

## PROJECT SUMMARY

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### **Overview:**

This proposal aims to test a novel learning strategy to help poor readers and second language learners improve their language skills. The work targets the need to learn statistical patterns in language, which are essential for comprehension and fluent second language use, but which ordinarily take significant time to learn. This time crunch is compounded by the fact that a) for second language learners, typical classroom instruction does not facilitate statistical learning, and b) for poor readers, learning some of the crucial text-specific statistics requires abundant reading, exactly what the poor reader is unable to do. The approach is to use oral language production to speed learning of these critical language statistics, building on prior work showing that production boosts learning and comprehension of artificial languages better than comprehension practice itself does. The approach is applied to learning situations that are relevant both to second language comprehension and to reading skill.

The proposal furthermore investigates how this learning increases the efficiency of encoding and maintenance processes in verbal working memory, which varies with language comprehension and production skill. The work also investigates how prior learning affects subsequent learning, specifically the rich-get-richer or "Matthew Effects" in language use, where individuals who begin schooling opportunities with more knowledge get more benefit from the instruction, such that achievement gaps between high and low skilled individuals at the start of learning grow rather than shrink. The proposed experiments test learning in artificial languages, which provide good experimental control for the first proofs of concept, and then also propose tests in natural languages, which provide more applicability to the real-world challenges that learners face. Methods include language production, training studies, artificial grammar learning, reading comprehension, verbal working memory, and corpus analyses.

### **Intellectual Merit:**

The merit in this proposal rests in the novel learning methods and the rigorous testing of alternative hypotheses for how learning interacts with prior knowledge, verbal working memory, and skill in language use. The experiments pursue a Theory-to-Application pipeline investigating not only the degree to which language production boosts learning for oral language comprehension but also why it works, whether it can be extended to improving reading, how it is affected by prior knowledge, and how verbal working memory varies with language expertise and reading.

The proposal has merit and increased probability of success because the PI and her team have extensive expertise in key components of the research, including a) conducting corpus analyses that reveal key statistical patterns in English relevant to oral comprehension and reading; b) conducting reading studies investigating how language statistics affect fluent reading; c) developing methods for assessing individual differences in Text Exposure, the extent to which people engage with text via reading, being read to, and other methods; d) designing artificial languages that are learnable within a small number of experiment sessions yet capture important grammar and statistical properties of natural languages; e) testing the effects of comprehension vs. production on amount of learning of vocabulary and grammar and consequent levels of language comprehension skill; f) developing methods to assess verbal working memory and its relationship to language skill; and g) developing methods to elicit complex sentences in oral production, seeding interventions to increase learning.

### **Broader Impacts:**

Inability to achieve adequate levels of oral and written language skills create critical problems in the US. Low literacy is associated with tremendous costs to individuals and society: poorer health outcomes, lower earning potential, and higher rates of crime and incarceration. Low second language proficiency compounds these literacy issues in the US and also creates barriers between recent immigrants and the broader population, and limits US citizens participating in international business, the diplomatic corps, and translator services for government, military, and healthcare. The proposed research aims to ameliorate these issues by developing novel learning mechanisms to improve language and reading skill.