

LENA[®]

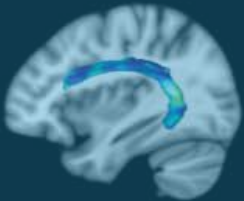
2018: The Year of the Conversational Turn

October 25, 2018

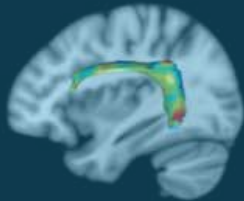


Higher
Connectivity

Lower
Connectivity



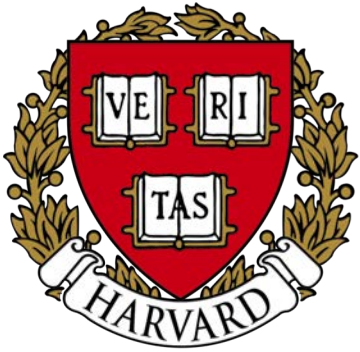
95 conversational
turns per hour



210 conversational
turns per hour

Agenda

- Introduction
- **Rachel Romeo:** “Conversational turns, socioeconomic status, and brain development in childhood”
- **Jill Gilkerson:** “10 Years Later: Predicting Longitudinal Outcomes from LENA Measures”
- Panel discussion facilitated by **Shannon Rudisill**
- Audience Q&A
- Closing



Conversational turns, socioeconomic status, and brain development in childhood

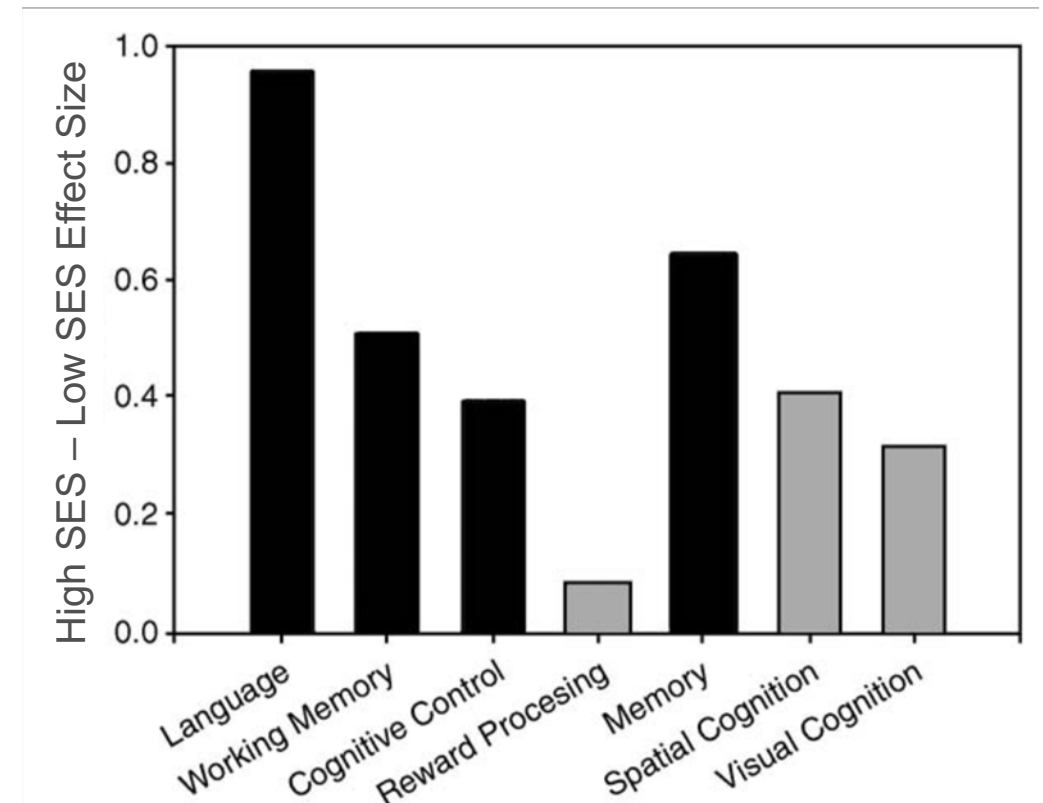
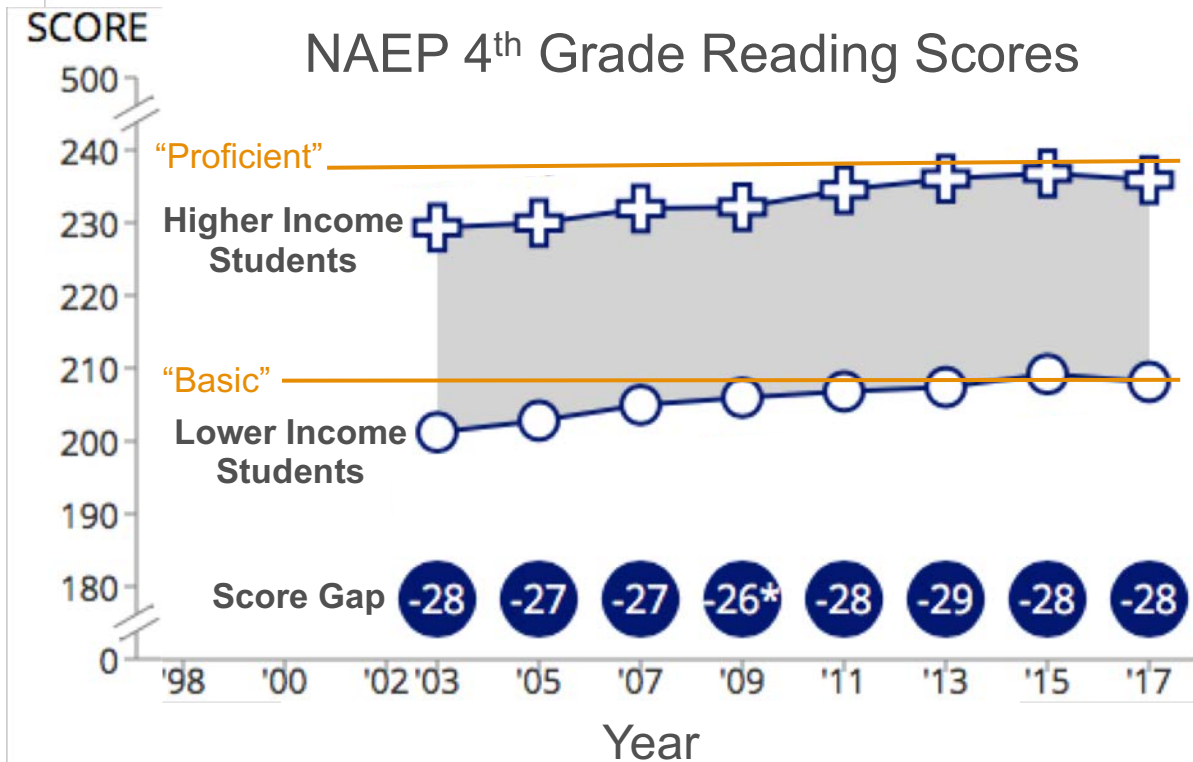
Rachel R. Romeo, PhD, CCC-SLP

Boston Children's Hospital
Massachusetts Institute of Technology
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The Achievement Gap

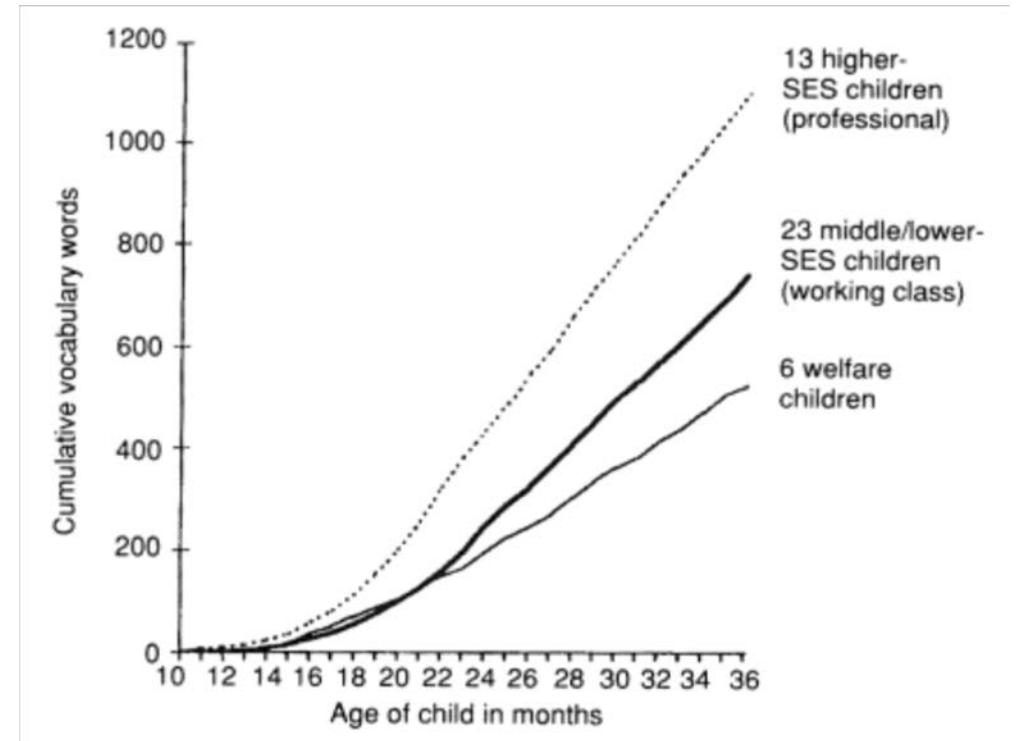
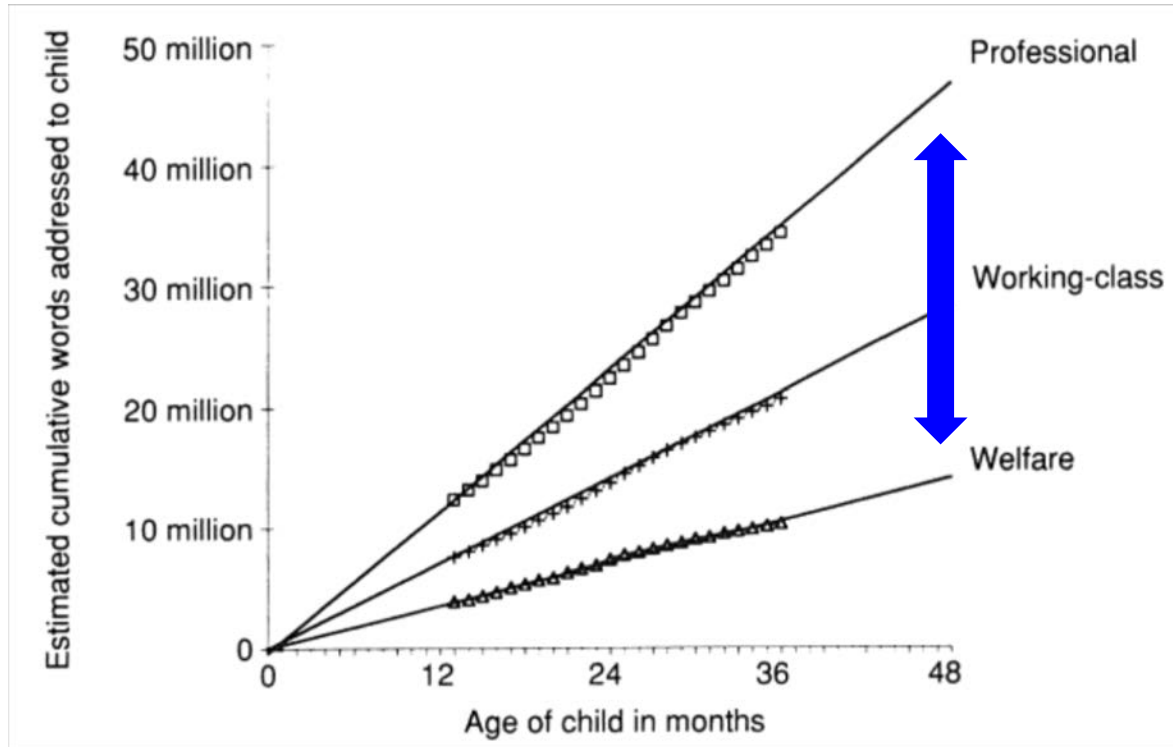
Socioeconomic status (SES) is a strong predictor of academic achievement and cognitive skill.

SES is more strongly related to language skills than other neurocognitive domains. Farah et al., 2006



The 30 Million Word Gap

“Parents in [higher SES] families devoted twice as much time to interaction and said three times as many words to their children.” Hart & Risley, 1995

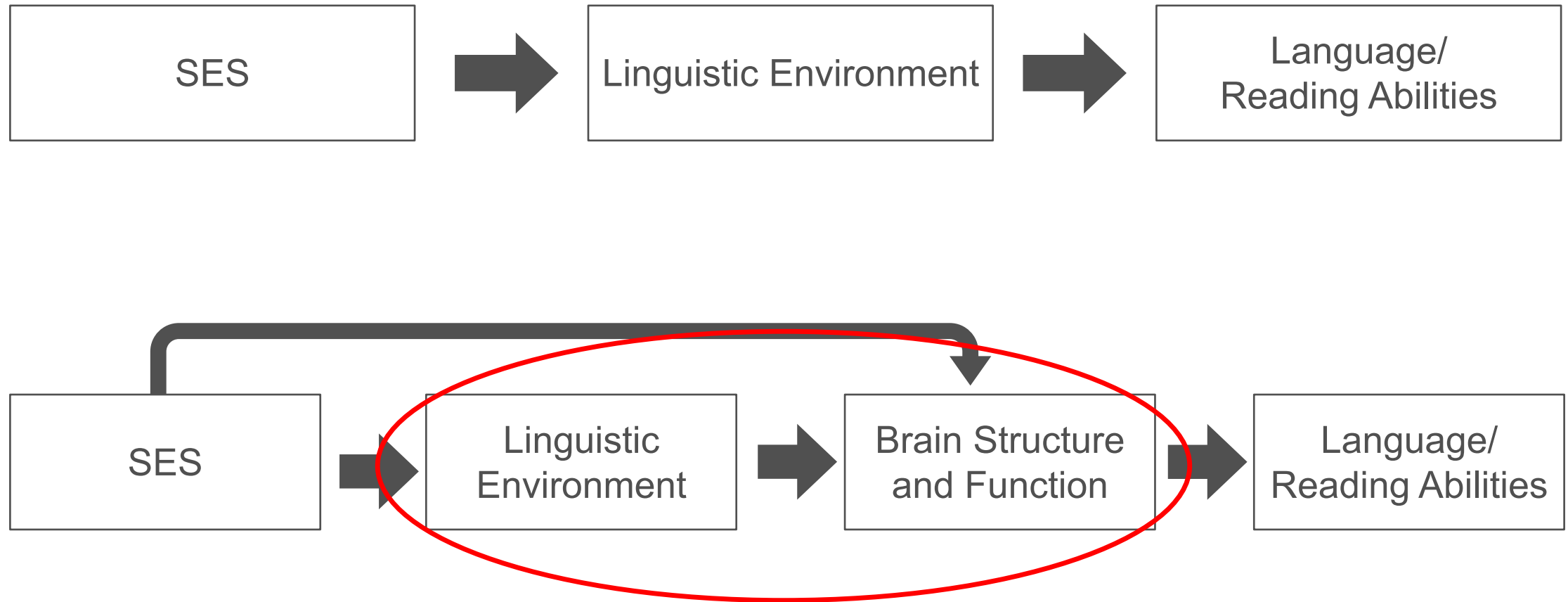


Word Gap



Achievement Gap in Language

Hypothesized Mechanisms



Methods part 1: Cognitive Development

63 children of varying SES

- Ages 4-6 years (in pre-K or K grades)
- Native English, no developmental delay or history of language impairment



Standardized language/cognition assessments

- Verbal composite = Receptive & expressive vocabulary and grammar knowledge
- Nonverbal composite = Reasoning, working memory, processing speed

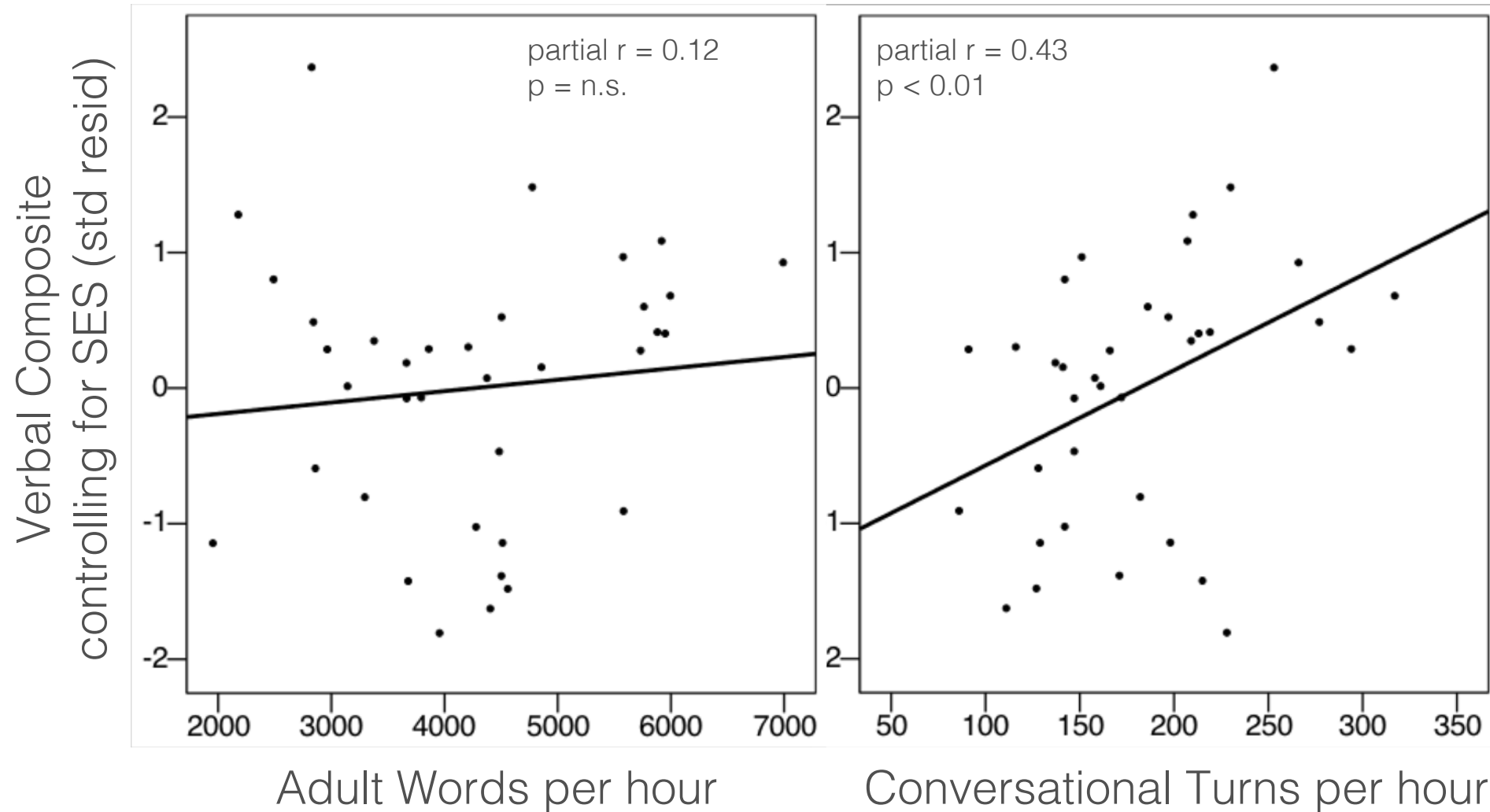


Home Language Recording

- 2 complete weekend days of **LENA**
- Estimate number of adult words, child vocalizations, and conversational turns



Conversational turns predict verbal scores, independent of SES



Romeo et al., *Psychol Sci*, 2018

Methods part 2: MRI scan

First acclimate child in “mock” scanner

Structural scan:

5-min while watching a movie
(n = 58)

Functional task:

6-min. language listening task
(n = 36)

White matter scan:

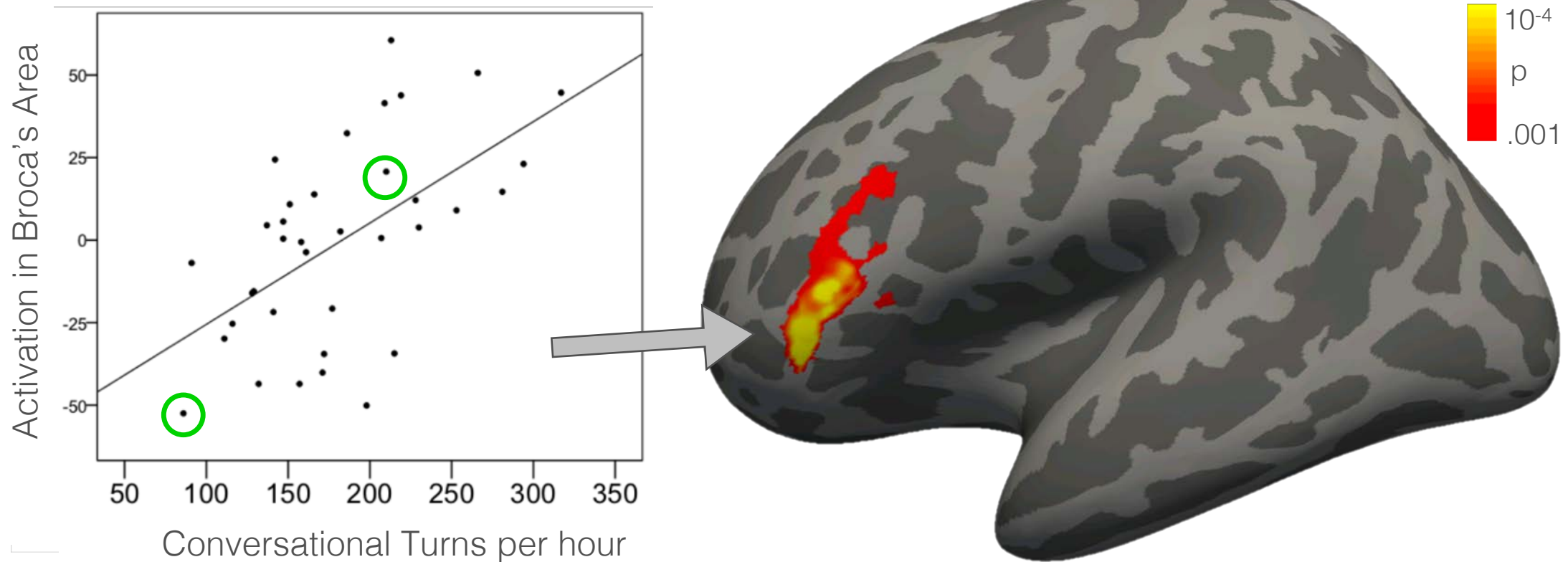
6-min while watching a movie
(n = 40)

After:

Learn about the parts of your own brain!



Greater brain activation in children who experienced more Conversational Turns

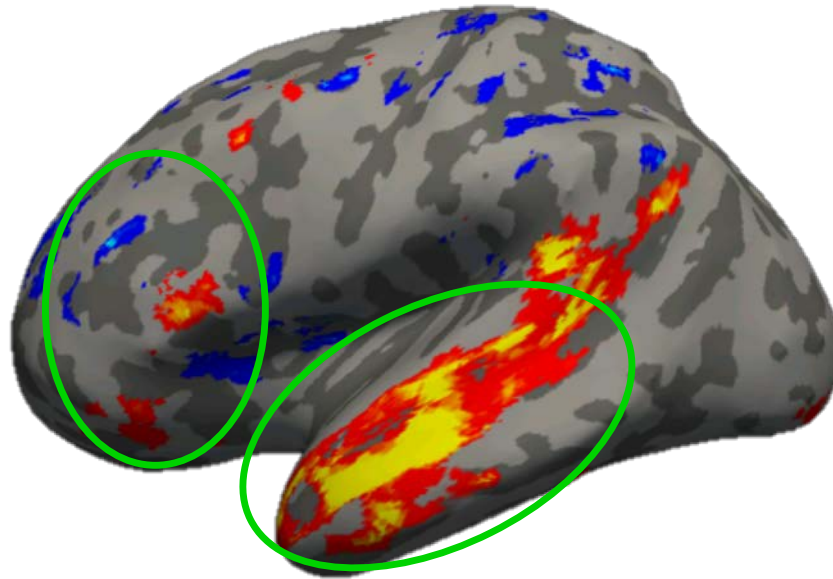


Romeo et al., *Psychol Sci*, 2018

A Tale of Two Brains

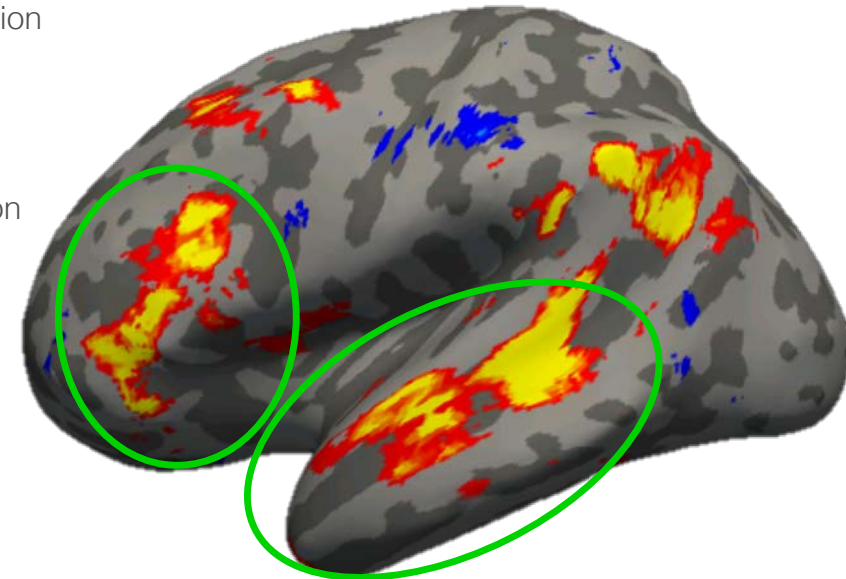
Two 5-year-old girls from lower SES backgrounds

95 turns per hour



Verbal score = 92

210 turns per hour

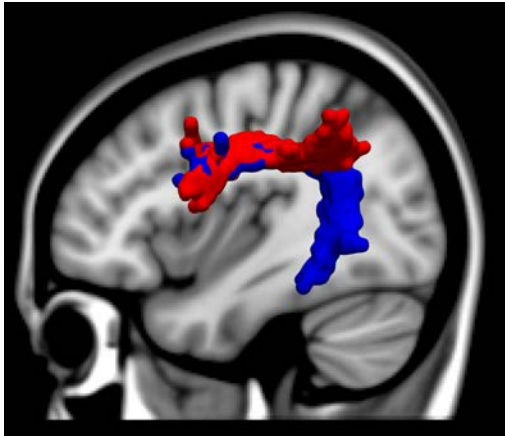


Verbal score = 121

Broca's activation + conversational turns together explain
23% of the total SES gap in children's language skills.

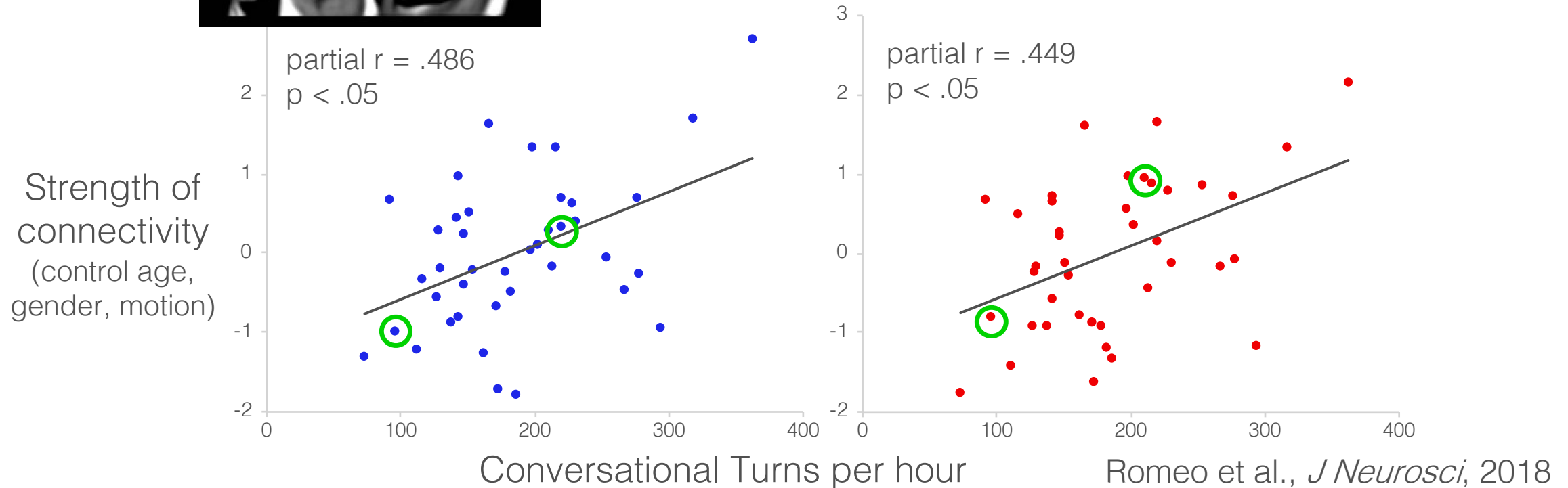
Romeo et al., *Psychol Sci*, 2018

What about brain *structure*?



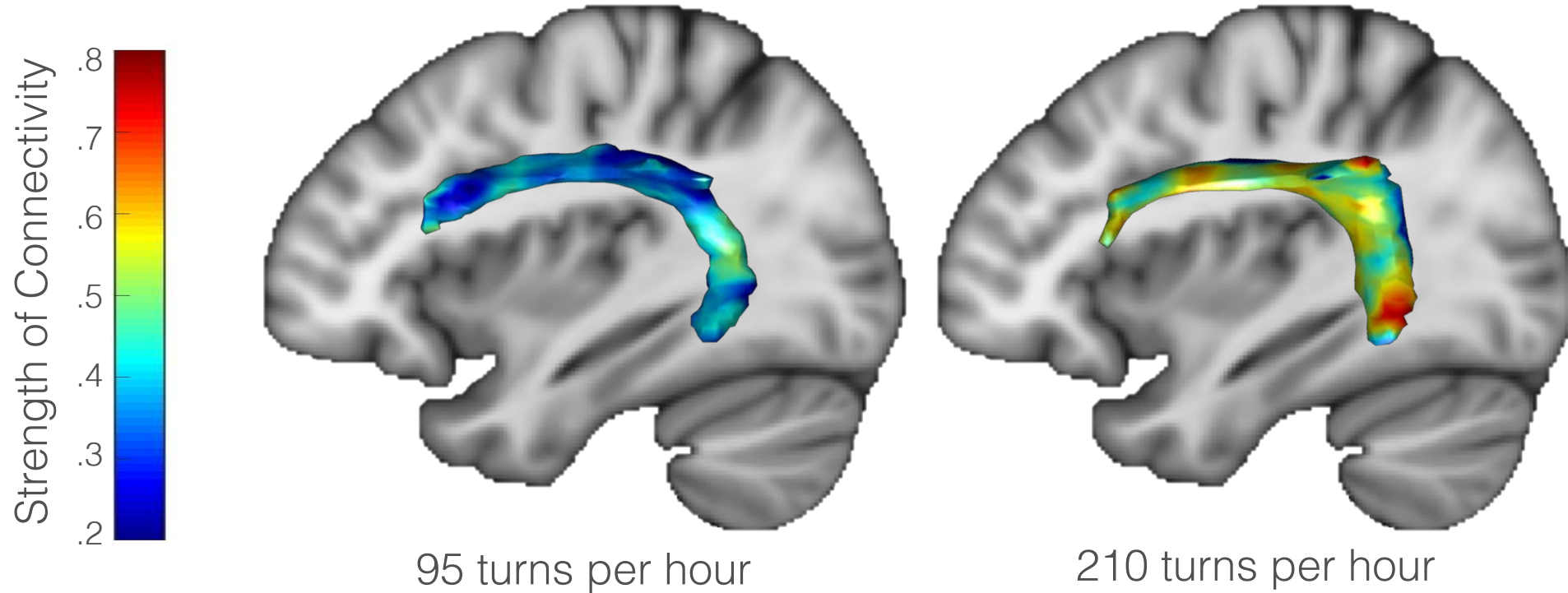
Arcuate Fasciculus
(connects Broca's to Wernicke's area)

Superior Longitudinal Fasciculus
(connects Broca's area to parietal lobe)



A Tale of Two Brains, continued

Two 5-year-old girls from lower SES backgrounds



Connectivity strength + conversational turns together explain
30% of the total SES gap in children's language skills.

Romeo et al., *J Neurosci*, 2018

Summary and Discussion

- Conversational turns (but not adult words alone) are associated with activation in Broca's area during language processing and the strength of white matter connectivity between Broca's and Wernicke's areas.
 - These measures explain 23-30% of the achievement gap in language skills.
- Why Broca's Area?
 - “Convergence zone” of smaller elements of language (e.g., phonemes, words) are unified into a coherent whole (Hagoort, 2014)
 - Greater activation = “deeper engagement” with language?
- Why conversational turns?
 - Incorporates exposure *quality* in addition to *quantity*
 - Language development relies on social interaction (Kuhl, 2007)
 - Increased opportunity for language “practice”

Acknowledgements & Funding

- Participating families and schools
- LENA Foundation

MIT

- John Gabrieli
- Julia Leonard
- Sydney Robinson
- Kelly Halverson
- Joshua Segaran
- Hannah Grotzinger
- Megumi Takada

Harvard

- Meredith Rowe
- Marty West
- Ethan Scherer

MGH

- Anastasia Yendiki

MGH Institute of Health Professions

- Emilia Motroni
- Lauren Pesta
- Veronica Wheaton
- Christina Yu

Transforming Ed & 1647 Families

- John Connolly
- Glennys Sanchez

Funding

- NICHD F31-HD086957
- NIDCD T32-DC000038
- Harvard Mind Brain Behavior Graduate Student Award
- Walton Family Foundation
- Gift from David Pun Chan

10 Years Later: Predicting Longitudinal Outcomes from LENA Measures

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Jill Gilkerson, Jeffrey A. Richards, Steven
F. Warren, D. Kimbrough Oller, Rosemary
Russo, Betty Vohr



Previous Research

- Early Language environment → Child Development

(e.g., Hart & Risley, 1992, 1995; Walker, Greenwood, Hart & Carta, 1994; Huttenlocher, Haight, Bryk & Lyons, 1991; Hoff, 2003; Rowe, 2008; Landry, Smith & Swank, 2006)

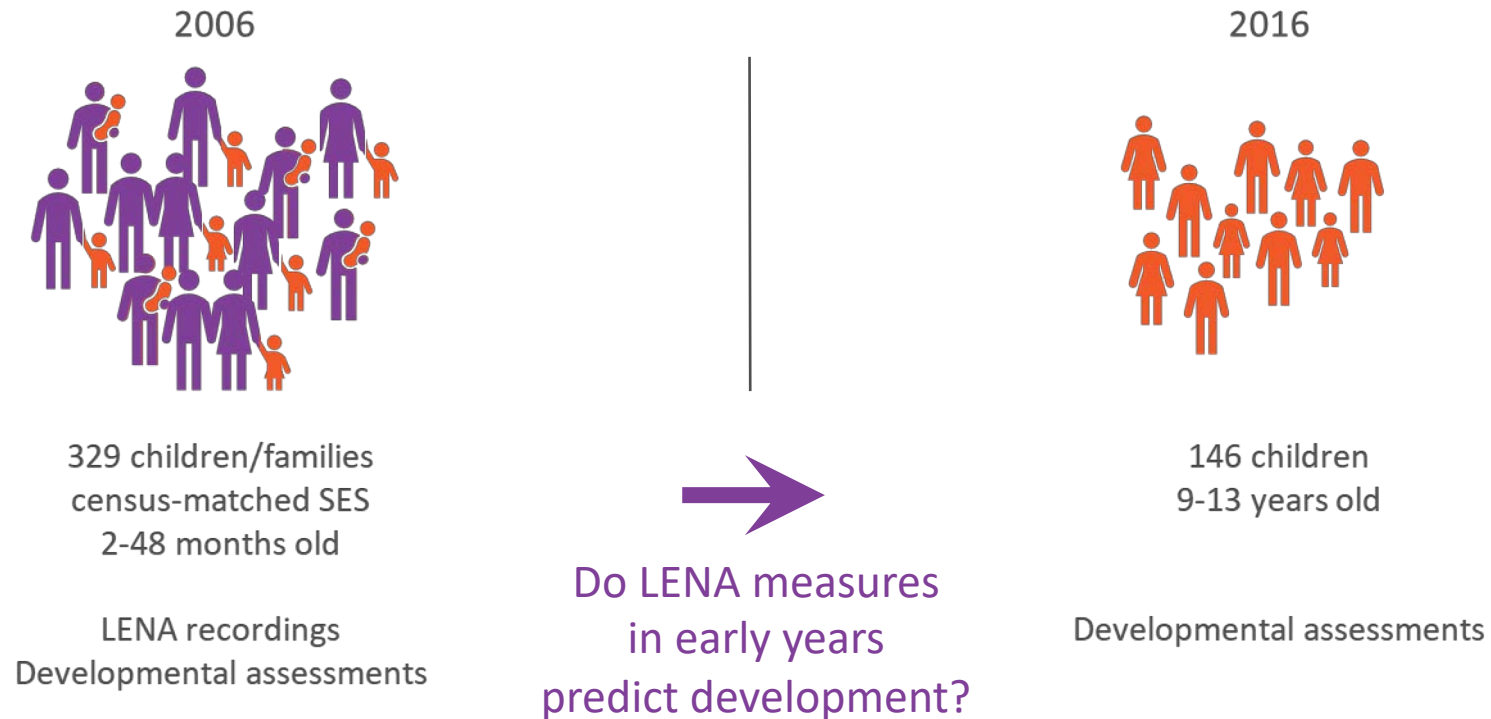
- Focus on very young children

Question: Is there a relationship between very early language experience and longitudinal outcomes?

Comparison: Language environment of babies with their IQ and language skills 10 years later.

LENA 10-year longitudinal study

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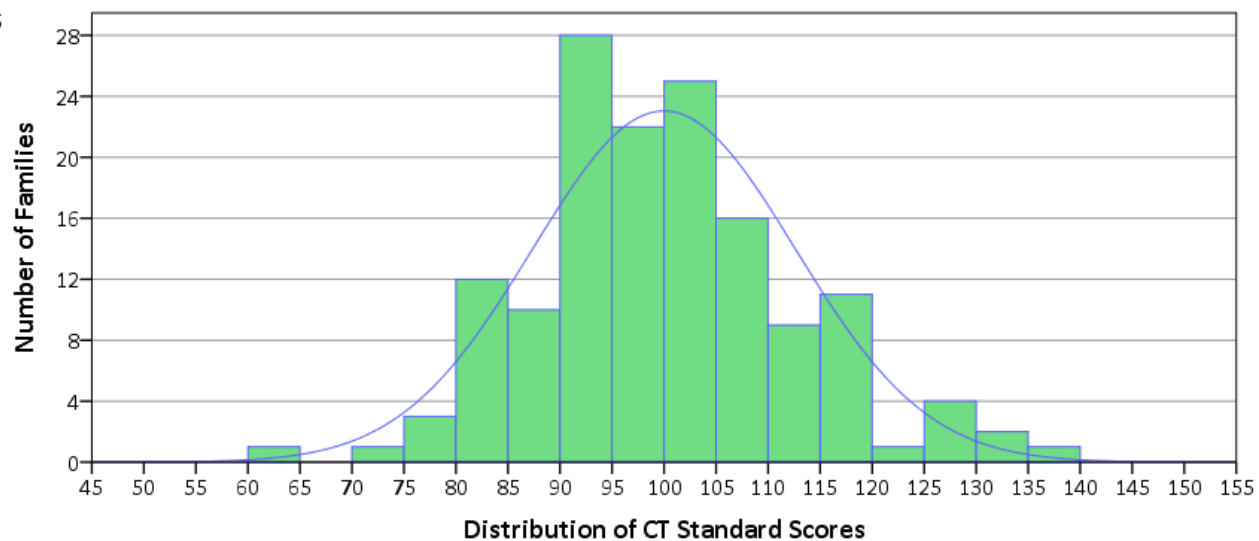
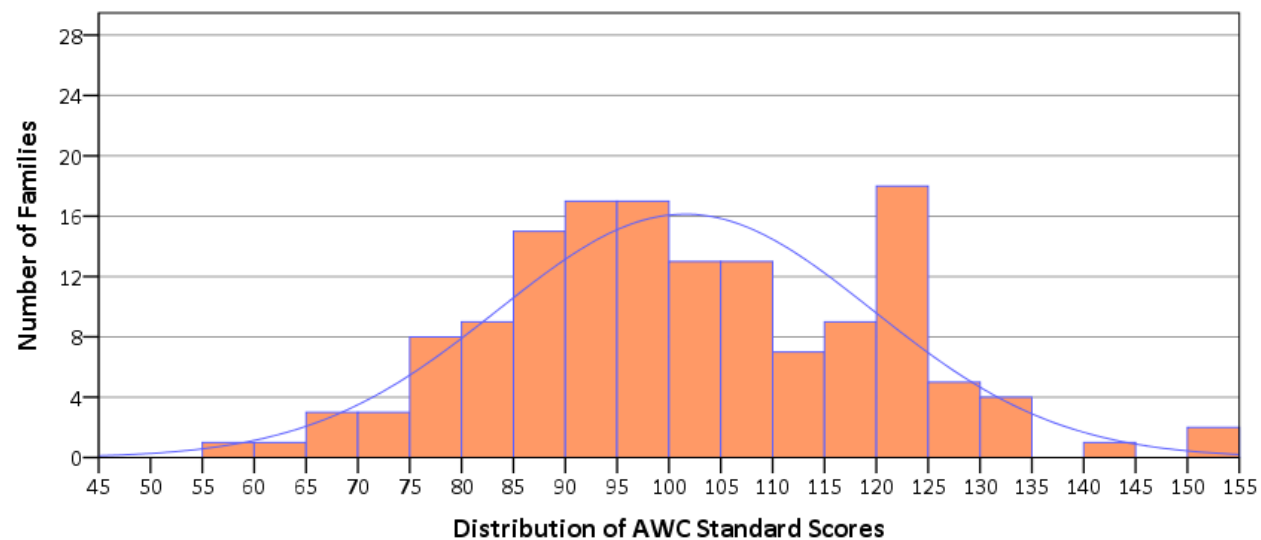
Longitudinal Assessments

- WISC-V – Wechsler Intelligence Scale for Children
 - Full Scale IQ (FSIQ)
 - Primary Scales
 - Verbal Comprehension Index (VCI)
 - Visual Spatial Index (VSI)
 - Fluid Reasoning Index (FRI)
 - Working Memory Index (WMI)
 - Processing Speed Index (PSI)
- PPVT – Peabody Picture Vocabulary Test
 - Receptive Vocabulary
- EVT – Expressive Vocabulary Test
 - Expressive Vocabulary

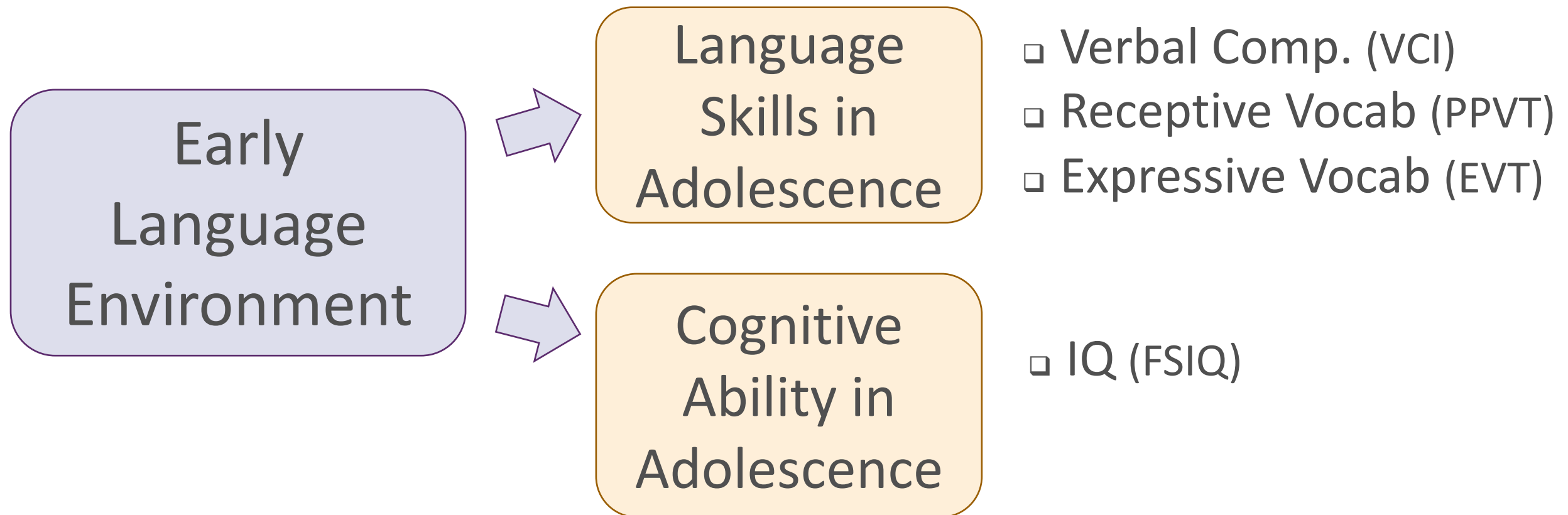
Demographics – Mother's Education

| Sample | N | Percent |
|-------------------------|-----|---------|
| Some High School | 10 | 7% |
| HS Diploma/Equivalent | 42 | 29% |
| Some College | 46 | 31% |
| 4-Year Degree or Higher | 48 | 33% |
| Full Sample | 146 | 100% |

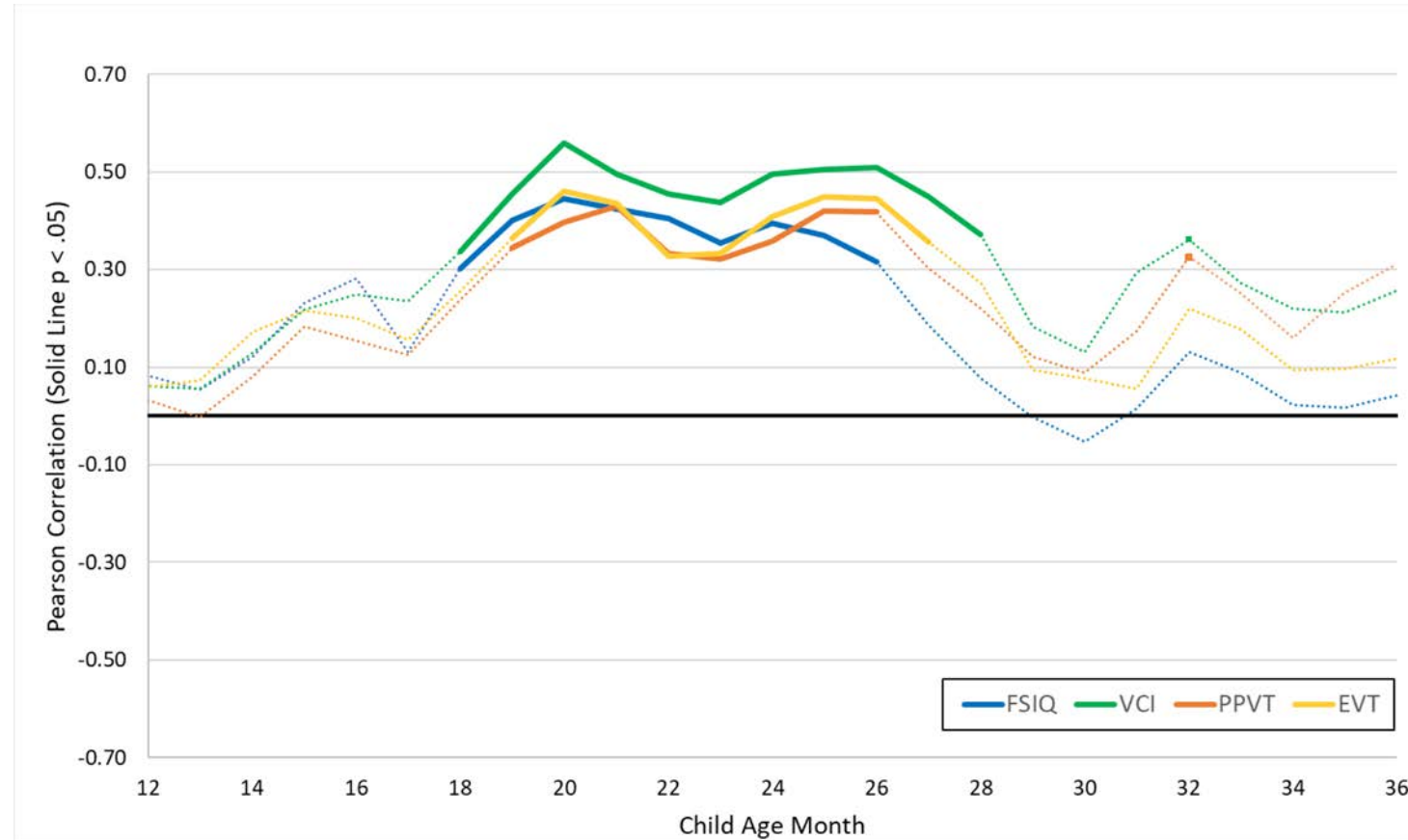
Distribution balanced for early words and turns



Primary Research Question



Turns in 2nd year is predictive of later outcomes



Gilkerson et al., *Pediatrics* 2018

Turns in 2nd year is predictive of later outcomes



Gilkerson et al., *Pediatrics* 2018

The importance of an early focus on talk

Quantity of words and turns early in life predicts later language ability

- Results confirm Hart & Risley, but with narrower window
- Accounts for large percent of variance in **18-24 month window**, even after controlling for SES

| | <i>Language Abilities</i> | | | <i>Cognitive Abilities</i> |
|-------|---------------------------|----------------------|-----------------------|----------------------------|
| | Verbal Comprehension | Receptive Vocabulary | Expressive Vocabulary | Full Scale IQ |
| Turns | 27% | 14% | 14% | 14% |
| Words | 9% | ns | ns | ns |

Summary of Results

- Interactive talk (turns) with toddlers linked to outcomes in early adolescence
- Turns matter more than words alone
- A window between 1 and 3 years of age is most strongly predictive of language and cognitive development

Gilkerson et al., *Pediatrics* 2018

What does this mean?

- Poverty is not destiny
- This is good news! Because talk is changeable
- Yes, SES factors like parent education and income will always play a role – so many economic variables are hard to change, some say impossible. But talk IS changeable.

Gilkerson et al., *Pediatrics* 2018

What does this tell us about timing?

Prepare parents with tools, practice, and awareness during infancy

- Ensure habits / routines in place by the time language environment is most crucial
- Strengthen those habits / routines through age 2 and beyond

Summary

- The fact that *automated measures* from a few days of recording can predict anything *10 years later* is remarkable
- Words and turns matter
- Socioeconomic status is not destiny
- Parents and caregivers have the power!

Acknowledgments

Terry and Judi Paul

Scientific Advisory Board

LENA Employees past and present

- Rebecca Mills, Research Supervisor
- Joanna Lester, Senior Research Coordinator

Questions?

Use the Q&A button to
submit questions!




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Building brains through early talk

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- rachelromeo.com
-  Twitter @RachelRRomeo

To learn more about Shannon Rudisill's organization:

- ecfunders.org



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