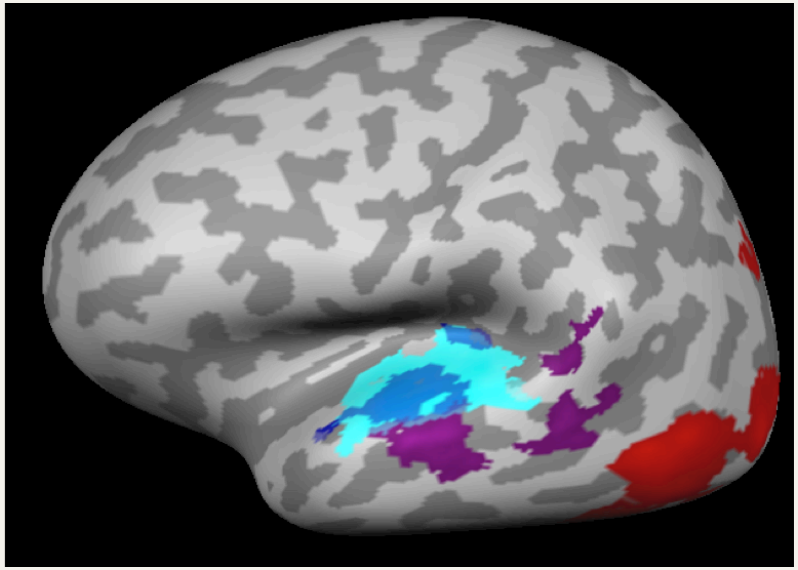
BRUCE MCCANDLISS

Early Education and the Brain: Making Novel Connections

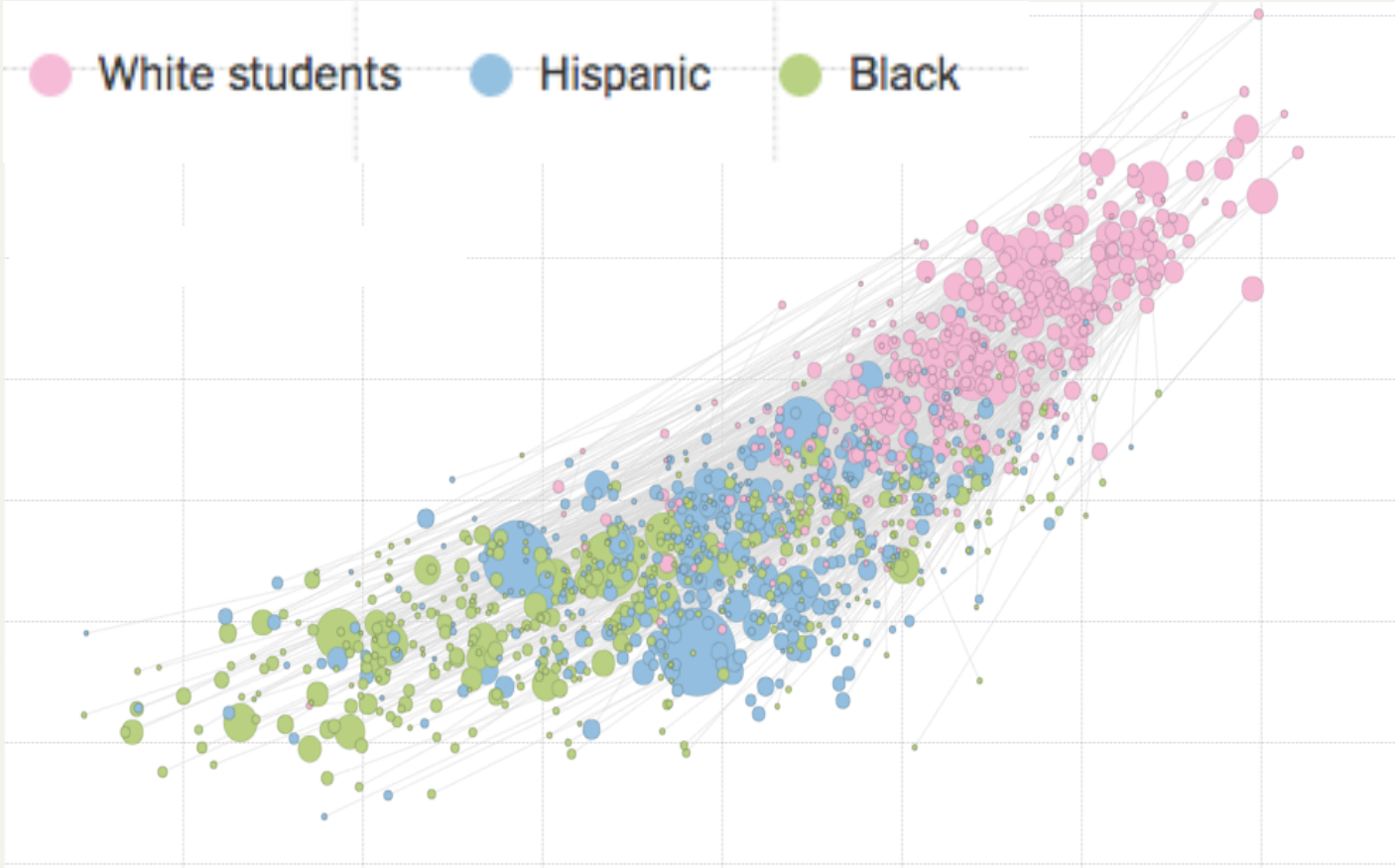
Stanford

Developmental Cognitive Neuroscience



Reading and the brain:

- What brain areas are critical?
- How do they develop these new functions?
- How do they differ across learners?
- How do educational experiences drive changes?



+ 3 Grades Levels

+ 2 Grades Levels

+ 1 Grade Level

Average

- 1 Grade Level

- 2 Grades Levels

- 3 Grades Levels

Poorer ← SES → Richer

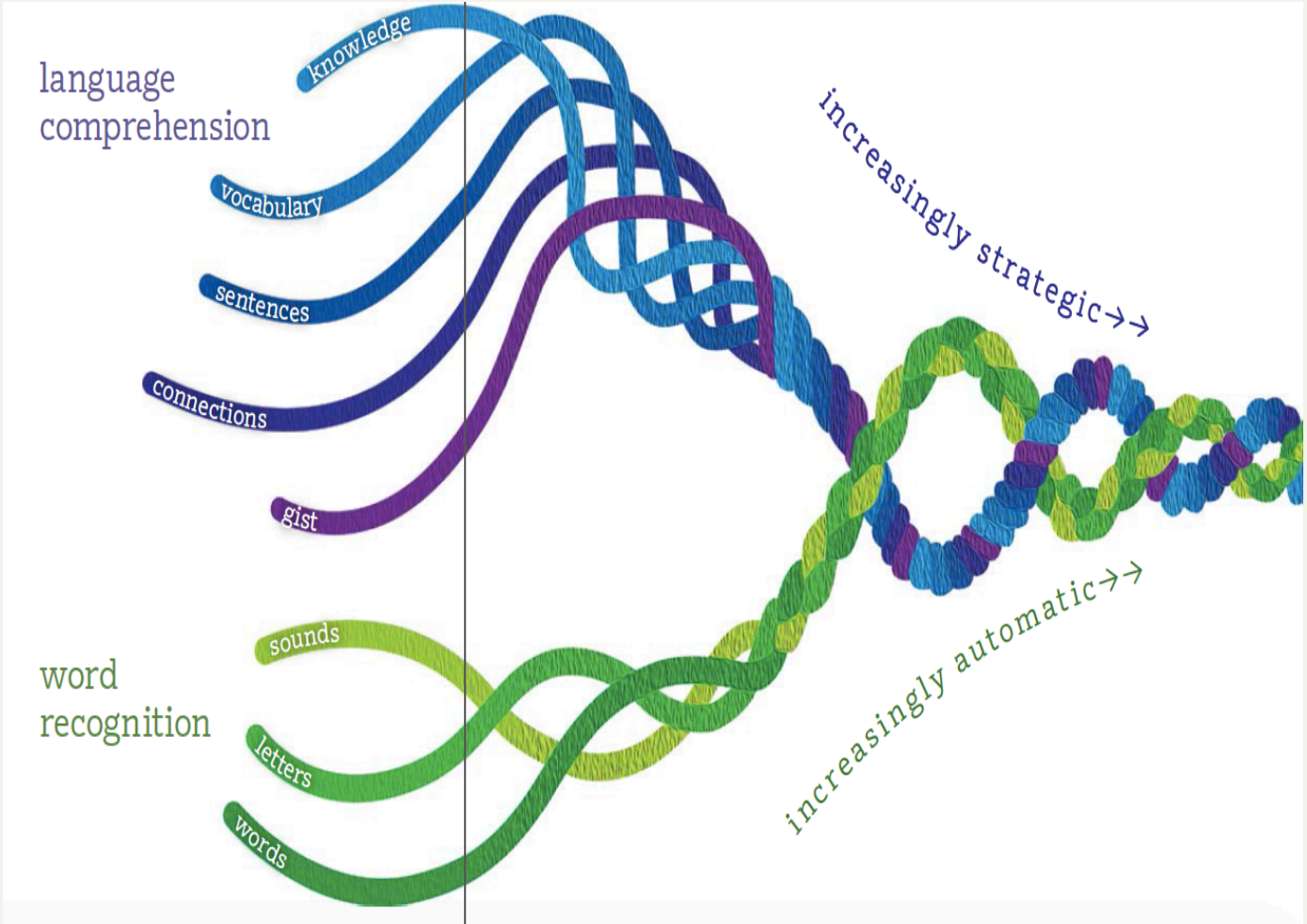
NY Times April, 2016

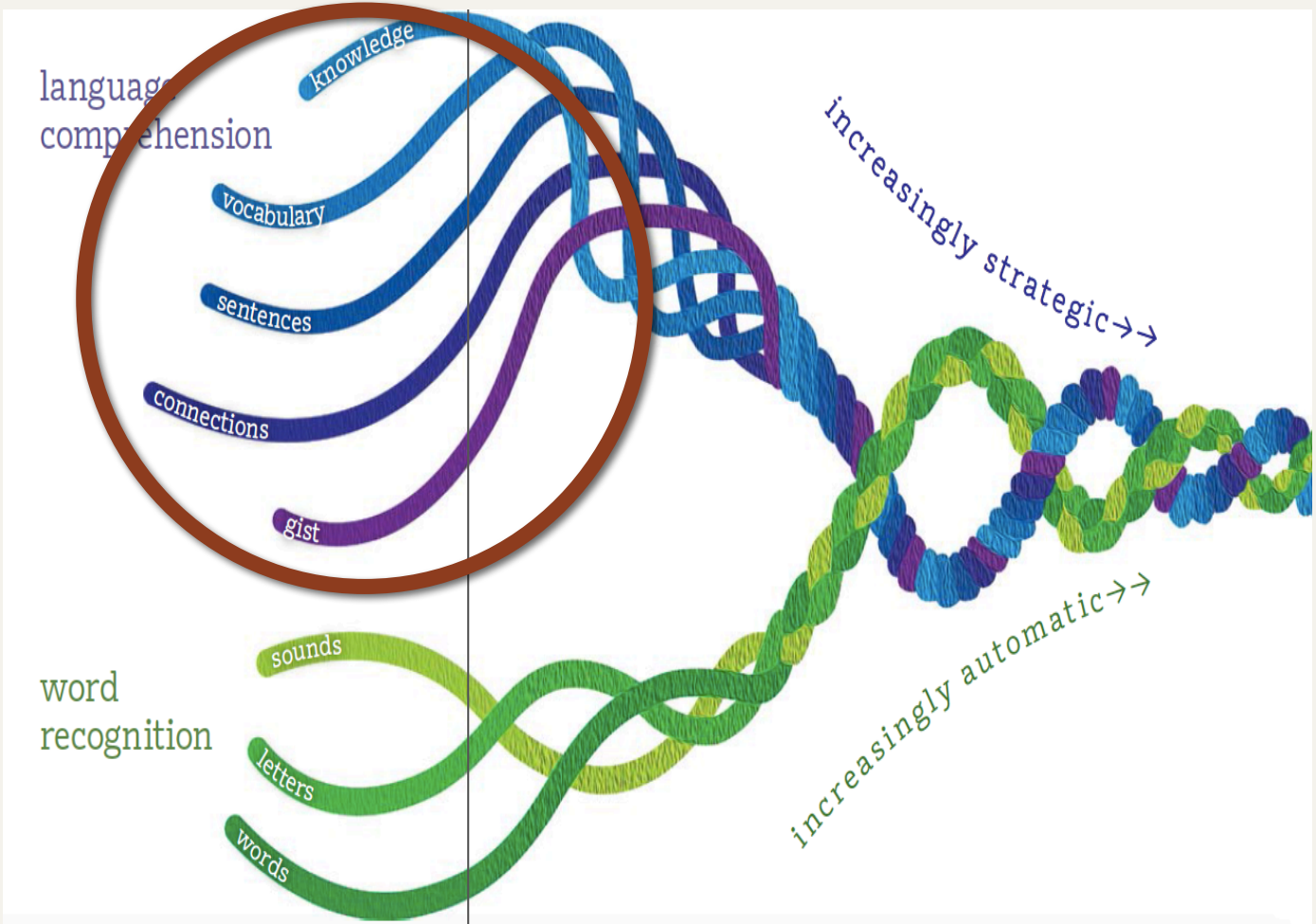
The Simple View of Reading answers the question: When you are presented with a passage of text, how do you get meaning from it? It says you need to do two things:

(1) You need to convert written words into speech.

(2) You need to understand that speech.

If written words were pictures, like emoji, one for each spoken word, children would need to learn 50,000 different pictures. Fortunately, writing instead tells you the sounds that each word is made of. There are just 44 different sounds in English.


language
comprehension
knowledge
vocabulary
sentences
connections
gist
word
recognition
sounds
letters
words
increasingly strategic→→
increasingly automatic→→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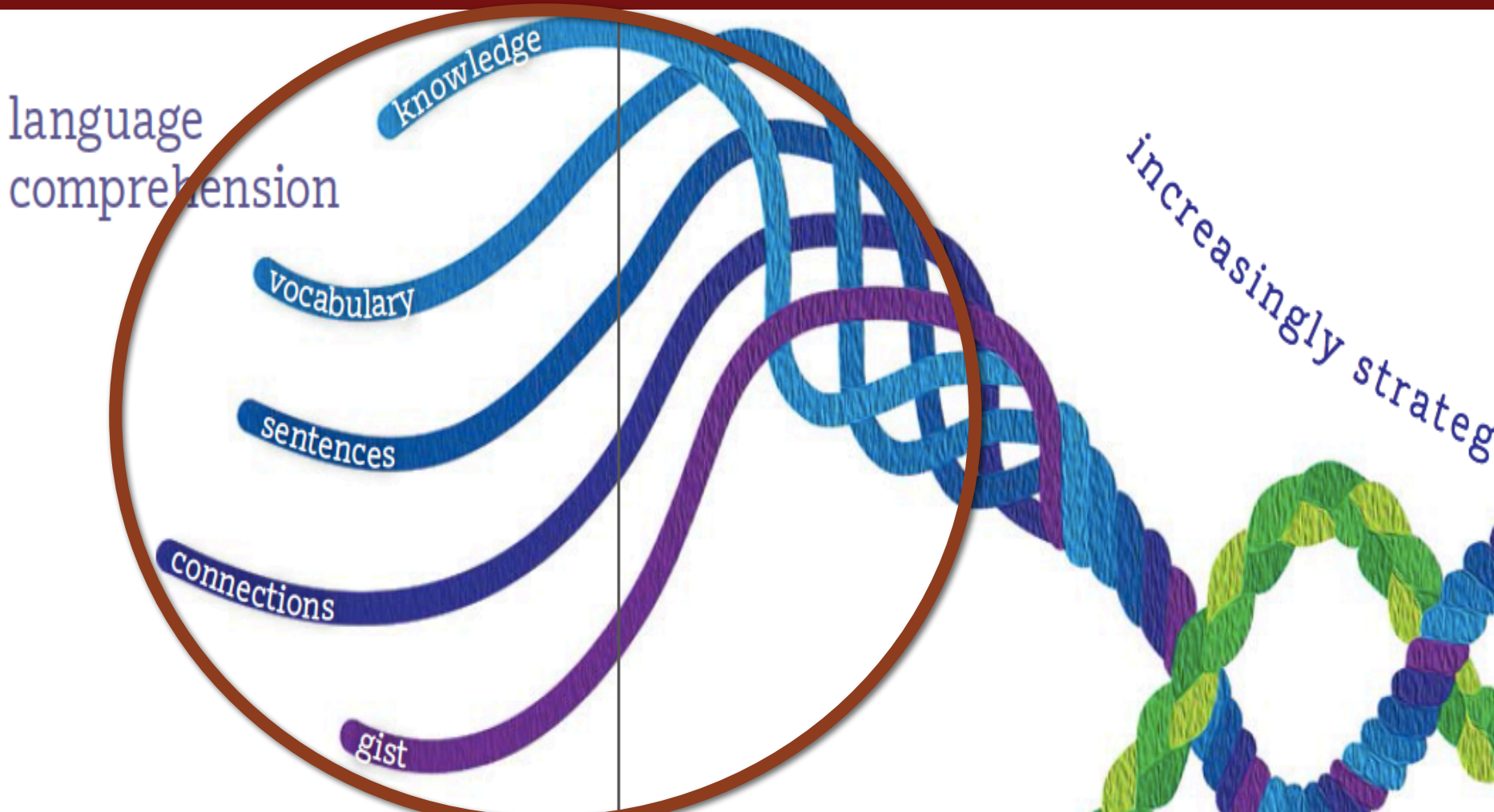
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increasingly strateg

This way can be a lot trickier than the ordinary method because you will know next to nothing beforehand. Make a plan that you are comfortable with, keeping in mind that familiar environments often work best. It's important to critically evaluate any descriptions you hear. We all know that certain words can be rather misleading.

Think about the intentions of the person presenting the idea before deciding to take the risk. It's hard to back out once things start. The initial moment has a great impact on what follows, with physical elements playing a prominent role. Remember, you are being reacted to as well as reacting.

Realizing you've made a mistake makes everything difficult, but try to complete the planned actions anyway. If all your expectations are met, repeat the process. Other people will ask a lot of questions. Be careful about who you talk to or all the details could become public knowledge.

Advice: The Blind Date

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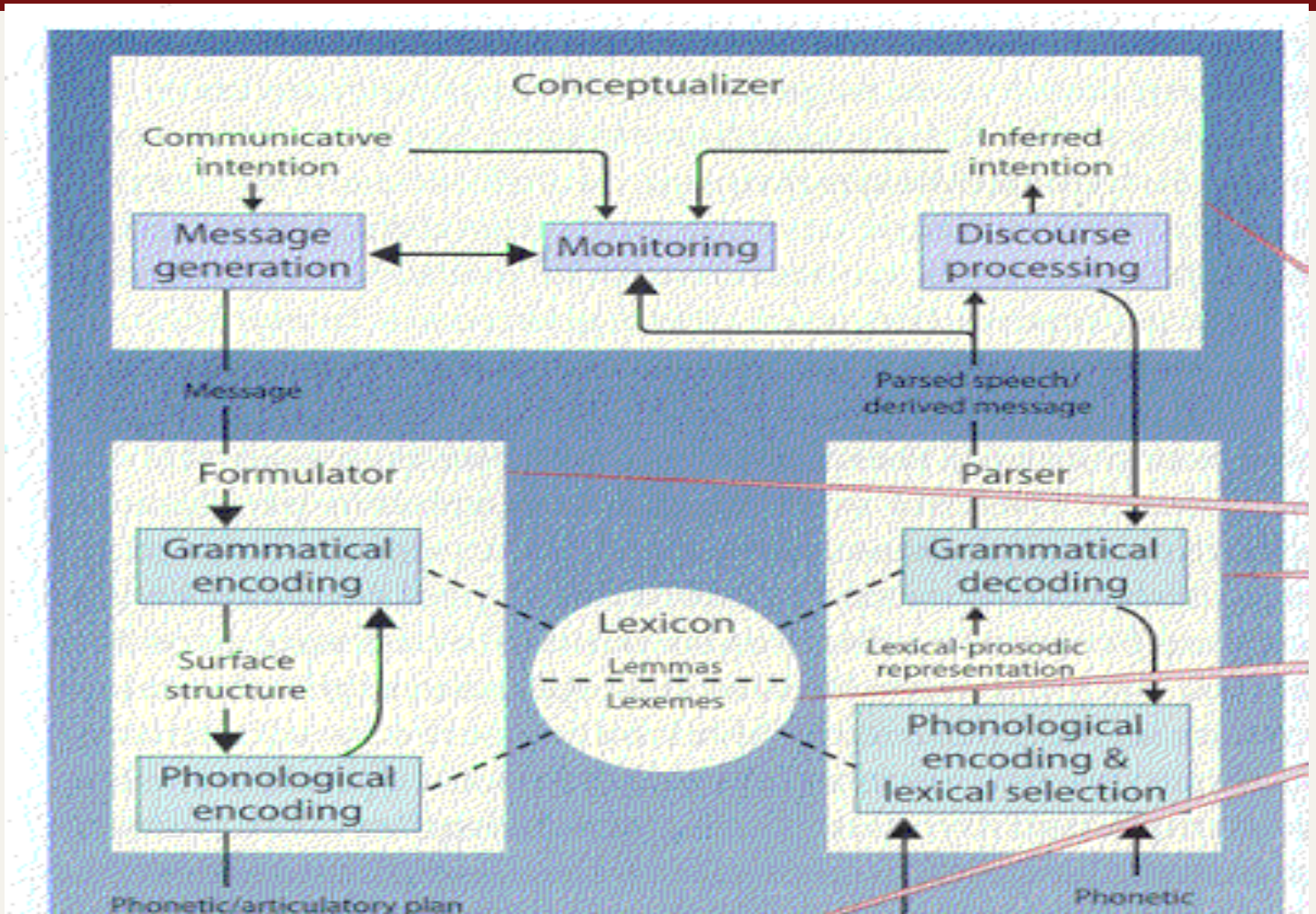

Conceptualizer
Communicative intention
Inferred intention
Message generation
Monitoring
Discourse processing
Message
Parsed speech/ derived message
Formulator
Parser
Grammatical encoding
Grammatical decoding
Lexicon
Lemmas
Lexemes
Surface structure
Lexical-prosodic representation
Phonological encoding
Phonological encoding & lexical selection
Phonetic/articulatory plan
Phonetic

Brain Networks and Comprehension

ONE SUMMER DAY, A BOY AND HIS DOG SET OUT WITH A NET AND PAIL, LOOKING FOR FROGS.

THE BOY AND THE DOG SPOTTED A FROG SITTING ON A LILY PAD IN THE POND.

THE BOY AND THE DOG EAGERLY RAN DOWN THE HILL TO THE POND WHERE THE FROG WAS.

THE BOY TRIPPED ON A TREE ROOT AND TUMBLED HEAD OVER HEELS DOWN THE STEEP HILL.

Robertson et al., 2000

Pictures from Froggy (Mercer Mayer)

Robertson et al., 2000

Robertson et al., 2000

Robertson et al., 2000

Robertson et al., 2000

Robertson et al., 2000

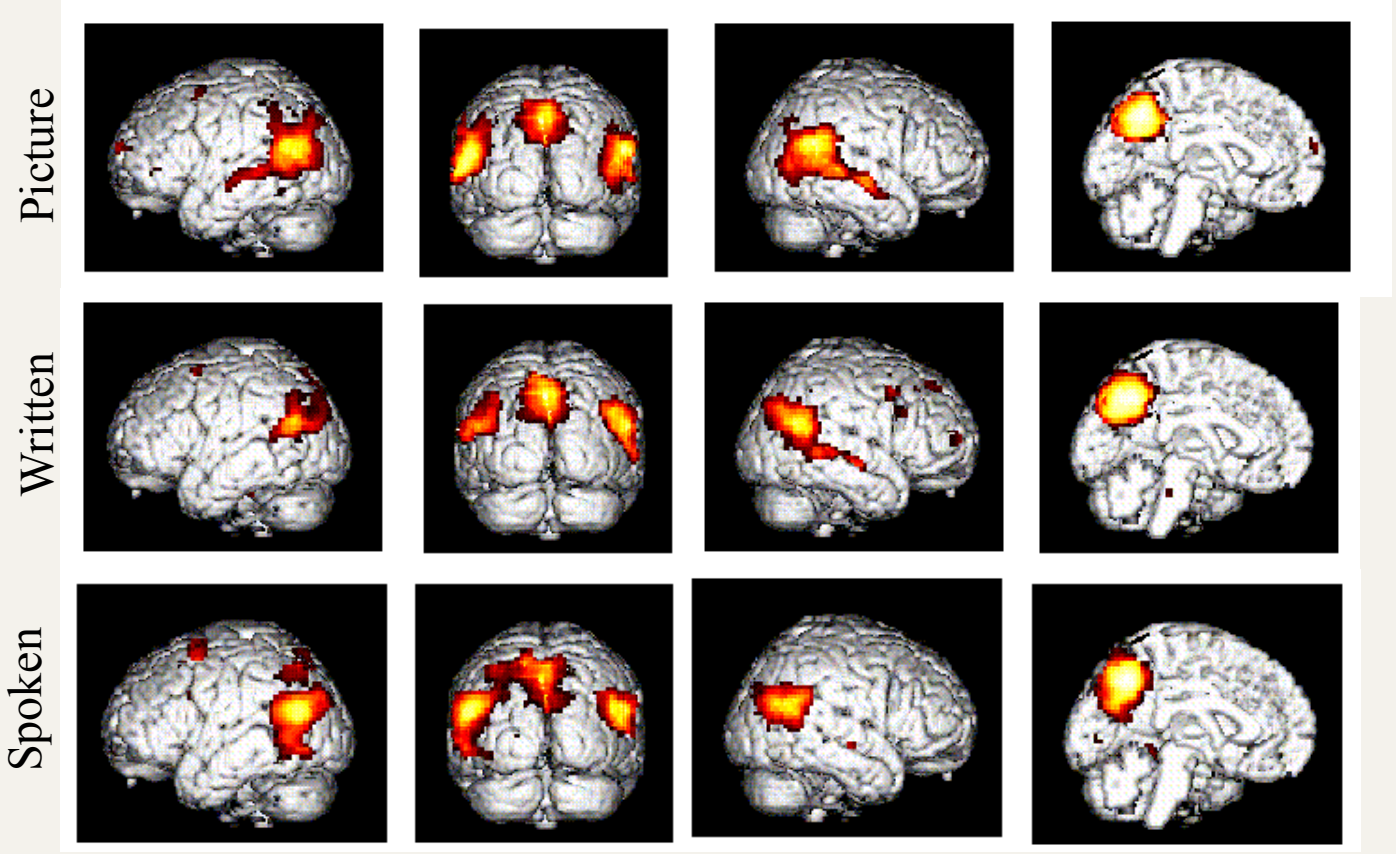
BOB HAD A TOOTHACHE SO HE CALLED HIS DENTIST TO SCHEDULE AN APPOINTMENT.

THE BRIDE AND GROOM DROVE TO THE AIRPORT TO TAKE OFF FOR THEIR HONEYMOON TRIP TO SPAIN.

TUESDAY MORNING THE CHILDREN WERE OUTSIDE MAKING MUDPIES IN THE SANDBOX.

Robertson et al., 2000

Comprehension & Coherence Brain Networks



Robertson et al., 2000

Emotional and Temporal Aspects of Situation Model Processing during Text Comprehension: An Event-Related fMRI Study

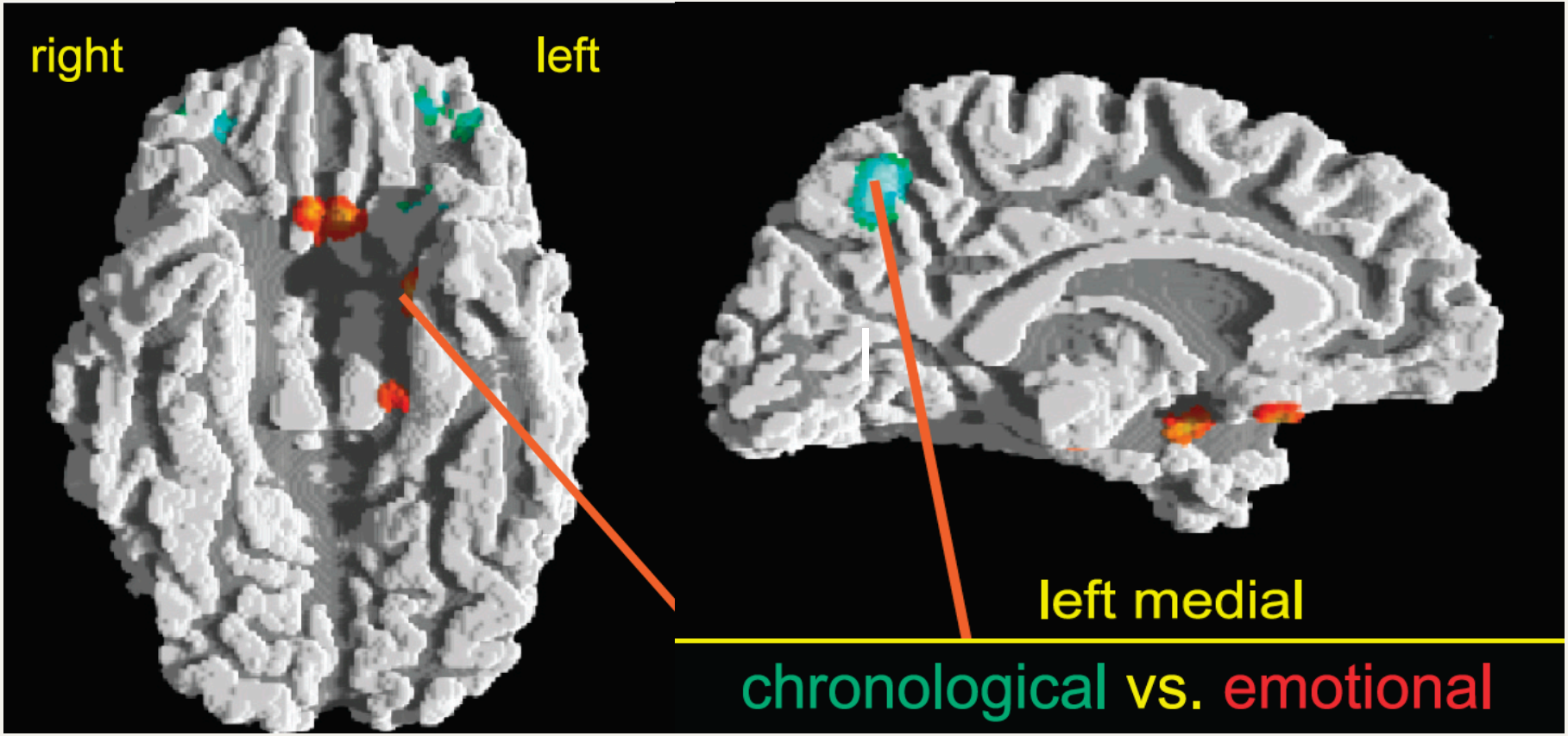
Evelyn C. Ferstl[1,2], Mike Rinck[3], and D. Yves von Cramon[1,2]

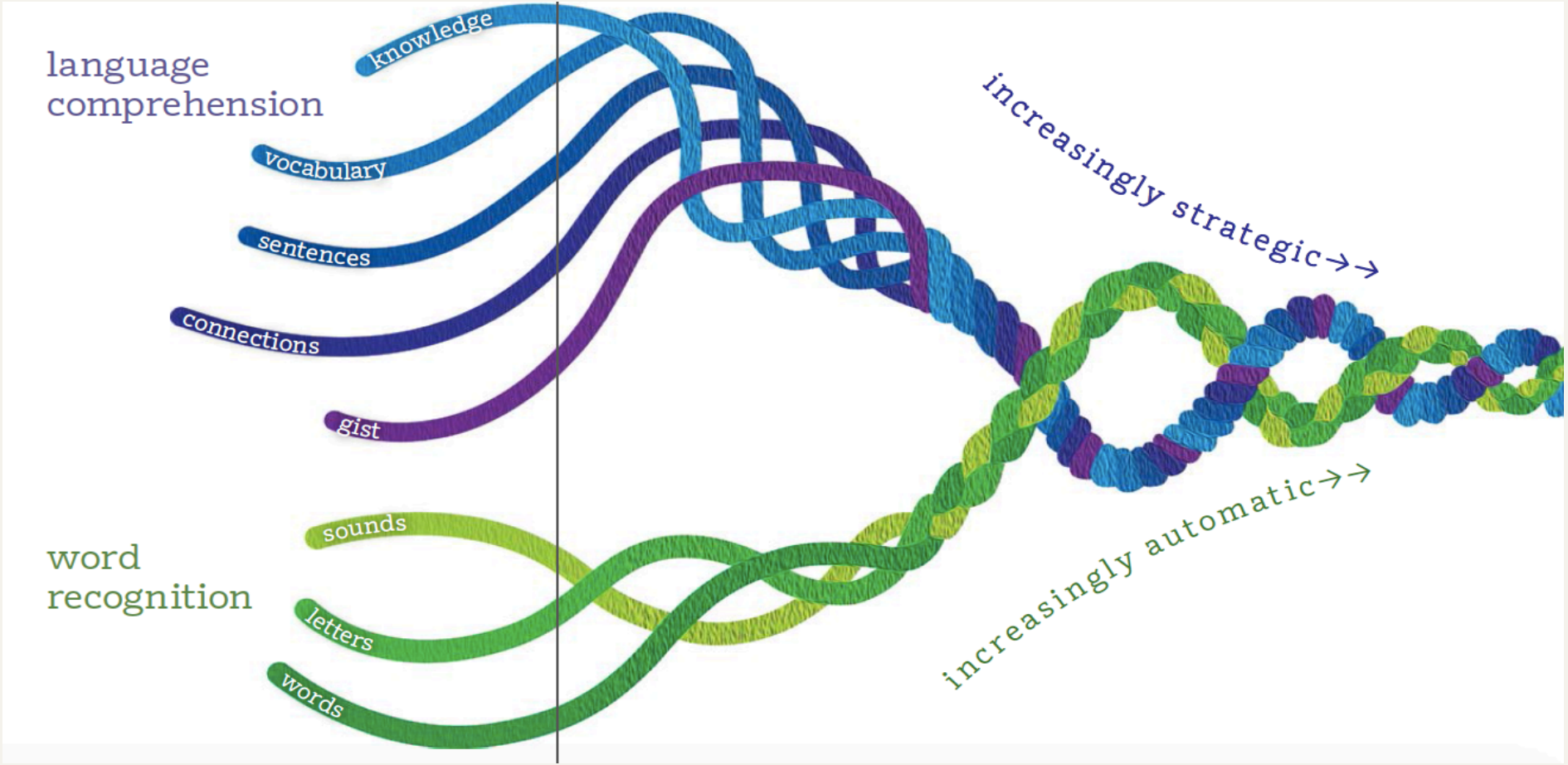
Chronological: sequence of events

Today, Markus and Claudia would finally meet again. Markus's train arrived at the station 20 minutes after/*before* Claudia's train. Markus was very excited when his train stopped at the station on time. He tried to think of what he should say when he met her. Many people were crowding on the platform. Claudia was **already waiting** for him when he got off the train with his huge bag. They were both very happy.

Emotional: Character's mental states

The semester was finally over and Sarah wanted to celebrate. A lot of her friends had shown up for her end-of-school party. It was one of these parties with everything being just perfect. Sarah's best friend gave her a hug and told her how much fun she was having. Sarah couldn't remember that she had ever been so **happy/*sad*** before. She put her favorite record into the CD player and started dancing by herself.


right
left
left medial
chronological vs. emotional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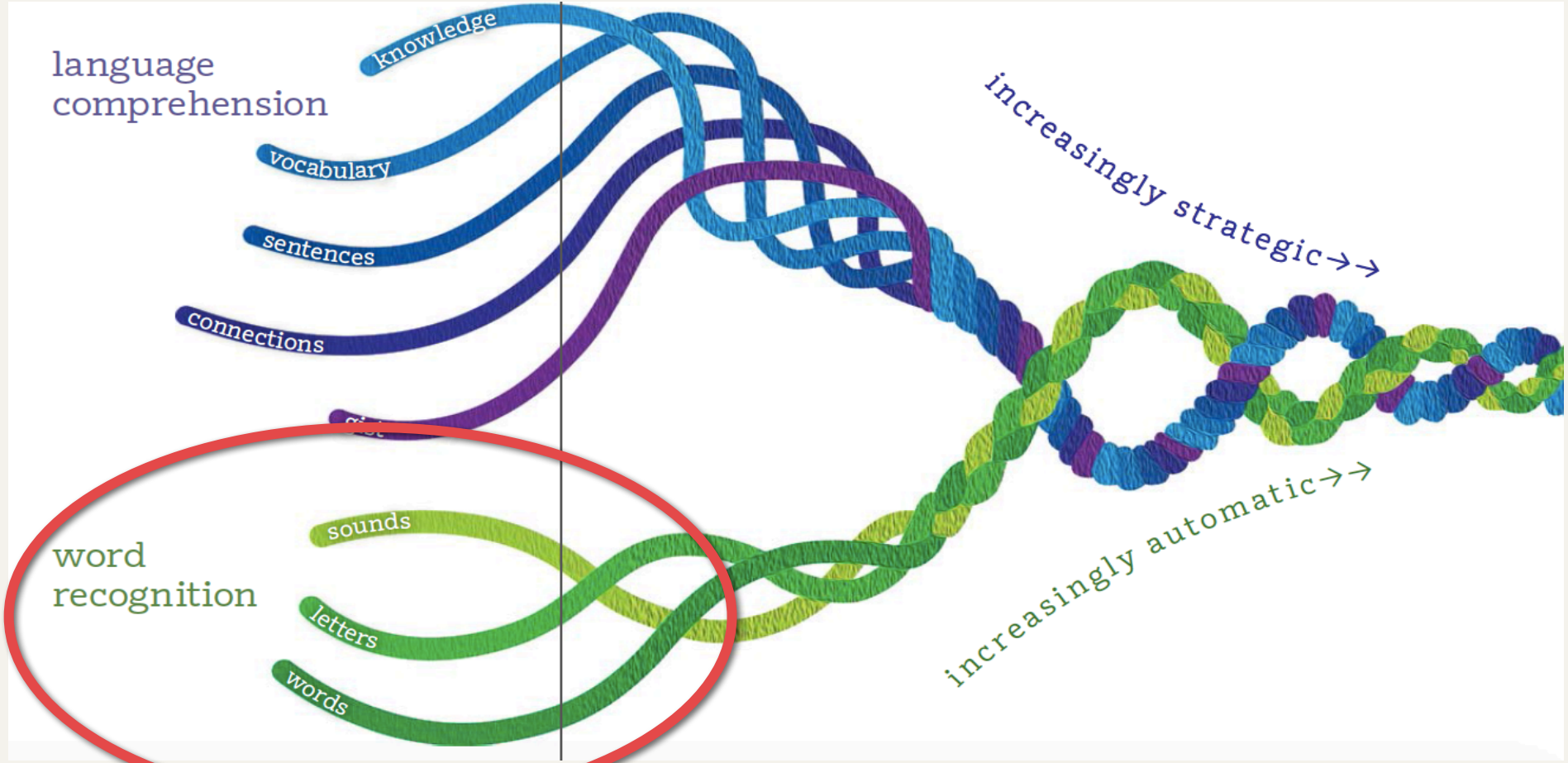
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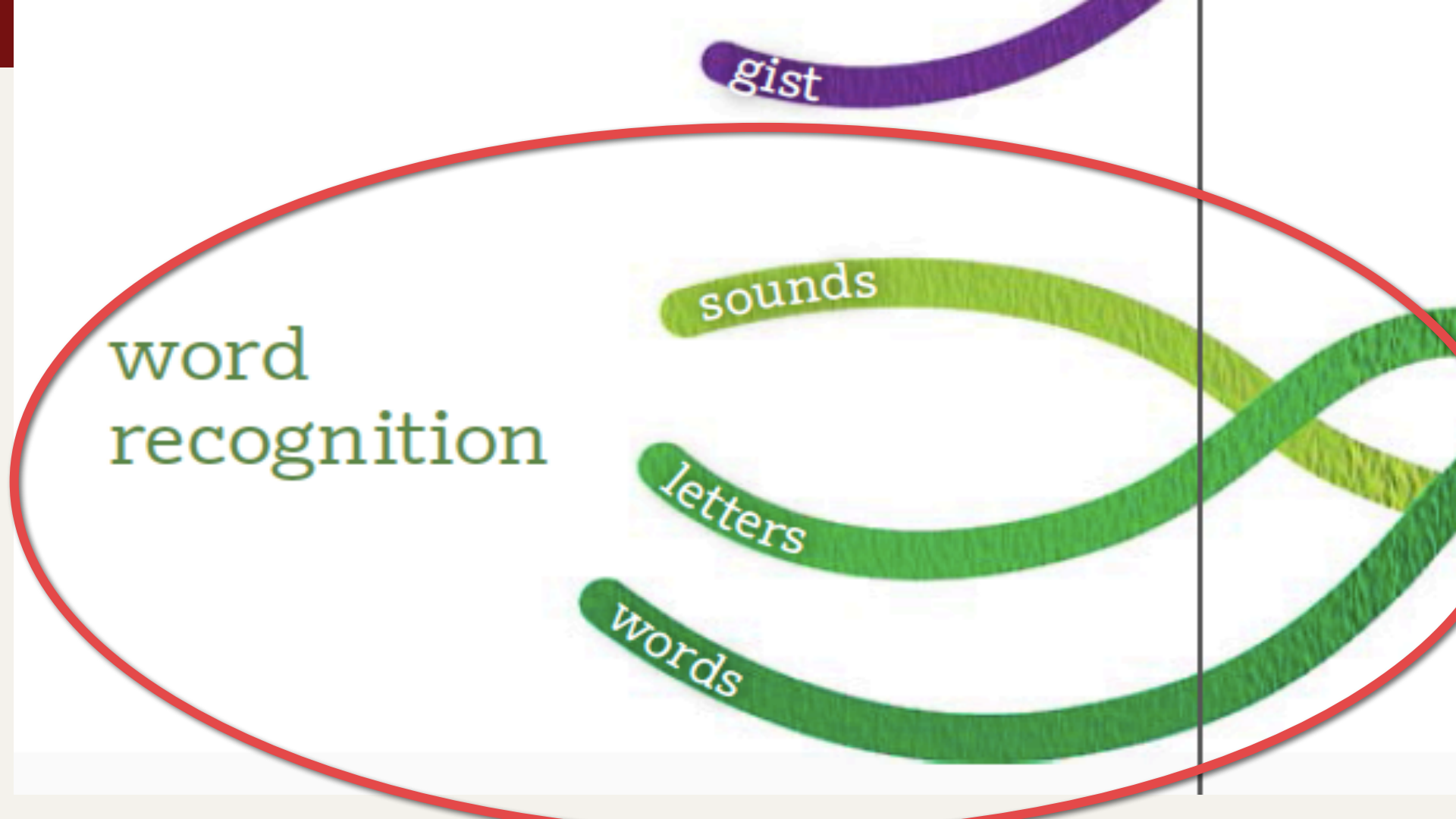
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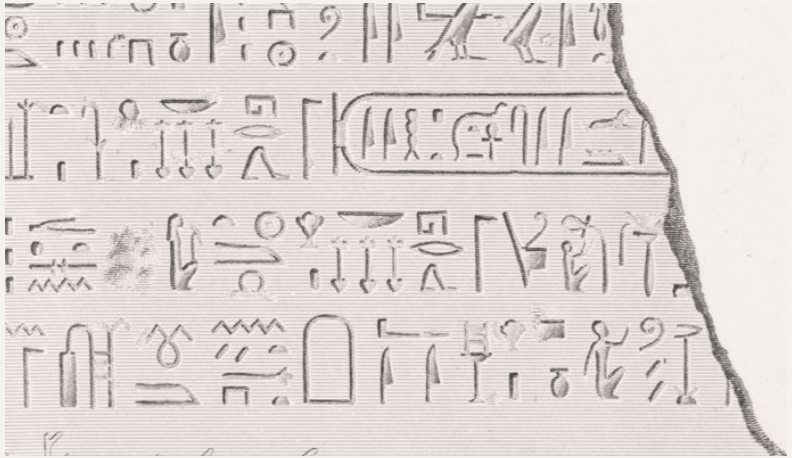
letters
words

Decoding

/a/		at	/f/		fat	/n/		net	/t/		tag
/b/		bat	/g/		got	/o/		odd	/u/		up
/k/		cat	/h/		hat	/p/		pat	/v/		vet
/d/		dog	/i/		it	/r/		rat	/w/		wet
/e/		end	/l/		let	/s/		sat	/z/		zen
			/m/		mat				/th/		thin

Answer: Kit ran and hid.

The Symbolic Brain



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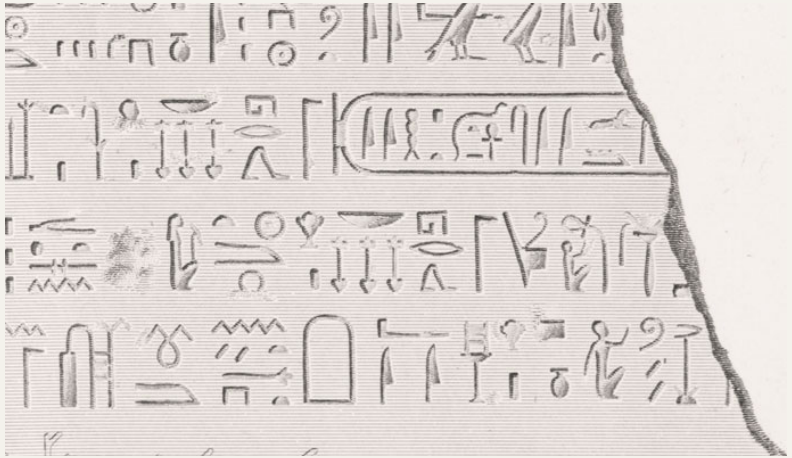
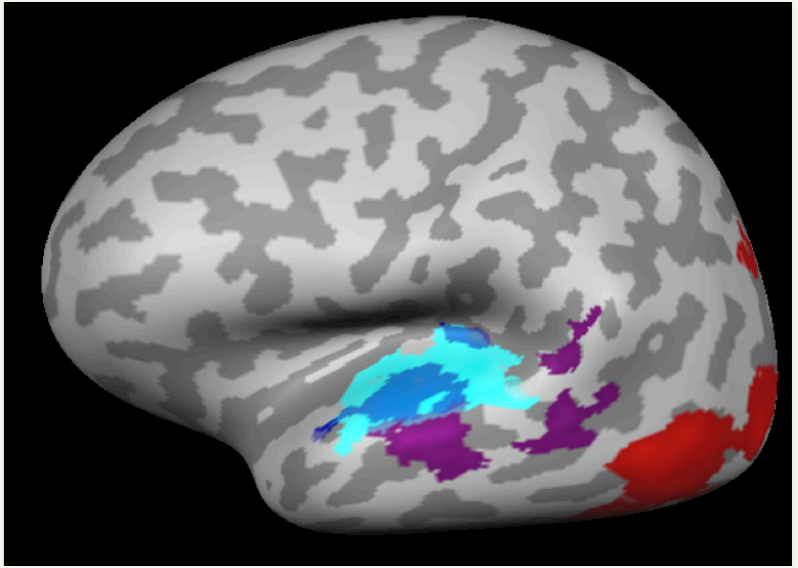
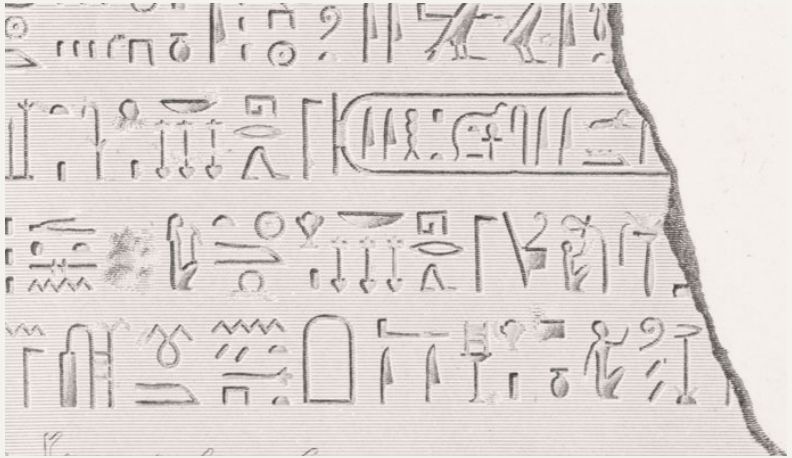
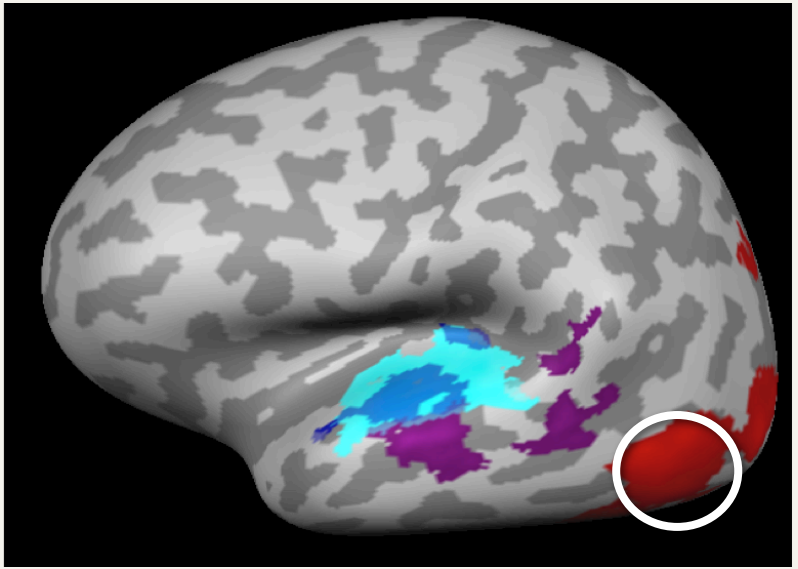




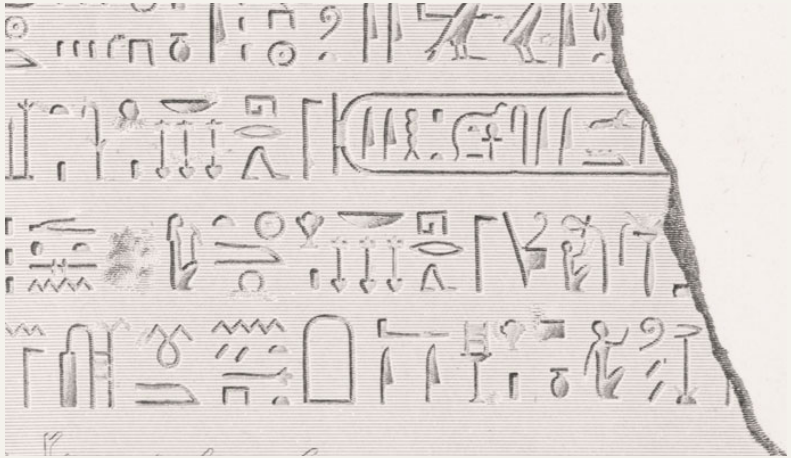
The Symbolic Brain

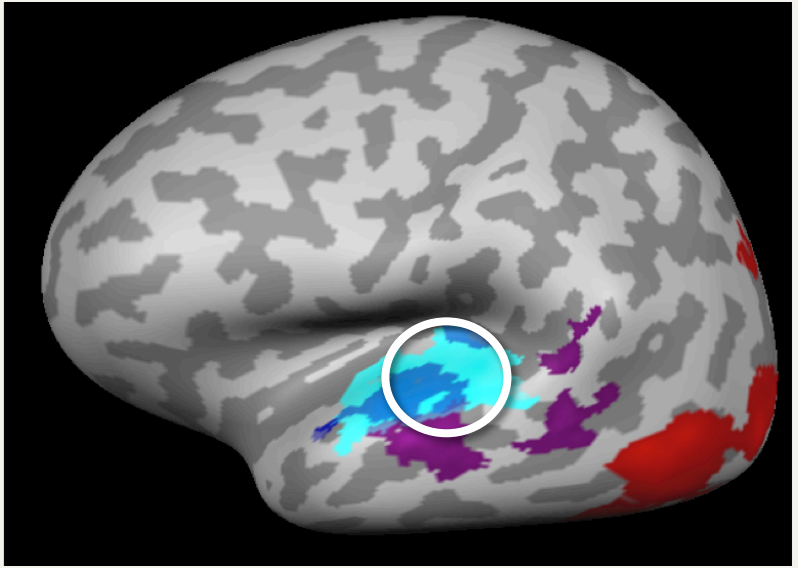




Visual Features

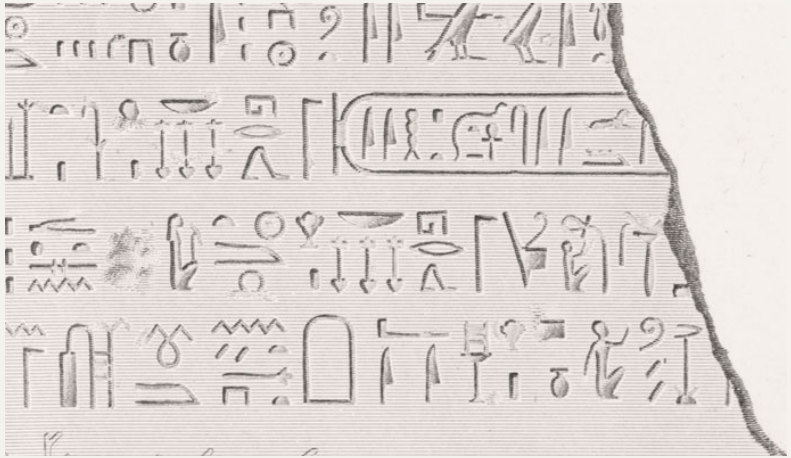
The Symbolic Brain

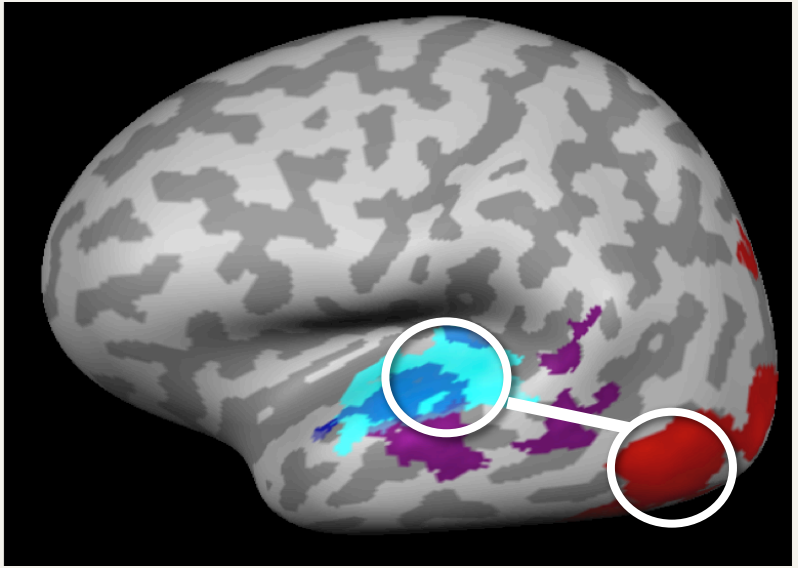




Speech
Sounds

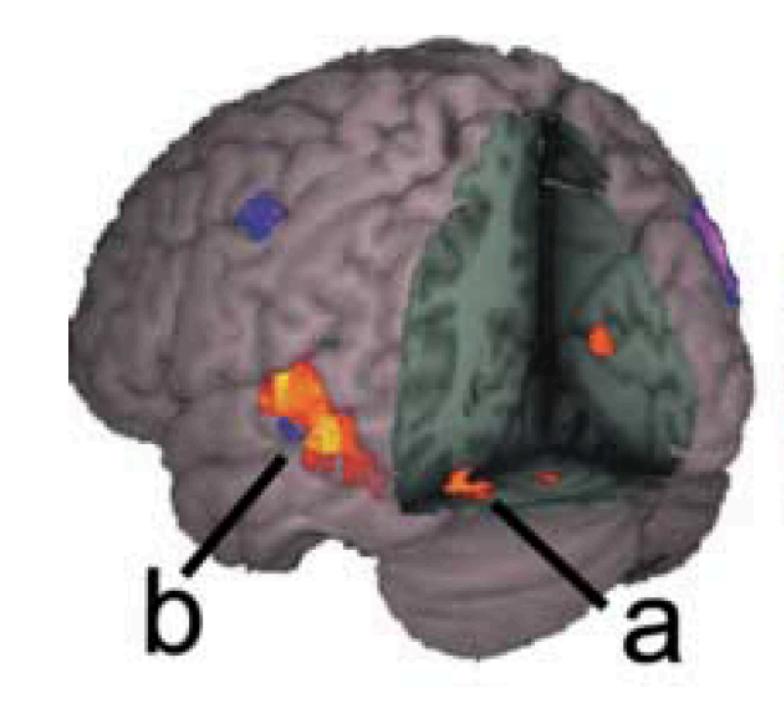
The Symbolic Brain





Integrated
Reading Circuit

Brain Differences that Matter



Strengths and
Weaknesses
in Phonological Awareness
Predict Activity in
Children's Reading Circuitry

Can the way a teacher directs attention impact the brain circuitry of reading?

Mechanisms of Change: Scaffolding Learning Experiences

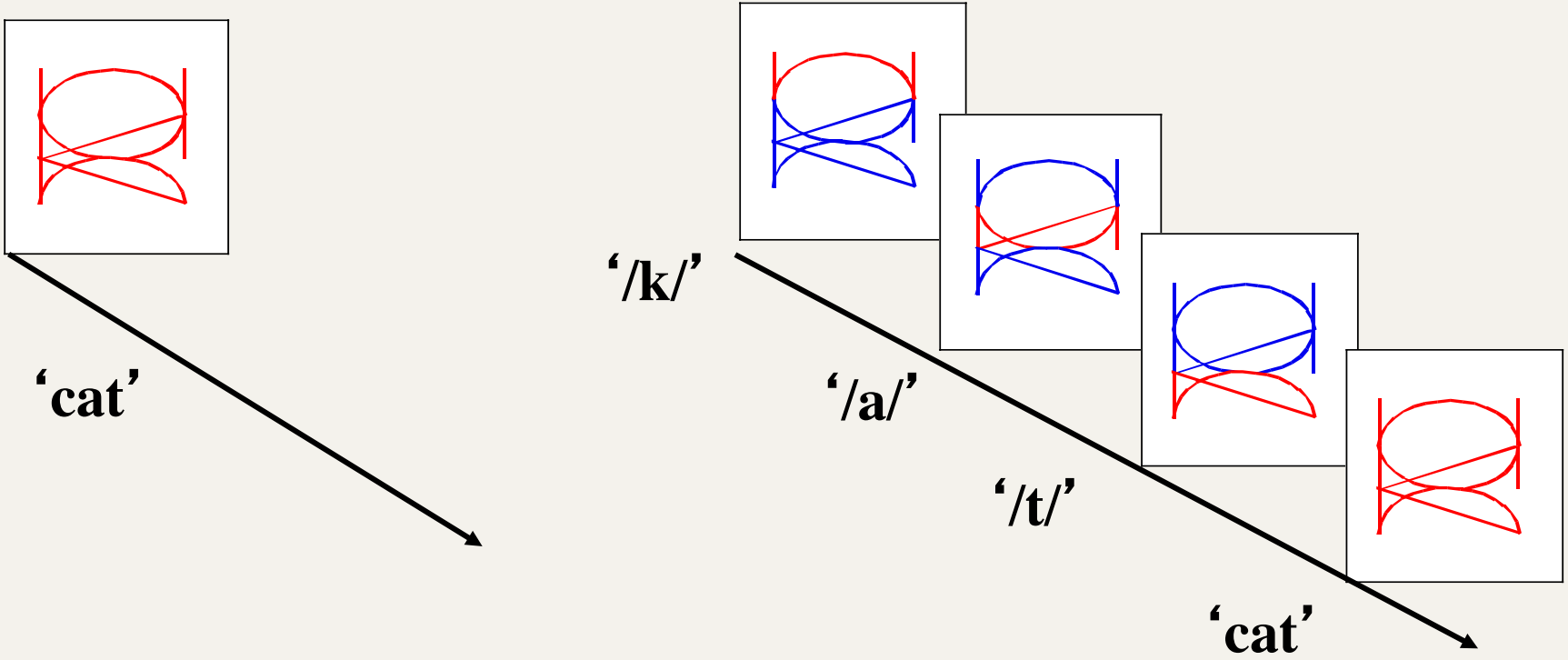
Mechanisms of Change: Scaffolding Learning Experiences

Jerome Bruner

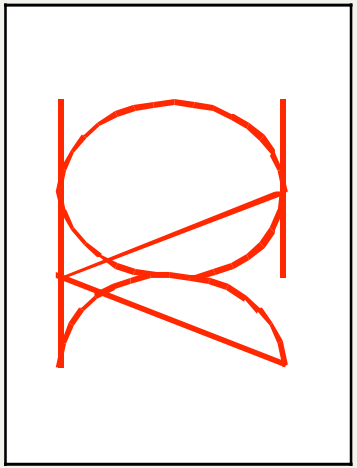
Scaffolding theory :

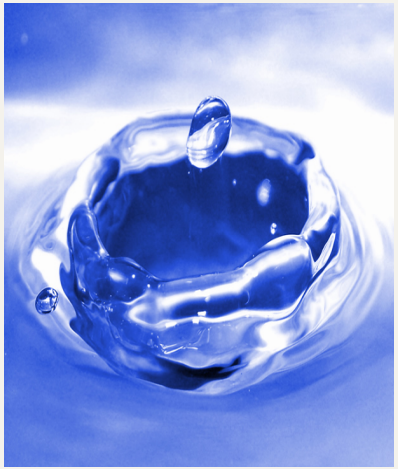
providing students with support in the initial stages of learning

Scaffolding Selective Attention to Letter-Sound Associations



Selective Attention and Learning: Changes Brain Circuitry

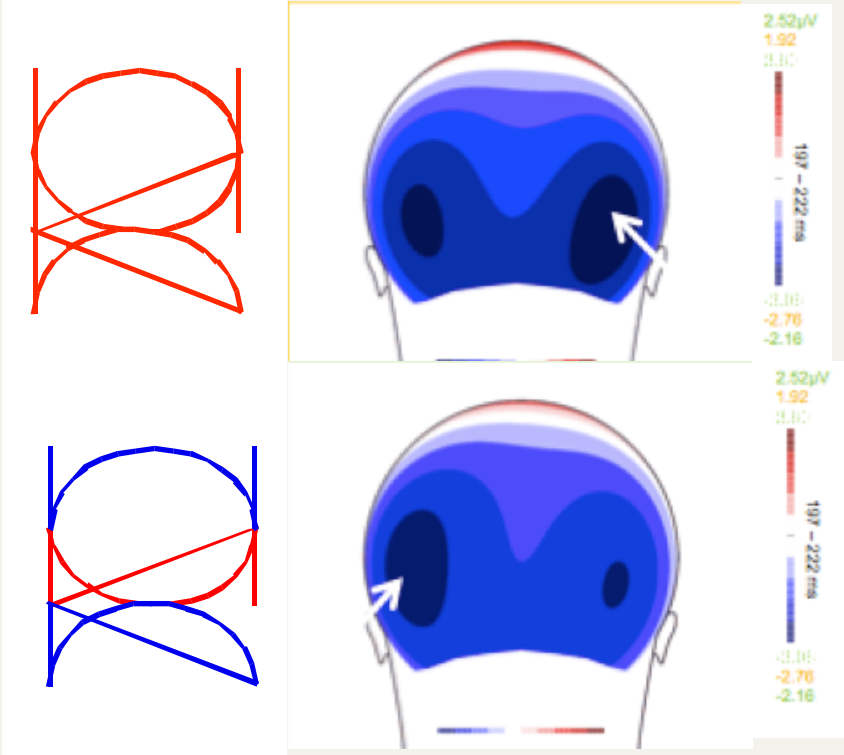




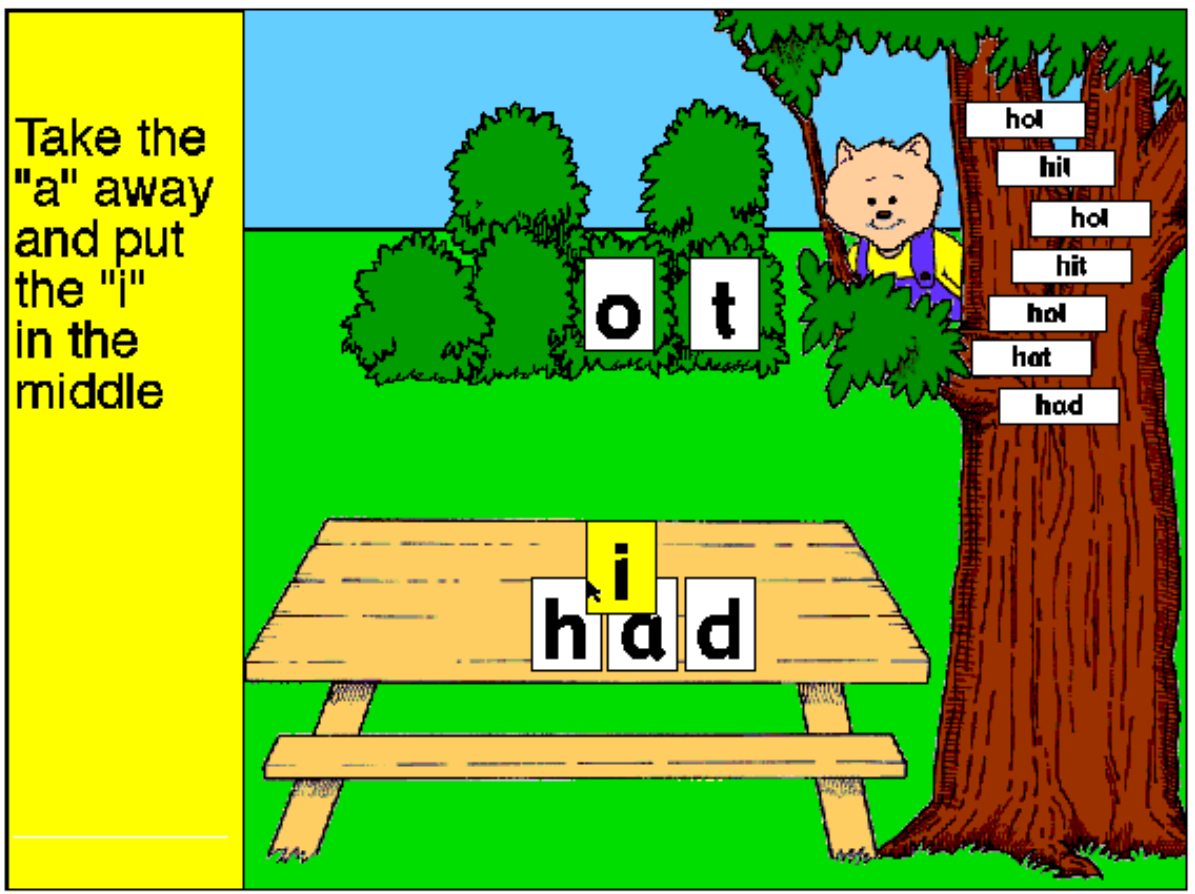
Selective Attention and Learning: Changes Brain Circuitry

Un-scaffolded Learning

Scaffolded Learning



Field Based Research: NYC Public Schools



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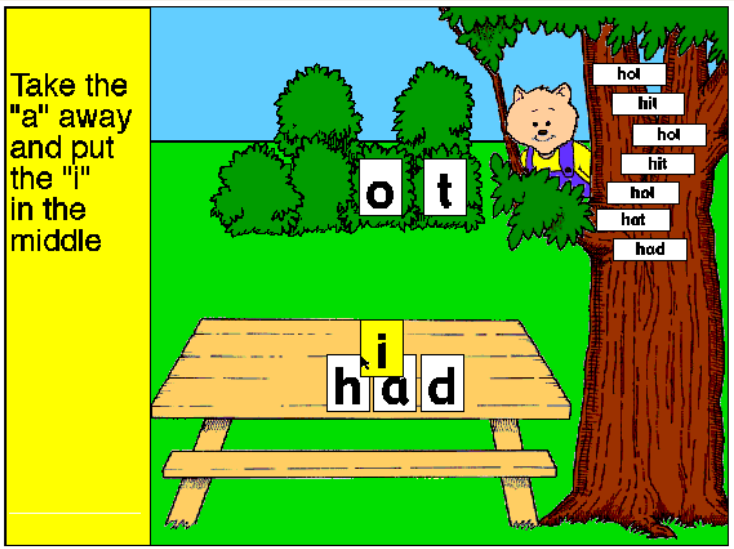
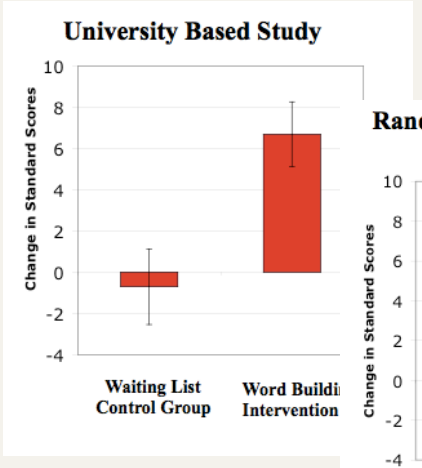
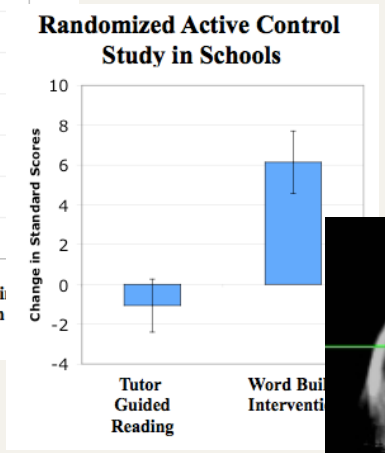
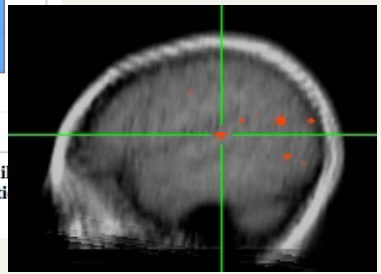




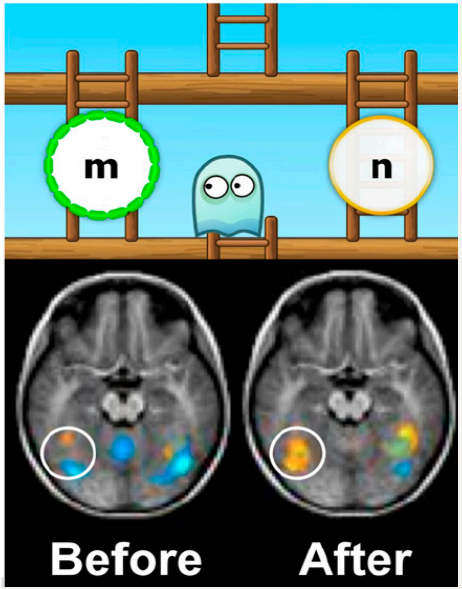




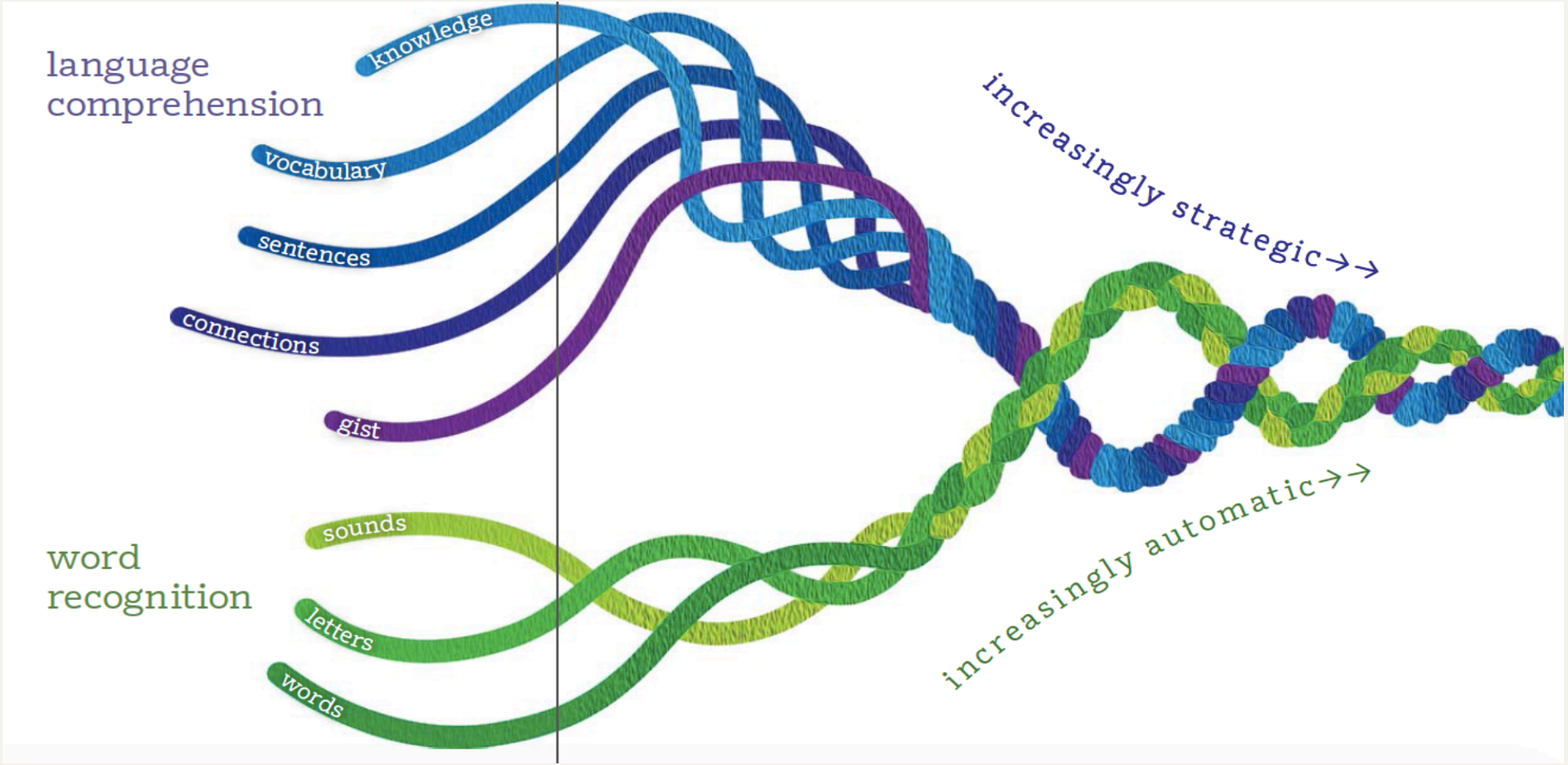
PNAS PNAS PNAS

Educational neuroscience: The early years

Bruce D. McCandliss[1]



Scaffolded Learning Environments Drive Changes In Reading Circuitry


language comprehension
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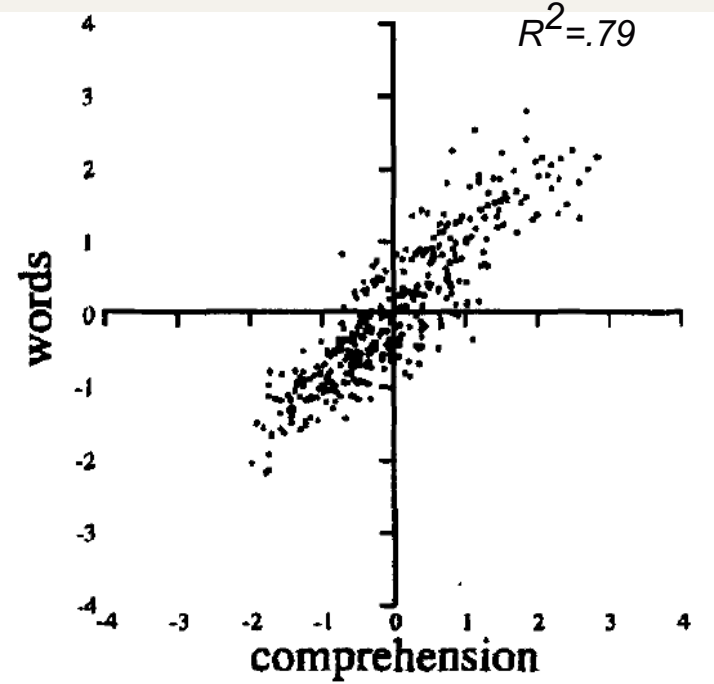
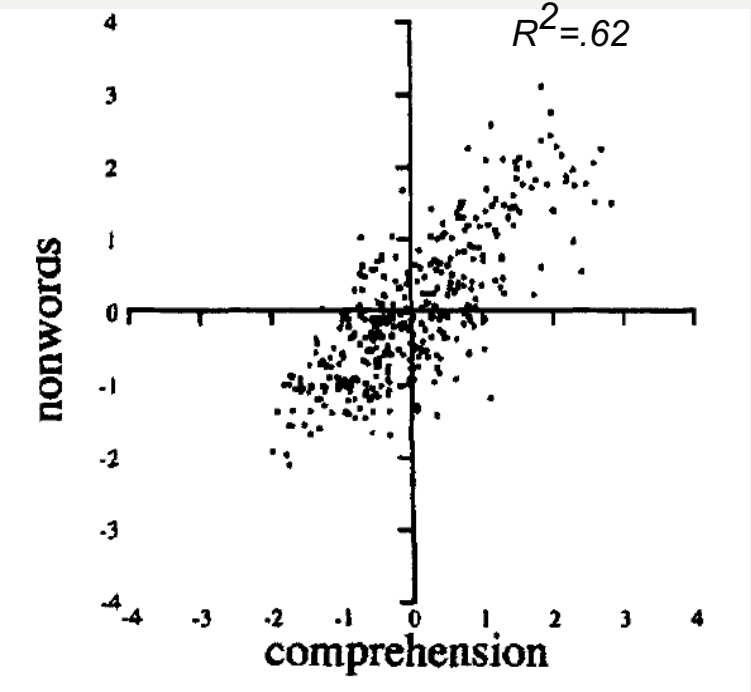
increasingly automatic→→

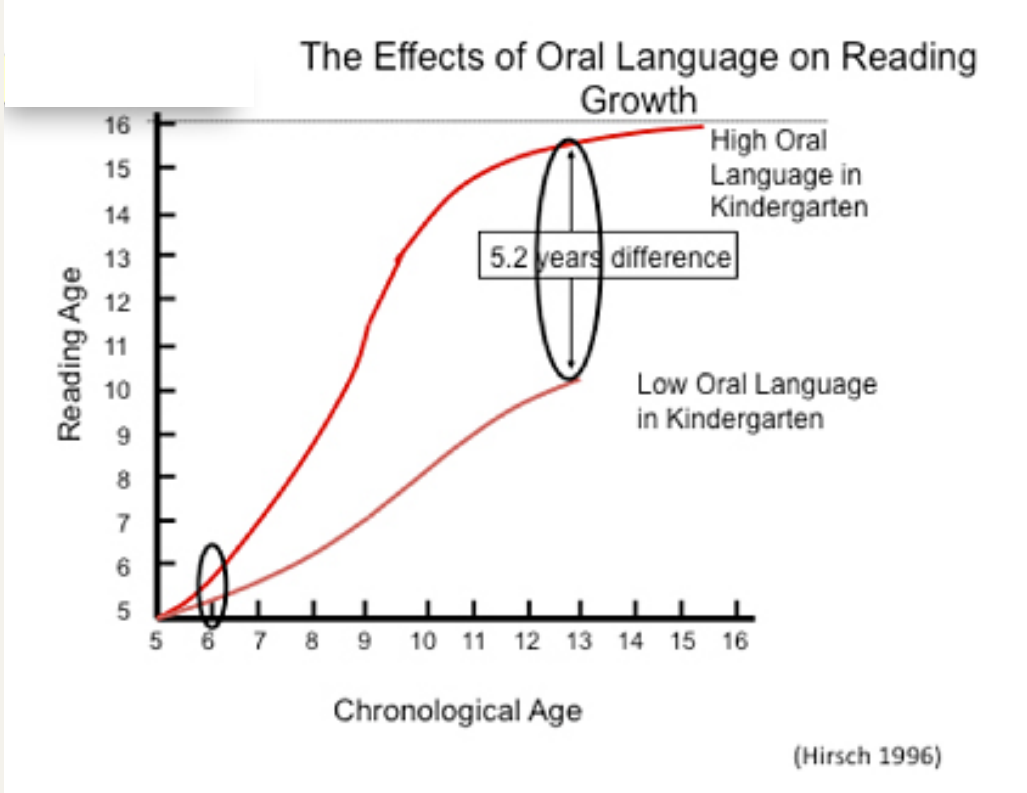
Comprehension and Decoding





Shankweiler et al., (1999)

Importance of starting early



Symbolic Circuits are Constructed

Children's Circuits Differ in Ways that Matter

Educational Scaffolding Can Change How Circuits are Constructed

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