

A Computational Study of Late Talking in Word-Meaning Acquisition

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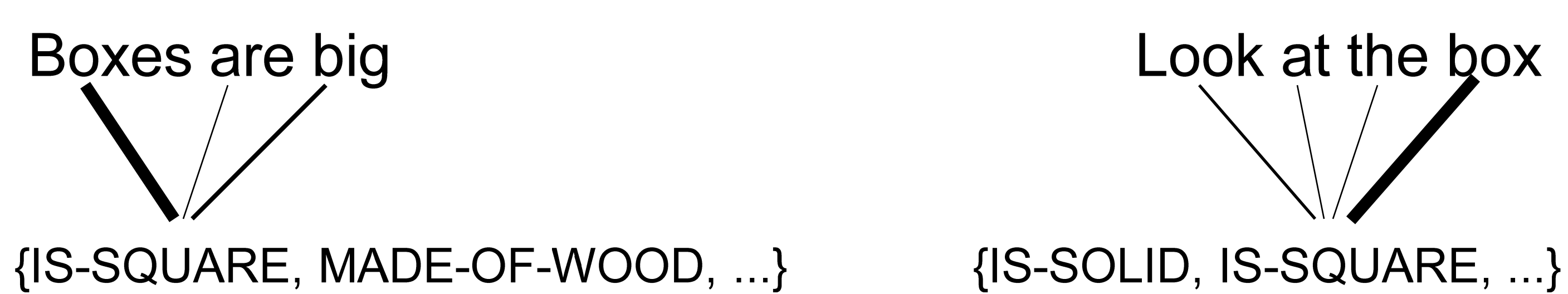
Late Talkers

- Most children are efficient word learners.
- Late talkers (LTs): slower vocabulary learners without evidence of any specific cognitive deficits.
- Some late talkers catch up with their age-matched peers while others exhibit Specific Language Impairment (SLI).
- Factors such as linguistic input and cognitive abilities contribute to late talking.

We use variations in attentional abilities to model differences between late-talking and normally developing children.

Our Model

- Aligning words to features and updating meaning probabilities

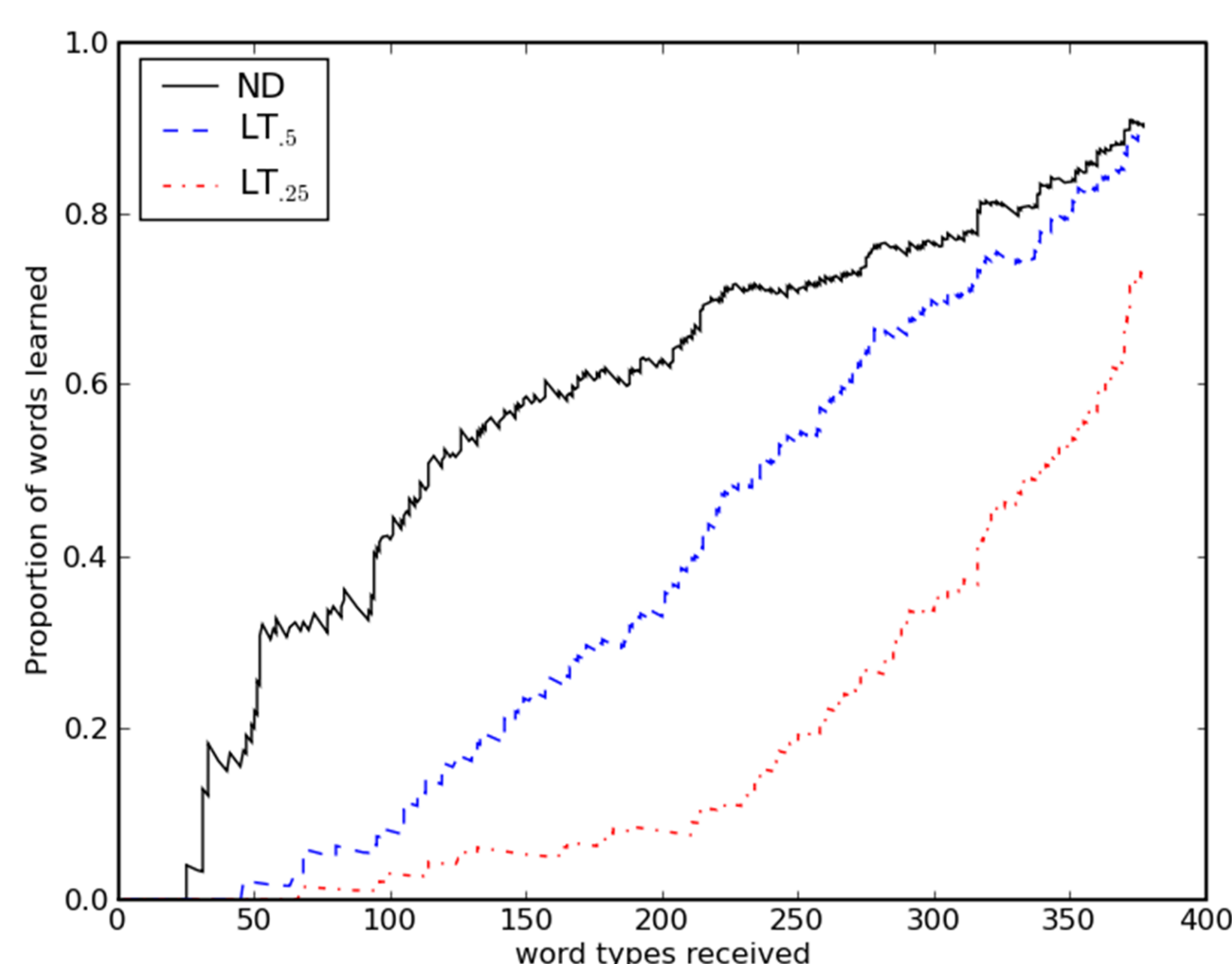


- Over time, the model learns to attend to important aspects of a scene.

Different learners are modeled by varying the development of their attentional abilities over time.

Patterns of Learning

- Trained the model on 76K utterances for a normally developing learner (ND) and two late talkers (LT_{fast} and LT_{slow}).
- Looked at the proportion of learned words out of all the seen words over time.

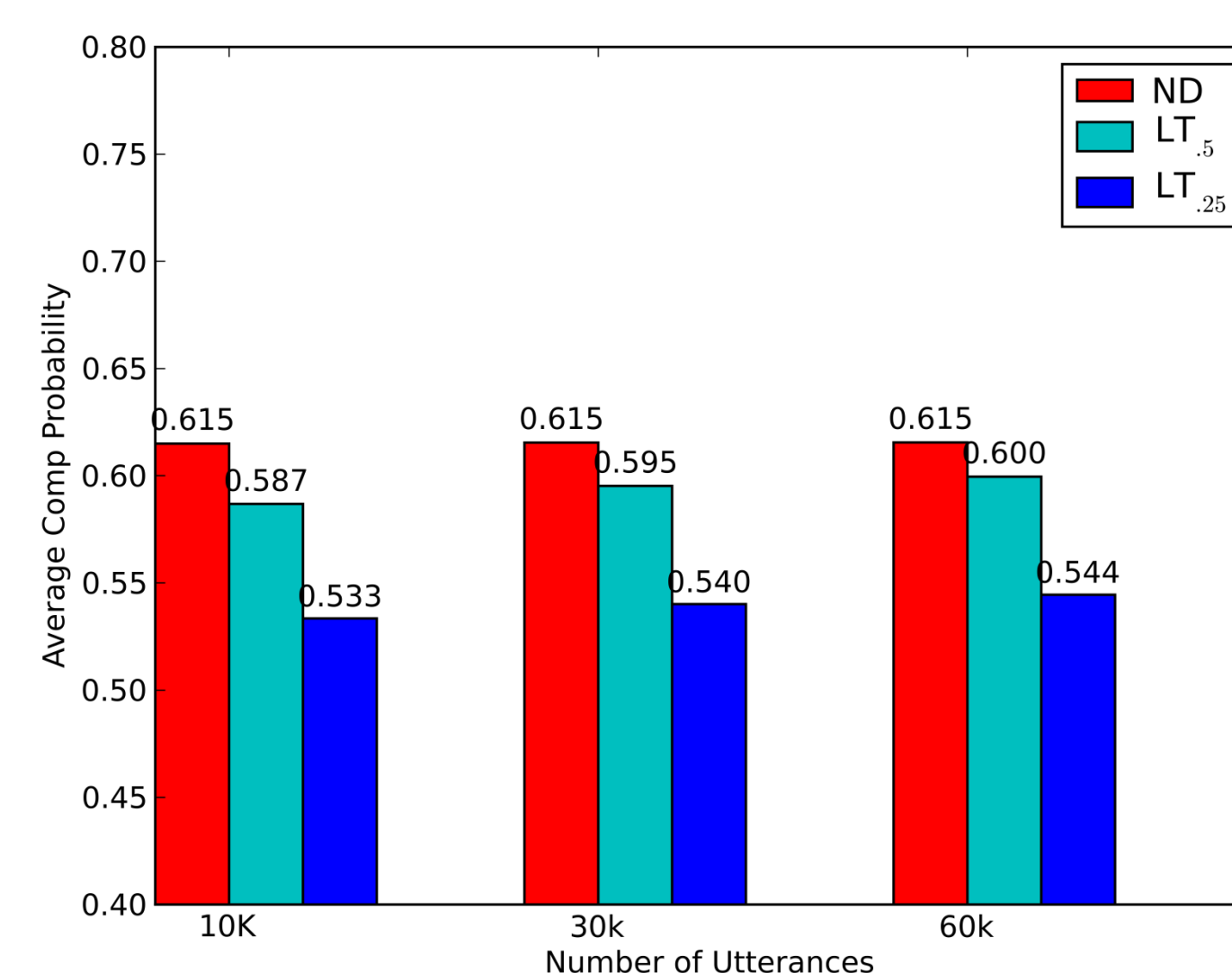


Proportion of noun/verb word types learned

Both LTs are slower than the ND in vocabulary learning. LT_{fast} eventually catches up with the ND but LT_{slow} doesn't.

Novel Word Learning Experiments

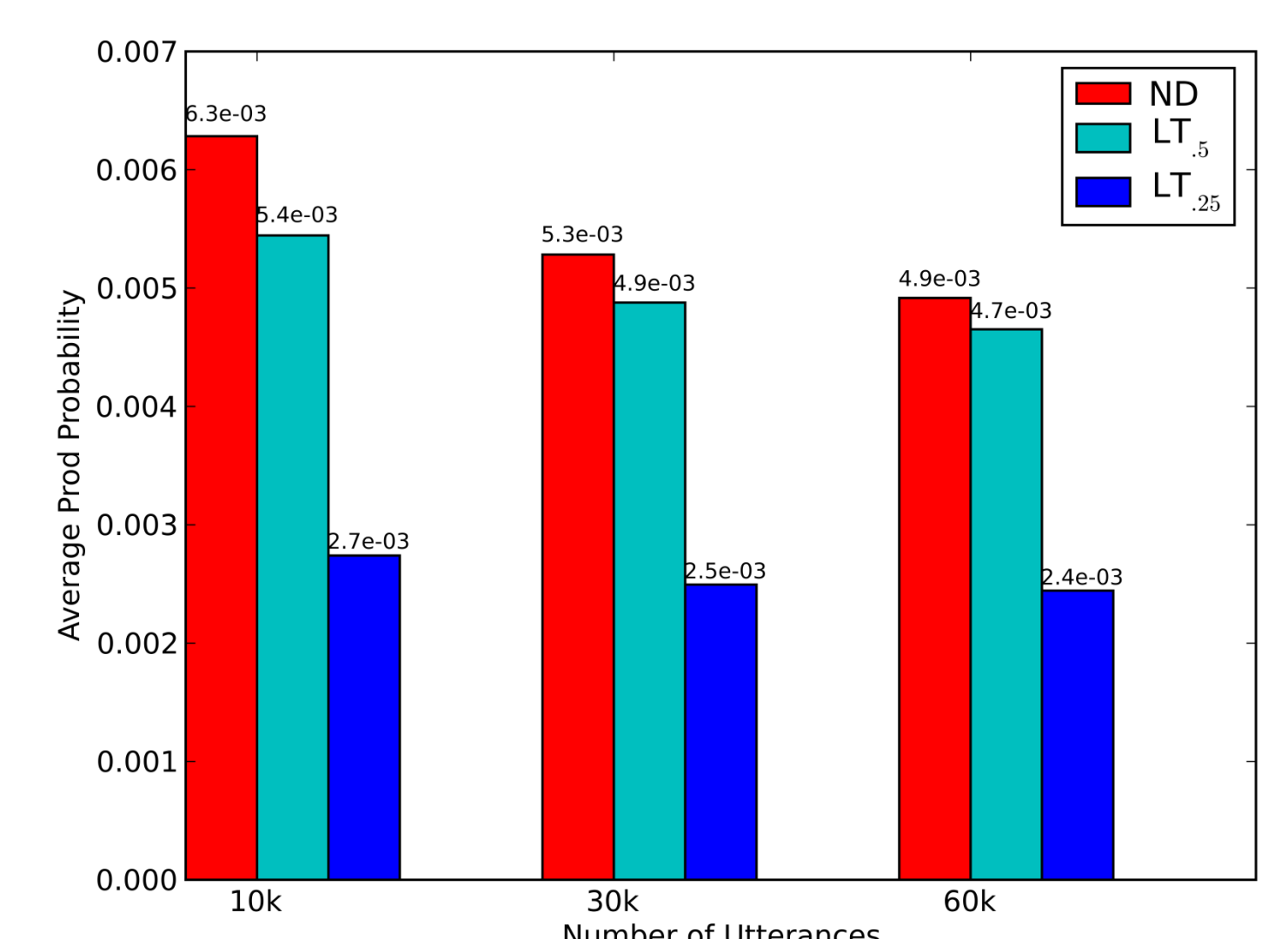
- Introduced a novel word to model after training on some input.
- Tested the model on two tasks: Comprehension, Production



Average Comp probabilities of learners over time.

In the production test, ND performs better than both LTs during all the stages of learning. The difference between LT_{fast} and ND is decreasing over time.

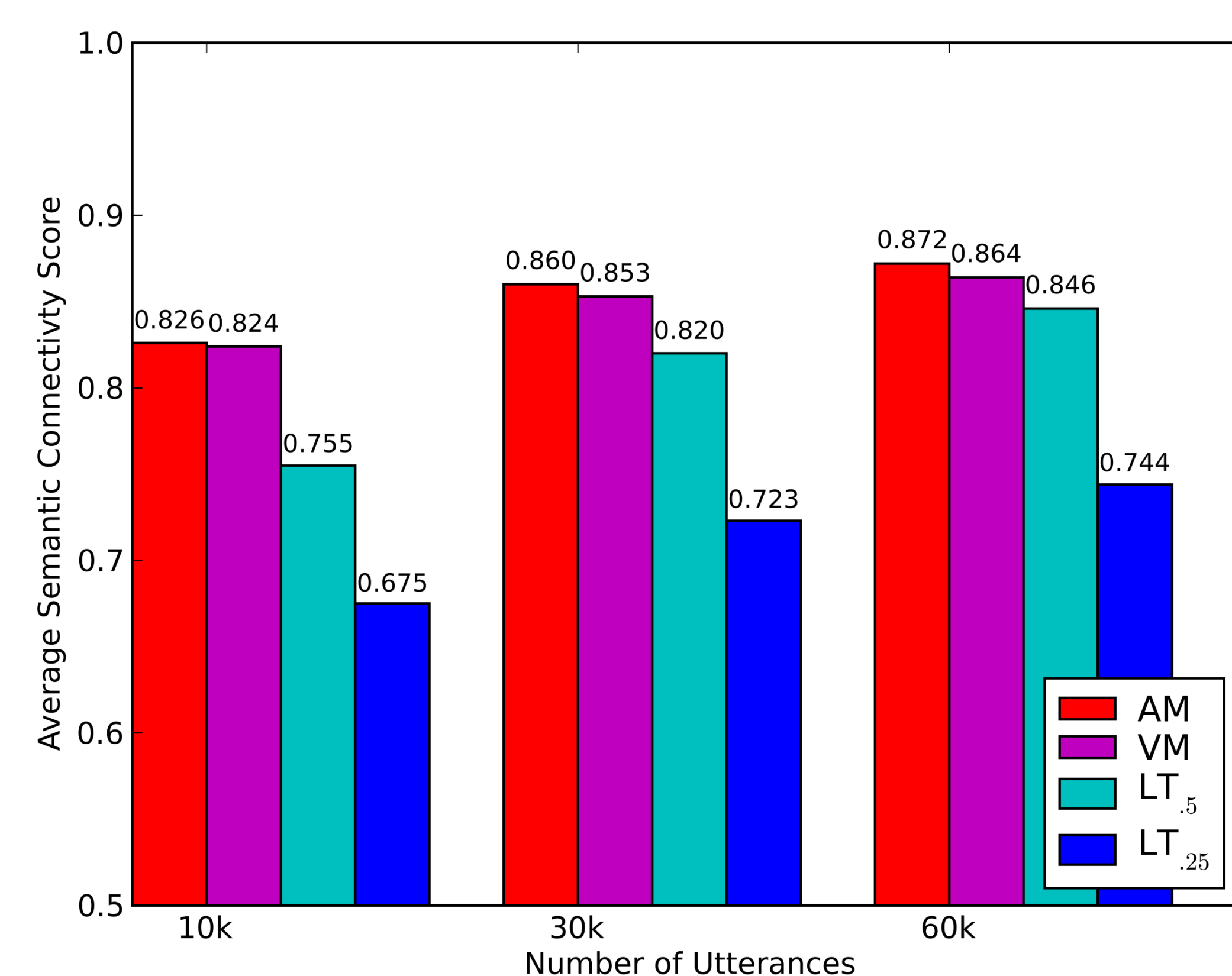
In the comprehension task, ND performs better than LT_{slow} in all the stages of learning but only better than LT_{fast} in earlier stages.



Average Prod probabilities of learners over time.

Semantic Organization Experiment

- Evaluated and compared the connectivity patterns of words within the semantic network of ND and LT learners.



Semantic connectivity scores of learners over time.

Both age-matched (AM) and vocabulary-matched (VM) models have more connected semantic networks than LTs.

Conclusion and Future Work

- The LT models exhibit delay in vocabulary learning, perform worse in novel word learning tasks, and have less connected networks.
- We modeled different learners by varying the attentional ability of the models: LT_{fast} eventually catches up with ND but LT_{slow} does not.
- By adding explicit categorization, we will be able to examine the learners in capturing semantic connections, and in using these connections to bootstrap word learning.