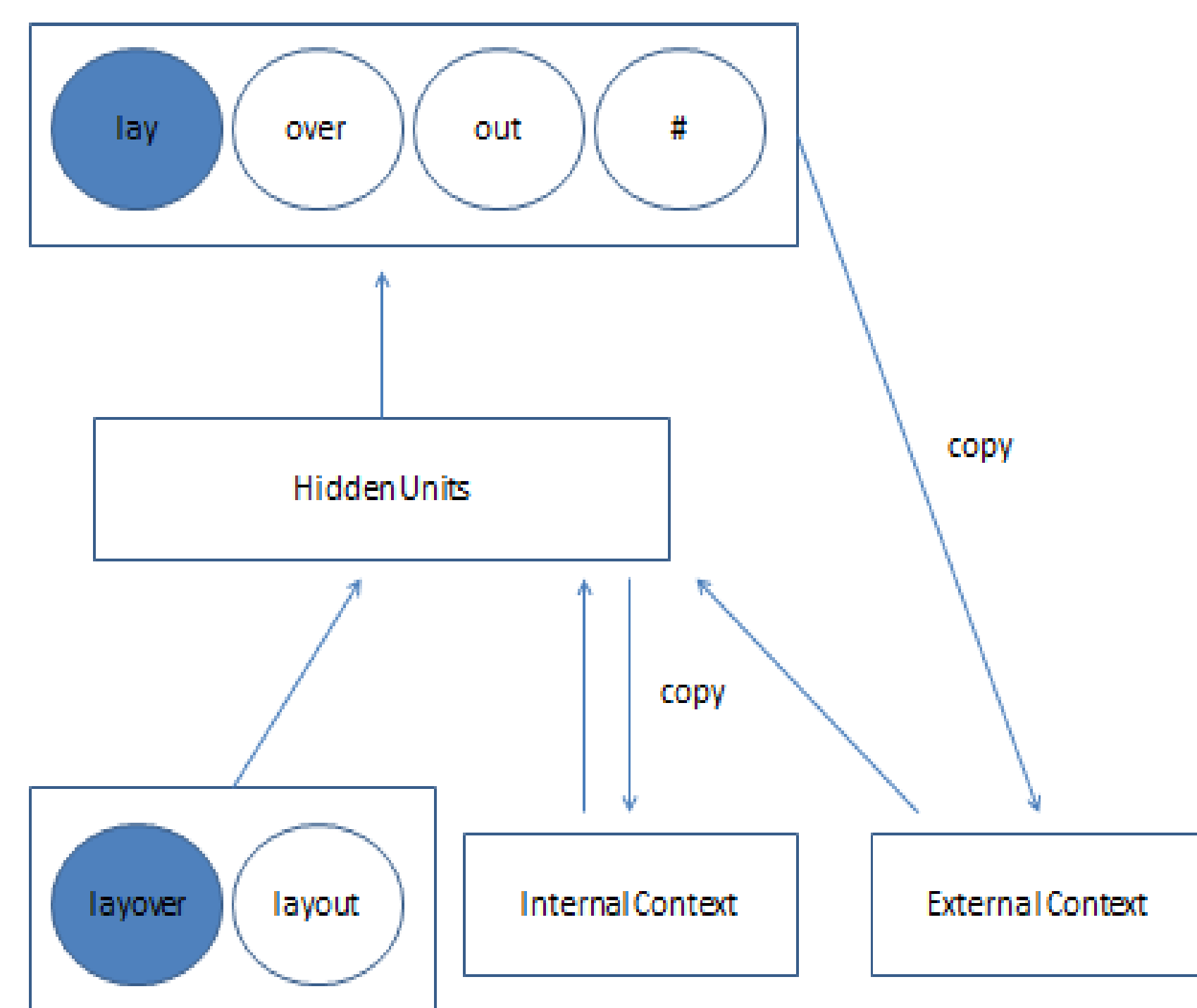
- Speakers lengthen words that are new, informative, or unpredictable in a conversation while shortening words that are given, predictable or non-informative (e.g. Aylett & Turk, 2004; Bell et al., 2009; Fowler & Housum, 1987; Jurafsky, 2001).
- One explanation is that duration reflects underlying production processes. However, if lengthening is linked to planning difficulty, what benefit could a speaker derive from lengthening a new word once articulation has already begun?
- Sevald & Dell (1994) argue that phonological selection is serial.  
TICK - PICK is EASY  
PICK - PIN is HARD
- We investigate whether complexity in a serial phonological encoding system predicts duration both between and within words. Our test cases:  
Initial Overlap LAYOVER-LAYOUT  
Final Overlap OUTLAY-OVERLAY

## Hypothesis

Reduction and lengthening of words may be due to the serial nature of phonological encoding.

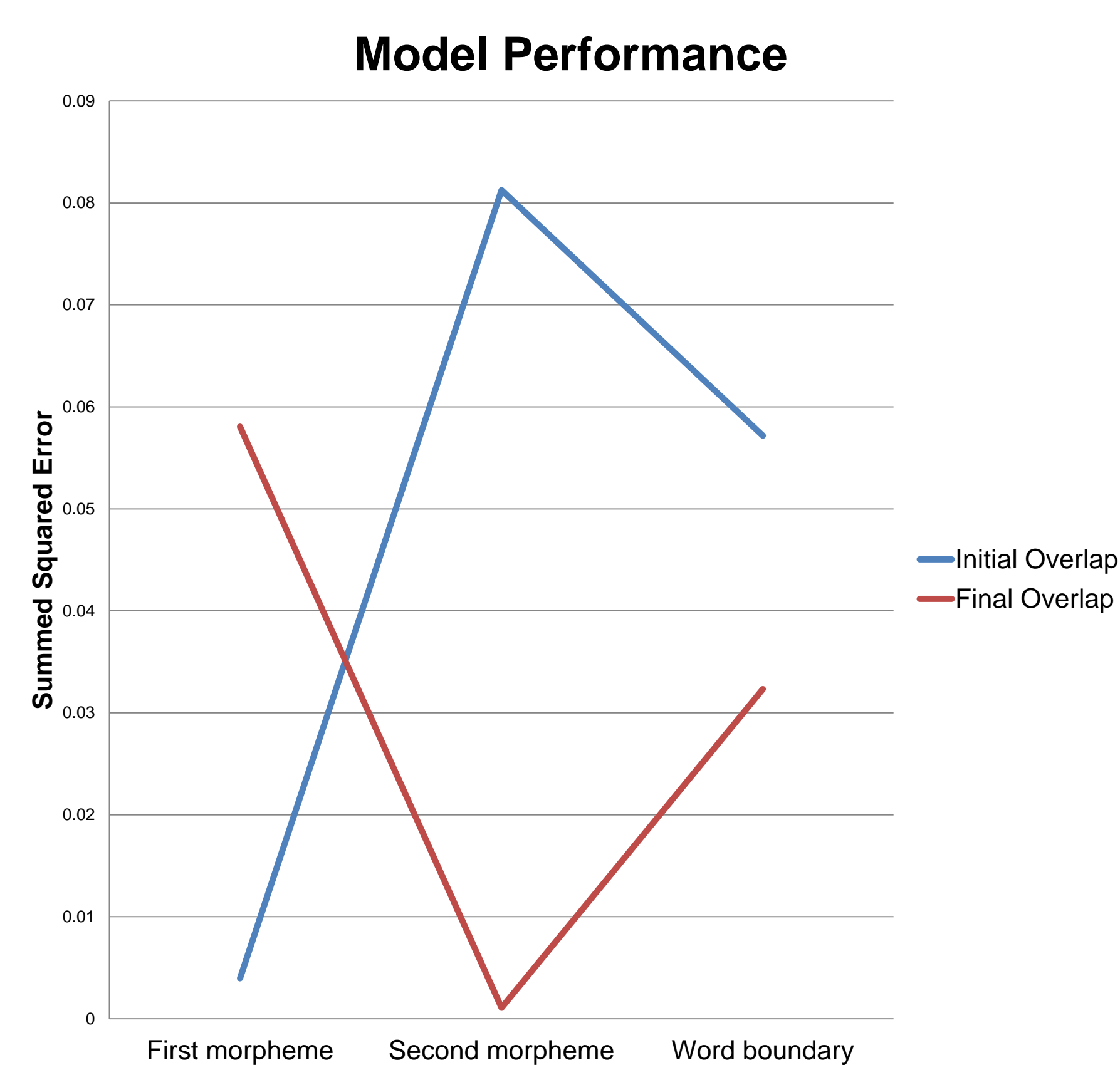
## Model

We used a simple recurrent network (SRN) inspired by Dell et al. (1993). Two types of models were trained to produce two-word vocabularies. One was trained to produce two compounds that overlapped in their initial morpheme (e.g. layover, layout). The other was trained to produce compounds that overlapped in their final morpheme (e.g. outlay, overlay). We trained 10 models of each kind for 200 epochs.



## Model Predictions

- Speakers should produce words that overlap initially with longer duration than words that overlap finally.
- Speakers should be slower to produce the parts of the word that do not overlap in the two conditions.



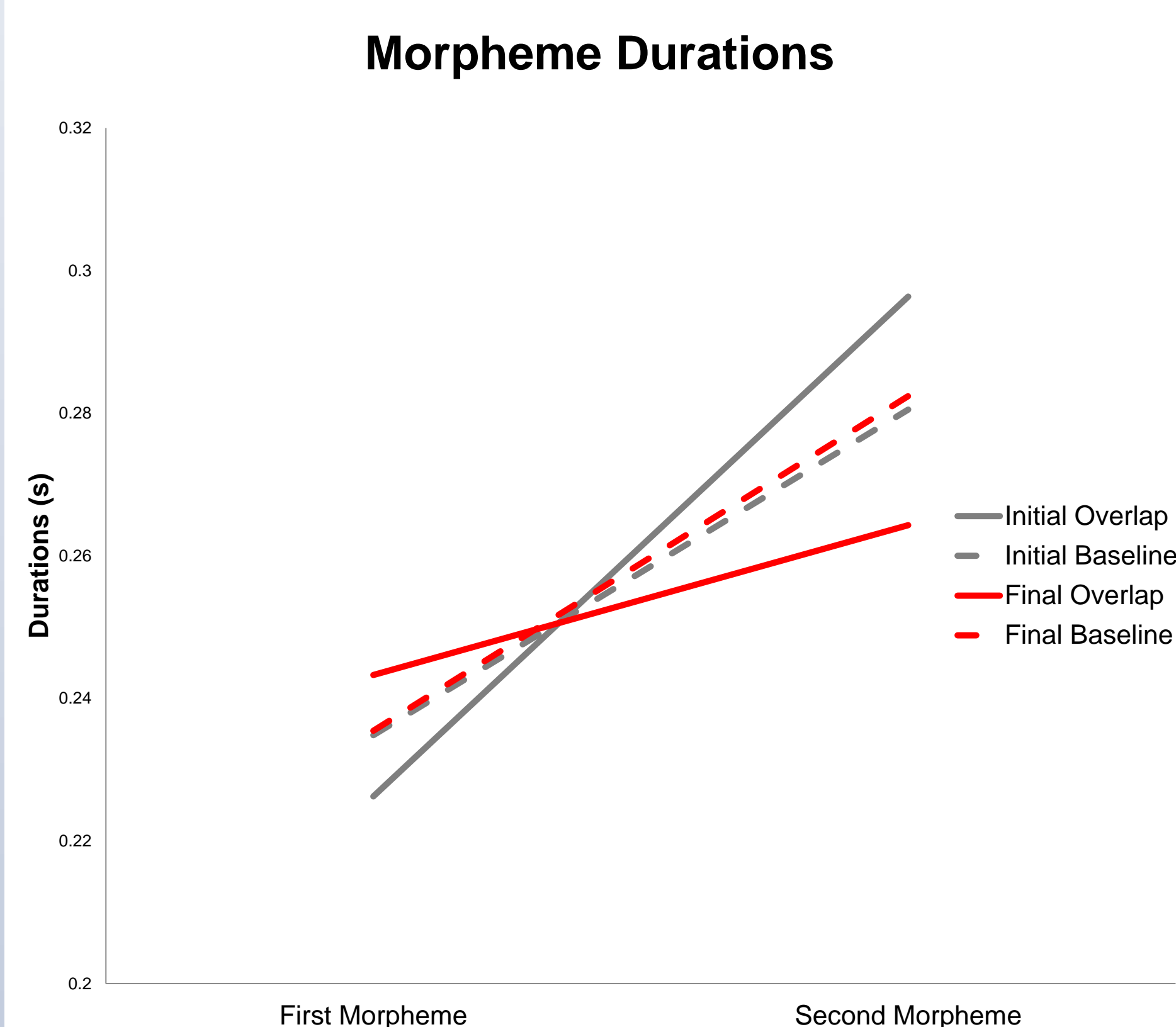
## Method

- 15 undergraduate participants
- Speakers had 8 seconds to produce alternating word sequences that overlapped either initially or finally.
- Target words were compared to a baseline condition that included the target word and another compound that did not overlap with the target.

## Example:

- Initial Overlap: layover layout
- Final Overlap: overlay outlay
- Initial Baseline 1: layover handout
- Initial Baseline 2: layout handover
- Final Baseline 1: overlay handout
- Final Baseline 2: outlay handover

## Results



- There was a 3-way interaction between trial type, morpheme position, and overlap ( $t = 10.57$ ).
- Initial overlap led to longer overall word durations than final overlap did.
- In both conditions, the non-overlapping morpheme was longer than the overlapping morpheme.
- Both of these results closely resemble what the SRN models predicted.

## Conclusions

Production processes involved in phonological selection can provide an explanation for duration differences both within and across words. In this case, complexity may occur in phonological encoding because of the nature of serial retrieval. The overlapping cues to retrieval that occur in words that are phonologically similar lead to interference, and ultimately, to production difficulty.

## References

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## Acknowledgments

This work was supported by NIH grant R01 DC008774 and a grant from the James S. McDonnell foundation.

