Learning to Read

A Primer | Part One

Center for
Early Reading
Amplify.

IN THE UNITED STATES, we aim to be a society in which everyone can read and understand text at a college-entry level or above.

We consider schools that are not on track to achieve this goal to be failing their students.

It is an admirable goal but an ambitious one. No diverse society has ever achieved it.

In France in 1720, only one-third of the population was literate.

Literacy in the U.S. was likely similar, though in 1776, 20 percent of colonists read (or at least purchased) Thomas Paine's *Common Sense*—not a straightforward text.

Today, only 57 percent of adults can perform moderately challenging literacy activities, such as understanding the last sentence.[1]

COMMON SENSE;

ADDRESSED TO THE

INHABITANTS

OF

AMERICA,

On the following interesting

SUBJECTS.

I. Of the Origin and Design of Government in general, with concise Remarks on the English Constitution.

II. Of Monarchy and Hereditary Succession.

III. Thoughts on the present State of American Affairs.

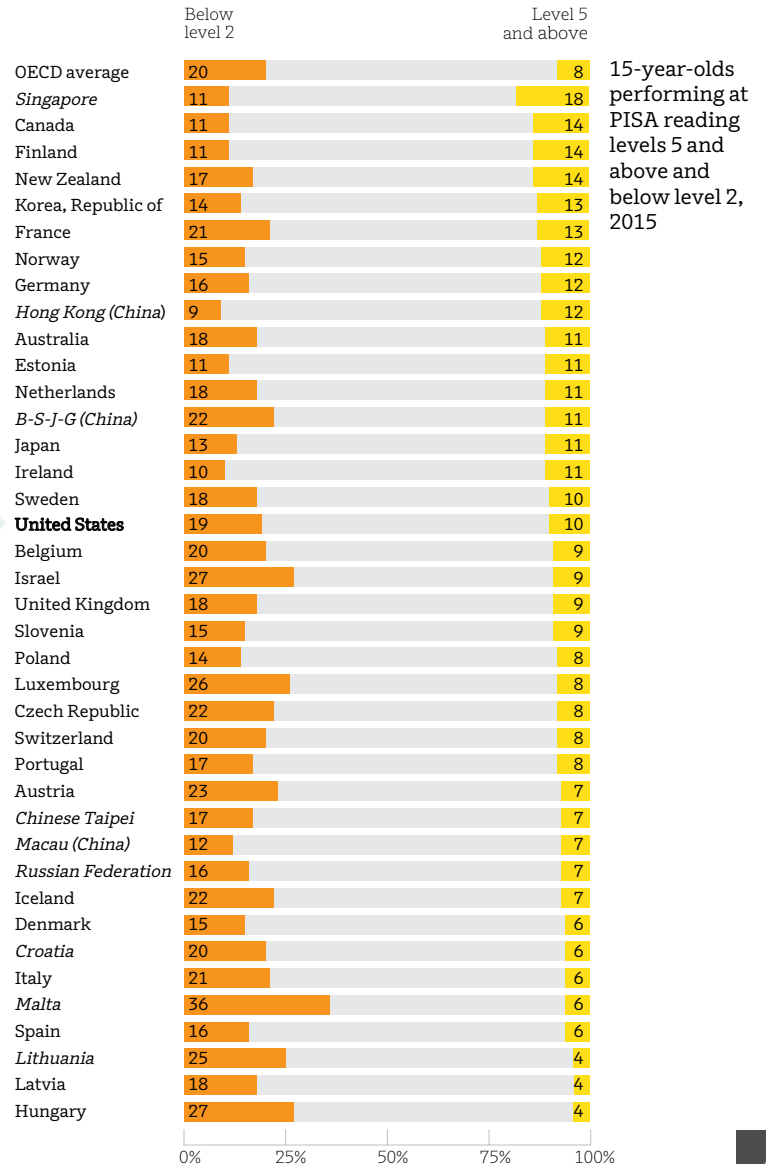IV. Of the present Ability of America, with some miscellaneous Reflections.

Man knows no Master save creating HEAVEN,
Or those whom choice and common good ordain.

THOMSON.

[1] National Assessment of Adult Literacy (2003)

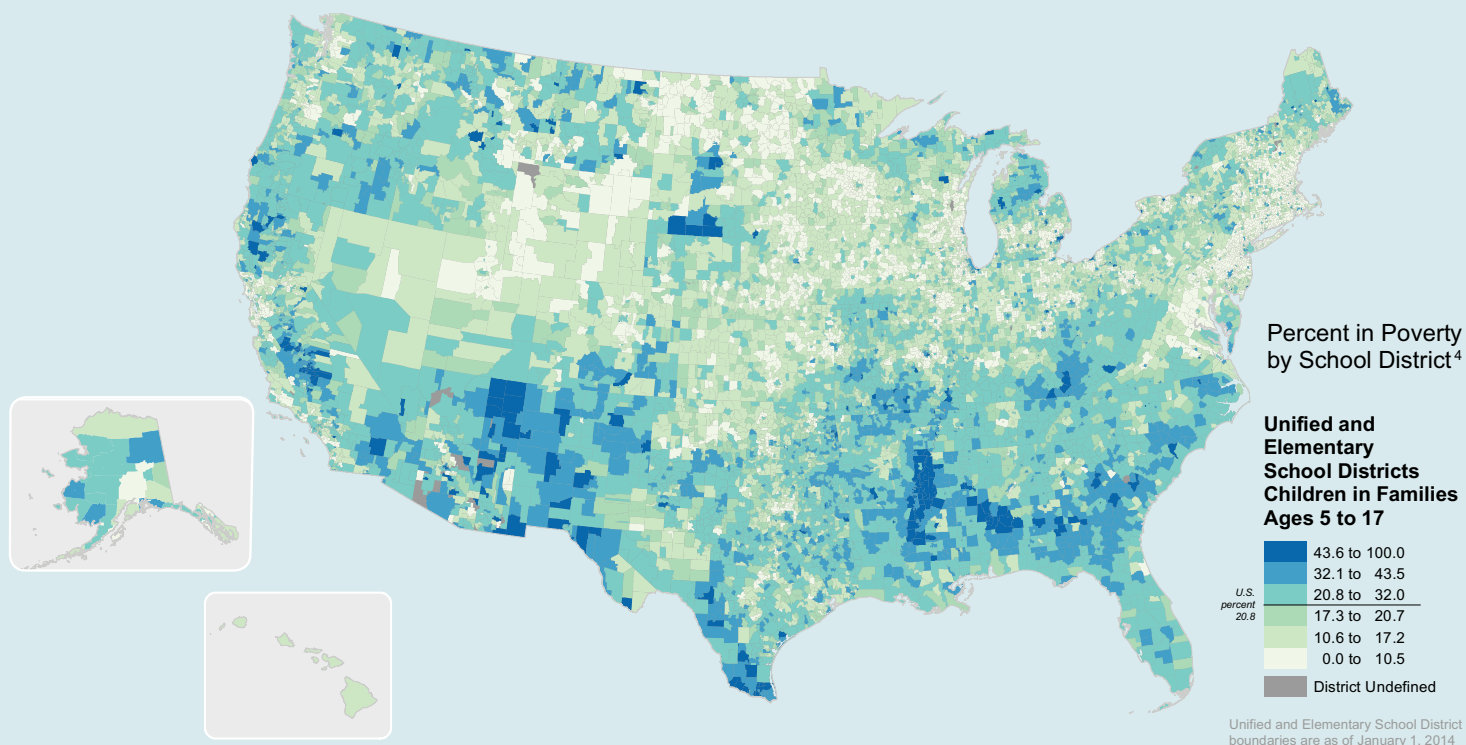For school-aged children, the U.S. manages only the middle of the pack in international comparisons of reading.[2]

And 31 percent of U.S. fourth-graders are below even a basic level.[3]

15-year-olds performing at PISA reading levels 5 and above and below level 2, 2015

	Below level 2	Level 5 and above
OECD average	20	8
Singapore	11	18
Canada	11	14
Finland	11	14
New Zealand	17	14
Korea, Republic of	14	13
France	21	13
Norway	15	12
Germany	16	12
Hong Kong (China)	9	12
Australia	18	11
Estonia	11	11
Netherlands	18	11
B-S-J-G (China)	22	11
Japan	13	11
Ireland	10	11
Sweden	18	10
United States	19	10
Belgium	20	9
Israel	27	9
United Kingdom	18	9
Slovenia	15	9
Poland	14	8
Luxembourg	26	8
Czech Republic	22	8
Switzerland	20	8
Portugal	17	8
Austria	23	7
Chinese Taipei	17	7
Macau (China)	12	7
Russian Federation	16	7
Iceland	22	7
Denmark	15	6
Croatia	20	6
Italy	21	6
Malta	36	6
Spain	16	6
Lithuania	25	4
Latvia	18	4
Hungary	27	4

0% 25% 50% 75% 100%

[2] Programme for International Student Assessment (2015)
[3] National Center for Education Statistics (2015)

It is true that the U.S. has more poverty than most of those other countries, and that drags the averages down. (If Massachusetts were its own country, it would do quite well.)

But if that is an excuse, it doesn't feel like a very happy one.

Percent in Poverty by School District[4]

Unified and Elementary School Districts Children in Families Ages 5 to 17

	43.6 to 100.0
	32.1 to 43.5
	20.8 to 32.0
U.S. percent 20.8	
	17.3 to 20.7
	10.6 to 17.2
	0.0 to 10.5
	District Undefined

Unified and Elementary School District boundaries are as of January 1, 2014
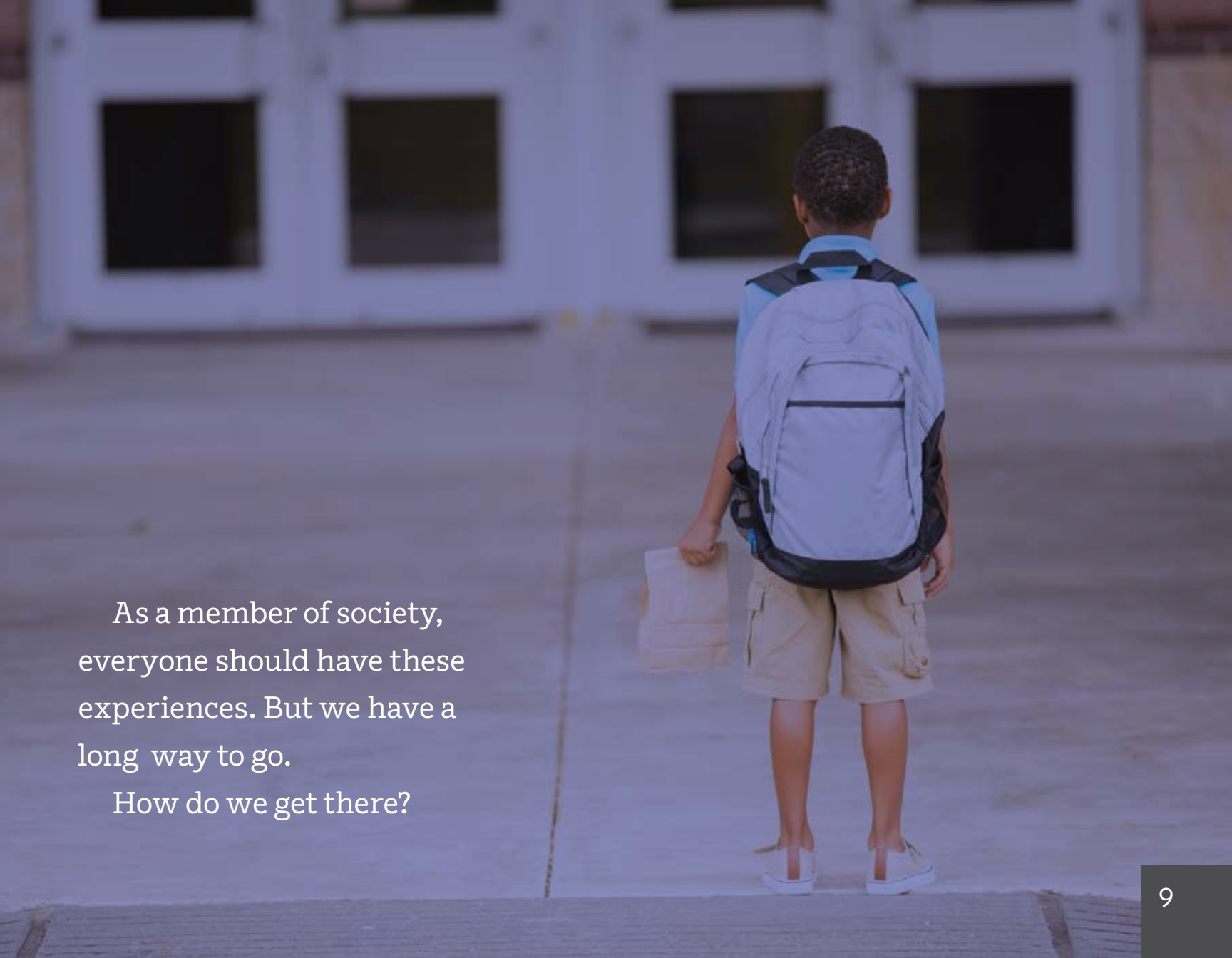
[4] U.S. Census Bureau, Small Area Income and Poverty (2014)

Why have we set ourselves such a challenging goal? Because we believe that reading is essential to playing a full role as a citizen. Because it is a source of self-improvement—in knowledge of the world and in understanding the human condition.

And, of course, because reading a good book, while lying in a hammock under elm trees, is one of the great experiences of being alive.

As a member of society, everyone should have these experiences. But we have a long way to go.

How do we get there?

IN 1986, TWO RESEARCHERS who connected through the University of Texas, Philip Gough and Bill Tunmer, proposed an easy way to understand the complex combination of skills that result in reading.

They called it the Simple View of Reading.[5]

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[5] Gough & Tunmer (1986)

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. Instead, alphabetic writing tells you the sounds that each word is made of. There are just 44 different sounds in English.

Decoding of text X **Comprehension of language** = **Reading to gain meaning**
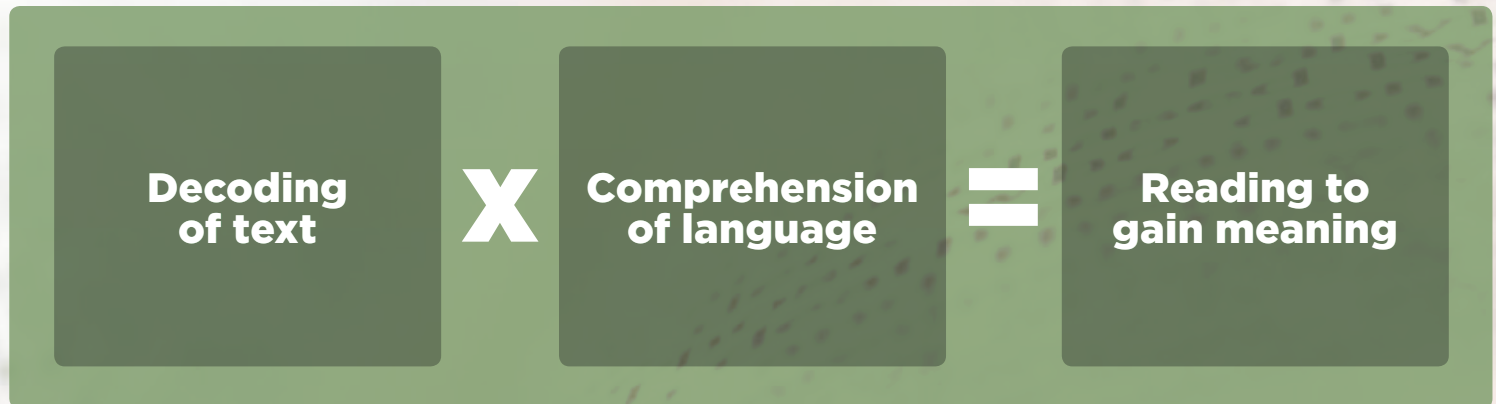
Of course, you don't actually have to speak when you read—though most people did until relatively recently.

In antiquity, reading without making a sound was considered a neat trick. Saint Augustine thought it strange enough to include as an anecdote in his *Confessions*.

The Simple View points out that if you can't decode the symbols in a sentence, you can't read it, even if you know the language in which it's written.

Here is an English sentence rewritten in a made-up system, with the code beneath it. Try decoding it. By the way, it is written right to left.

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

If you can't decode, you can't read. That's point #1 of the Simple View. But decoding isn't enough on its own.
Try reading this:

> "England's openers labored 34 balls before scoring their first boundary as Strauss cracked two fours through the leg side. Cook made a patient start before motoring past his skipper. "

You know the code, but you also need the vocabulary and background knowledge—in this case, cricket knowledge. That's point #2 (and it's especially important for English Language Learners).

When children first learn to read, they already understand a lot of spoken language.

But written words and letters are as strange to them as

Iꟻ W⅁⊗

Decoding of text	**X**	Comprehension of language	**=**	Reading to gain meaning
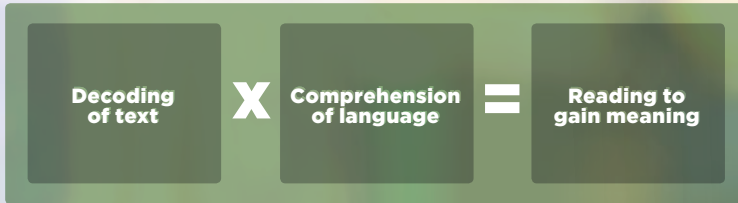
That means the best way to help students begin to read for themselves is to get decoding started.[6]

So it's important to teach children that words are made up of sounds (the technical term is *phonemes*), and then teach them what sounds the letters stand for. Unfortunately, the English system of writing does not make this easy. Let's see why.

language comprehension

knowledge

vocabulary

sentences

connections

gist

word recognition

sounds

letters

words

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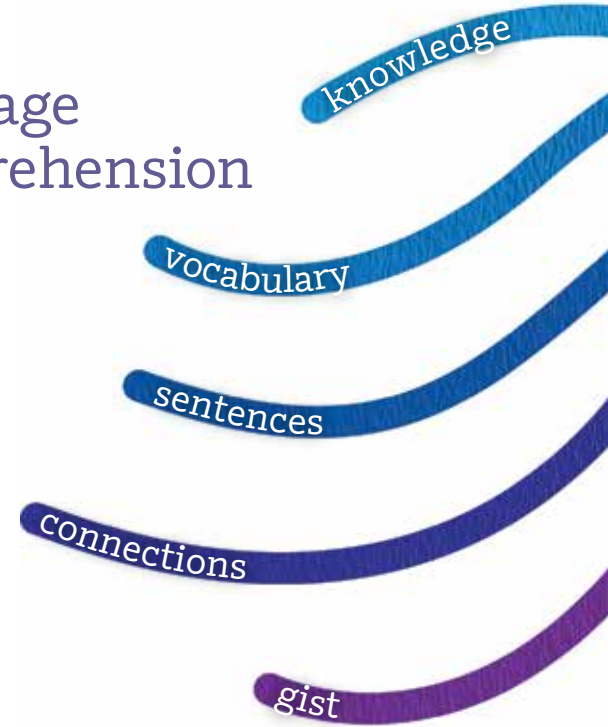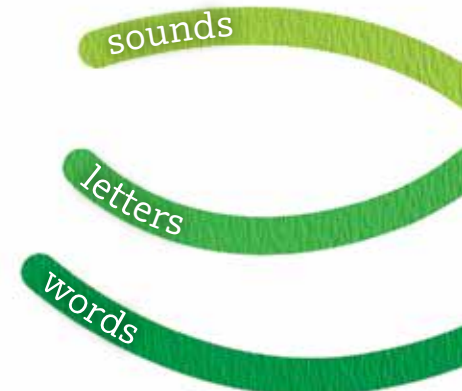
[6] lllustration based on Scarborough (2001)
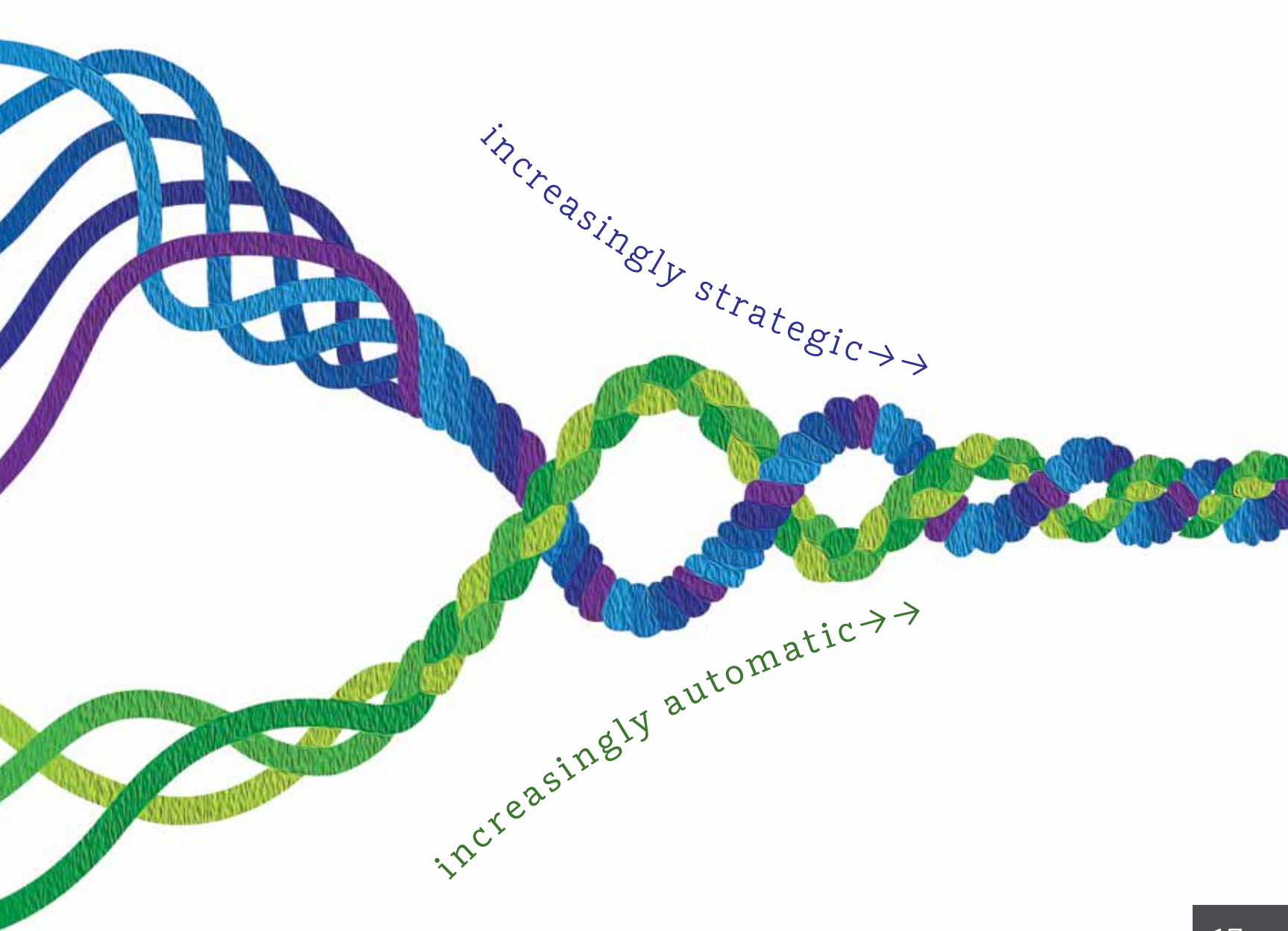
increasingly strategic→→

increasingly automatic→→

In Spanish, the symbol *p* always stands for the /p/ sound as in *palabra* (word).

In English, when you see a word beginning with *p*, it could represent the /p/ sound, but it could also represent /f/ as in *photo*. Or it could be silent as in *pterodactyl*.

p...

/p/

/f/

/—/

pen

photo

pterodactyl

Some letters are even more unpredictable. Try this:

A mystery word begins with the letter *e*. What sound does the word begin with? Come up with three before turning the page.

/e/ /ē/
end   eat

/ī/ /i/
eye   english

/er/ /ā/
early   eight

There are (at least) six possibilities. So kids can't just learn that *e* makes the /e/ sound in *end*—though that's a good start. They have to learn each specific pattern. There are hundreds of them. Finnish has 29.
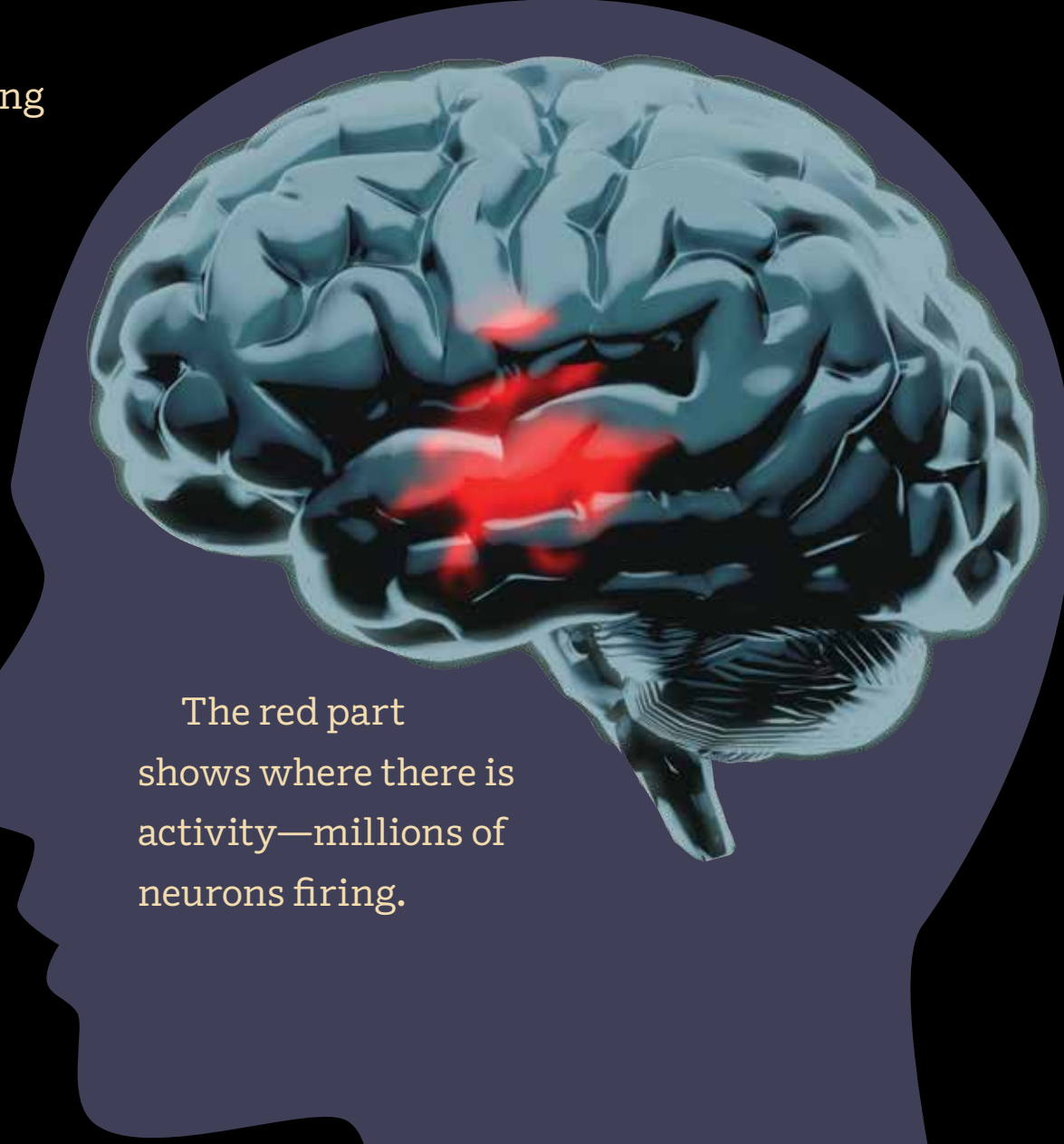
EACH TIME YOU LEARN A NEW CONNECTION—for example, that *sh* stands for the /sh/ sound at the start of *ship*—a tiny part of your brain gets rewired.

Scientists have recently begun to understand how that works. It turns out it's a lot like building a muscle.
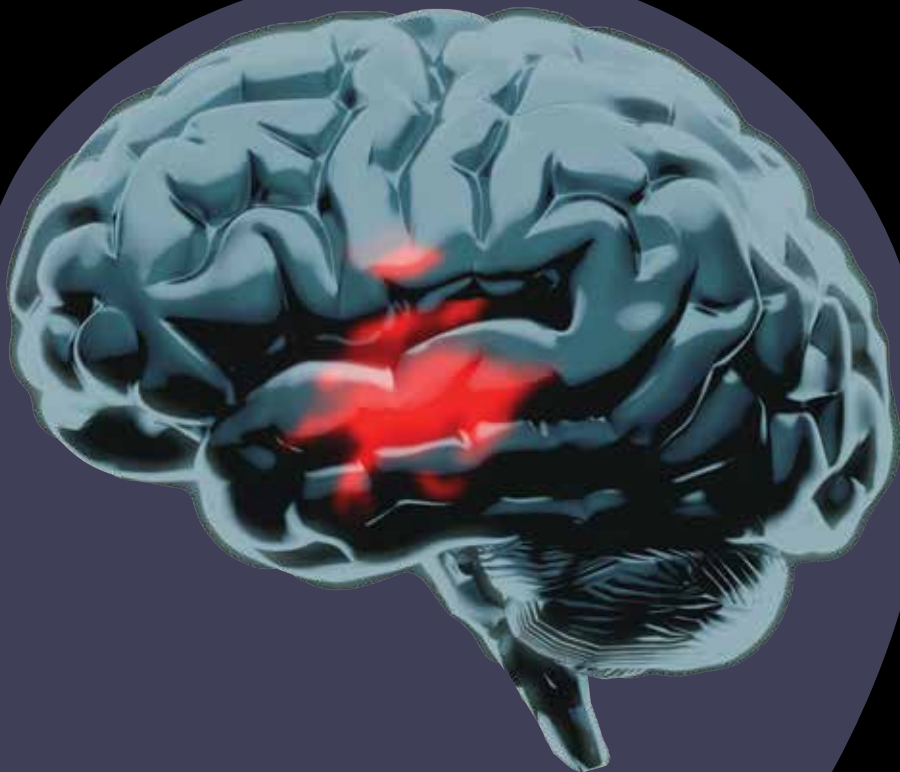
sh→/sh/

You are looking at a brain from the left side.

The red part shows where there is activity—millions of neurons firing.

spoken word

Here is a time-lapse sequence starting at the left.
It shows the brain of someone speaking a word
(not reading it; we'll look at that next).

55 ms   170 ms   250 ms   320 ms   420 ms
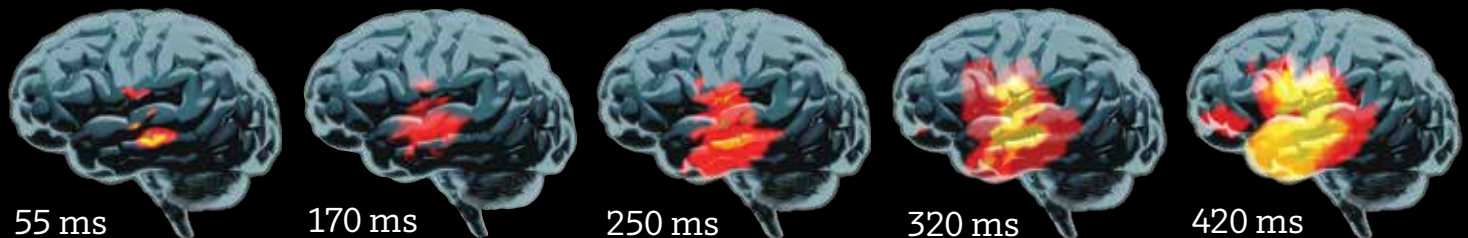
When you say a word, activity starts out in a small spot roughly in the middle of the left side.[7]

55 ms   170 ms

[7] Marinkovic, Dhond et al. (2003)
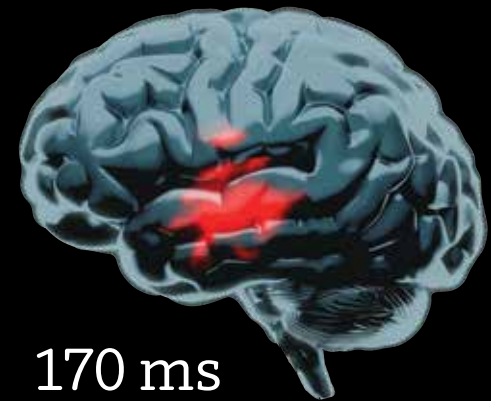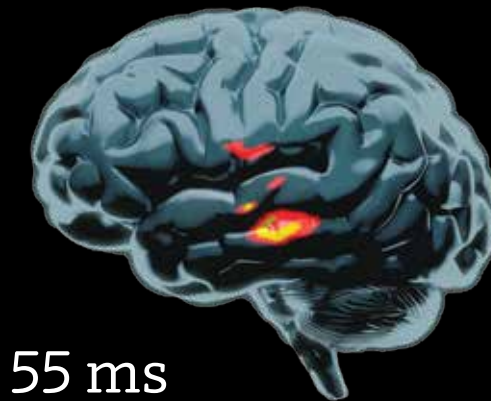
spoken word
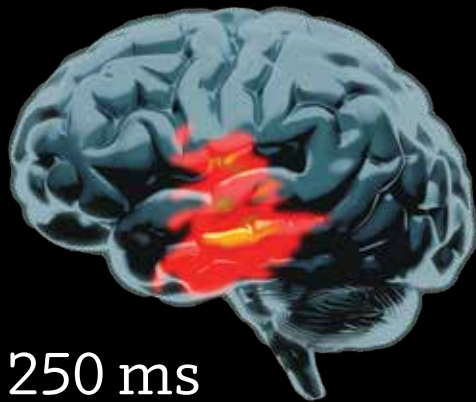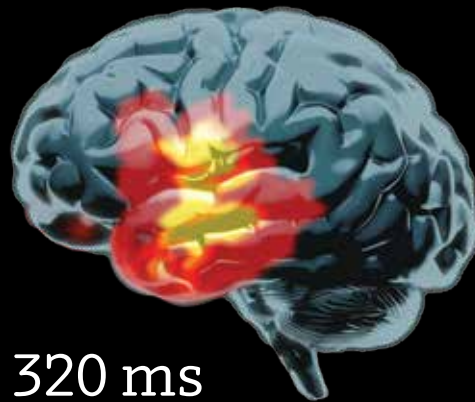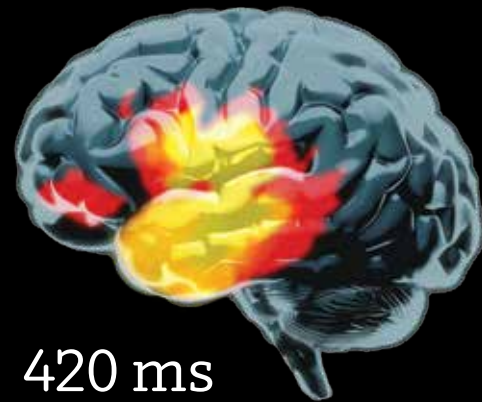
250 ms   320 ms   420 ms

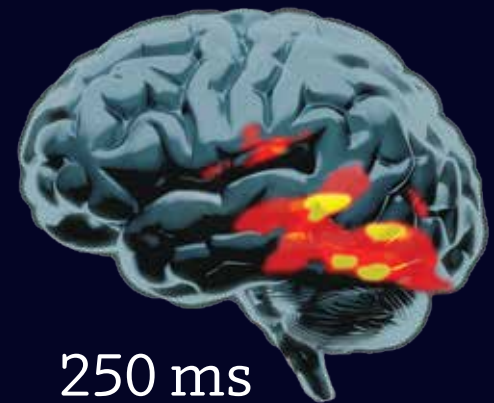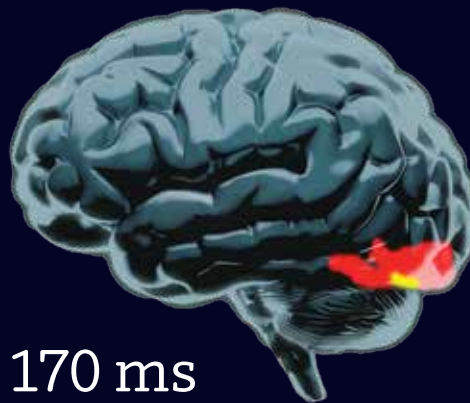But in less than a second it spreads downward and forward until a big chunk of the left side lights up.
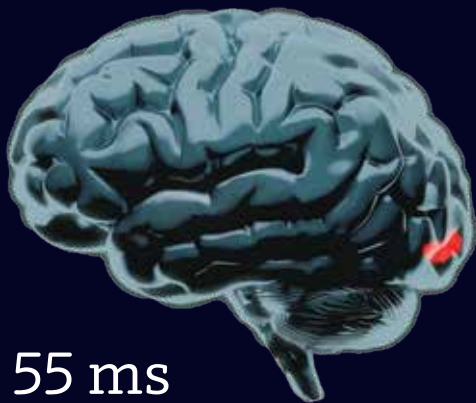
The part that lit up is the part of the brain that deals with speech.

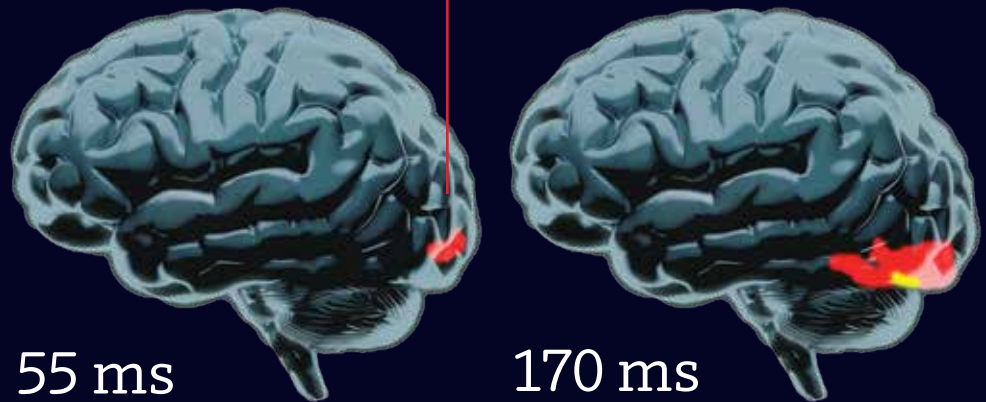Notice that the rear of the brain is dark. It isn't involved in speech at all.

Now here is a different time-lapse sequence. It shows the same brain reading a word instead of speaking it.

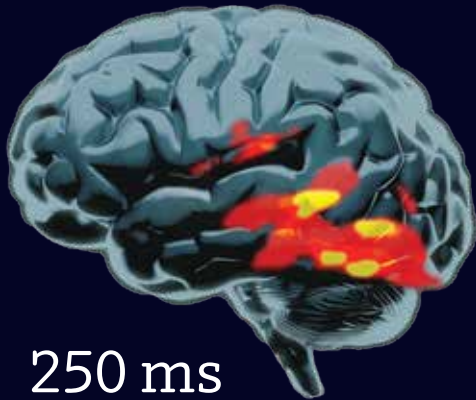55 ms   170 ms   250 ms

This time, activity starts at the back of the brain—which is the visual area. It's a long way from your eyes but that's where visual signals are sent.[8]
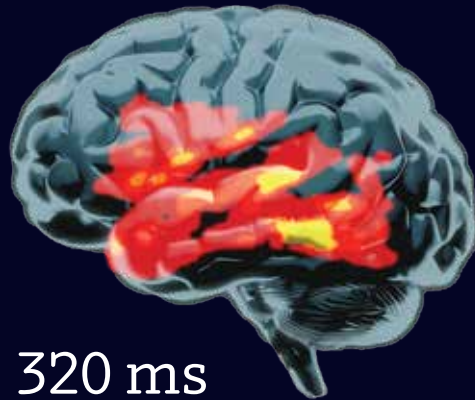

55 ms   170 ms

If this were the brain of someone who couldn't read, that's where the signal would end.

But it isn't.

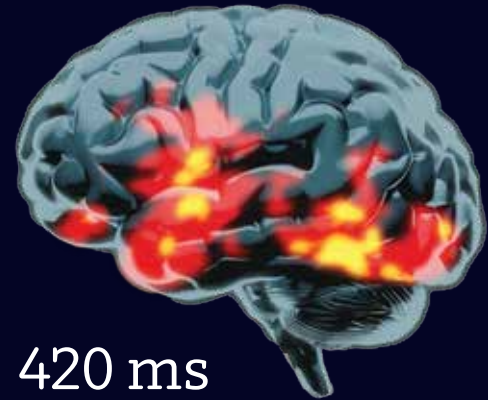[8] Marinkovic, Dhond et al. (2003)
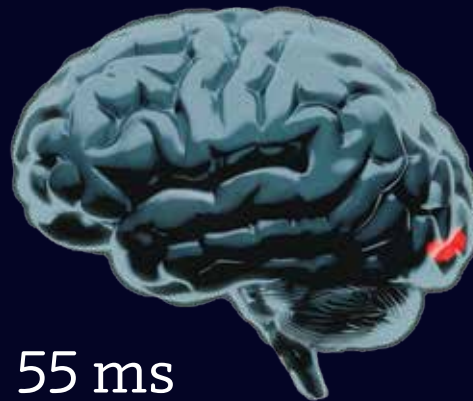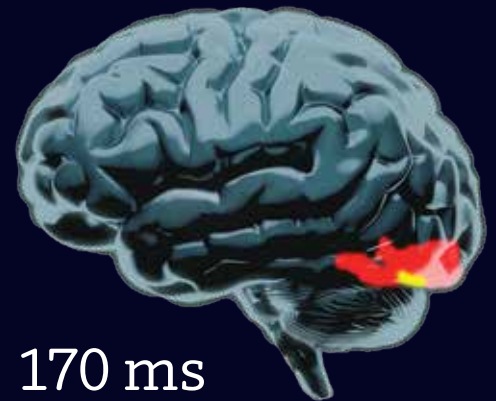
written word

250 ms   320 ms   420 ms

Instead, activity spreads from the
back of the brain, along the bottom
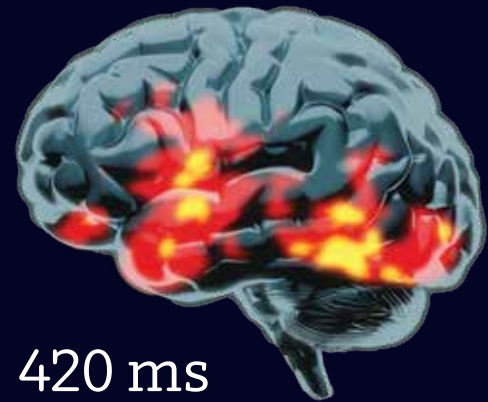surface, and into the whole middle area.

As we've seen, the middle area is
responsible for speech.

55 ms   170 ms

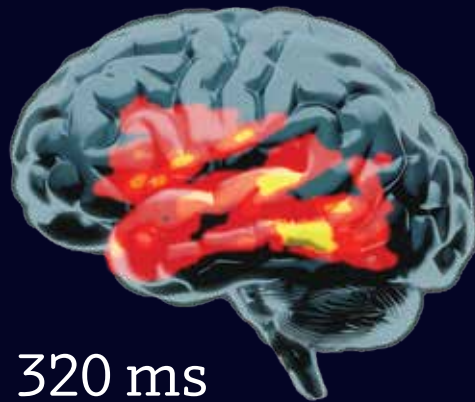# written word

250 ms 320 ms 420 ms
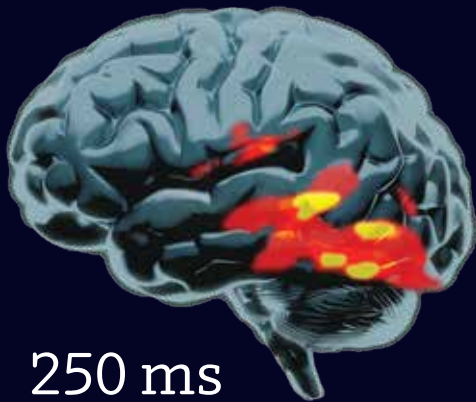
So what we are seeing here is a written word triggering speech. This happens whether you actually speak the word out loud or not. The same circuit is involved in articulating a word or just recognizing it.

Between these two zones—the visual zone at the back of the brain and the spoken language zone in the middle—lies a critical switchboard. It is the seat of reading. If you have it, you can read; if you don't, you cannot.

It's called the *visual word form area.*[9]
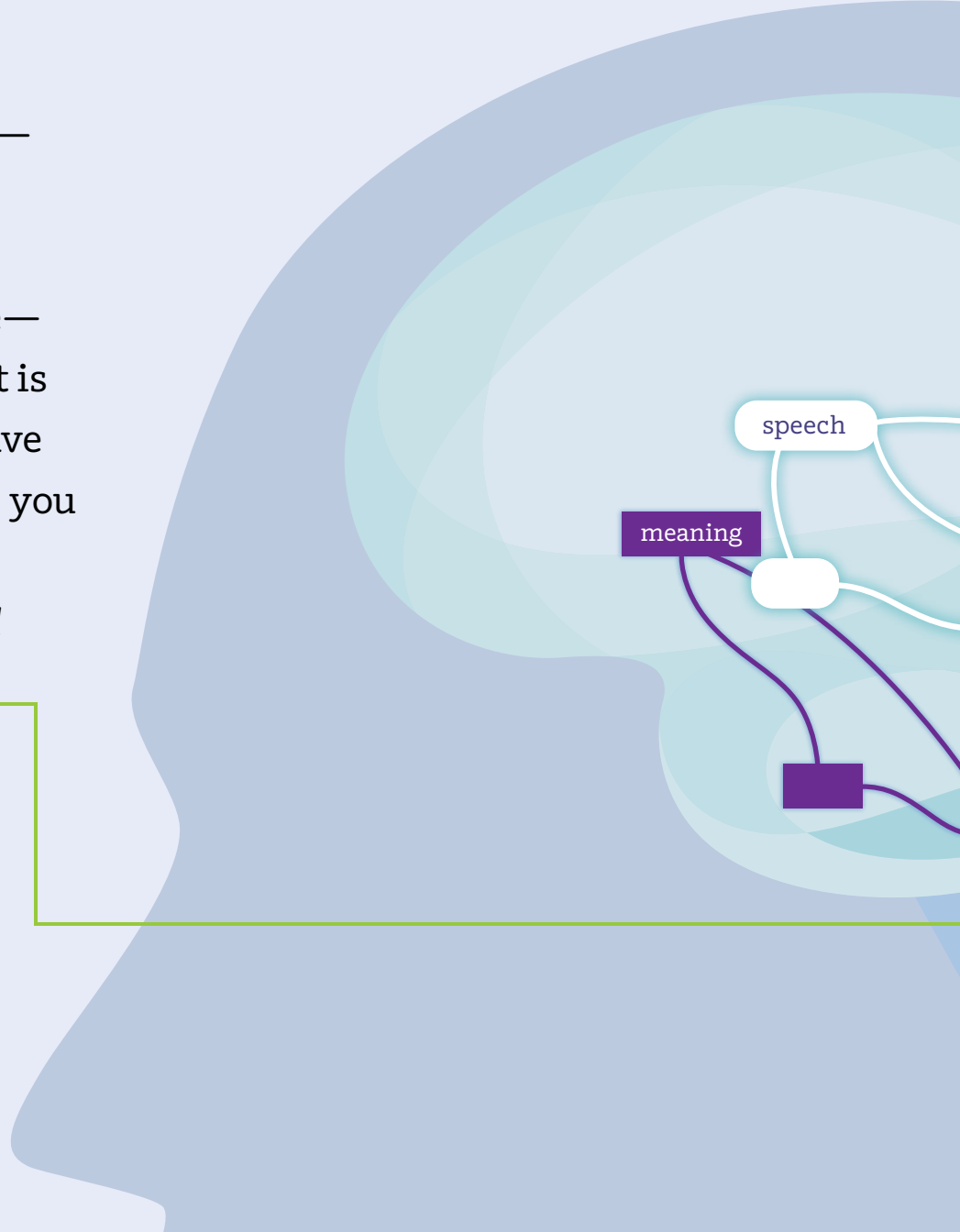
speech

meaning

[9] Illustration based on Dehaene (2009)

visual
word form
area
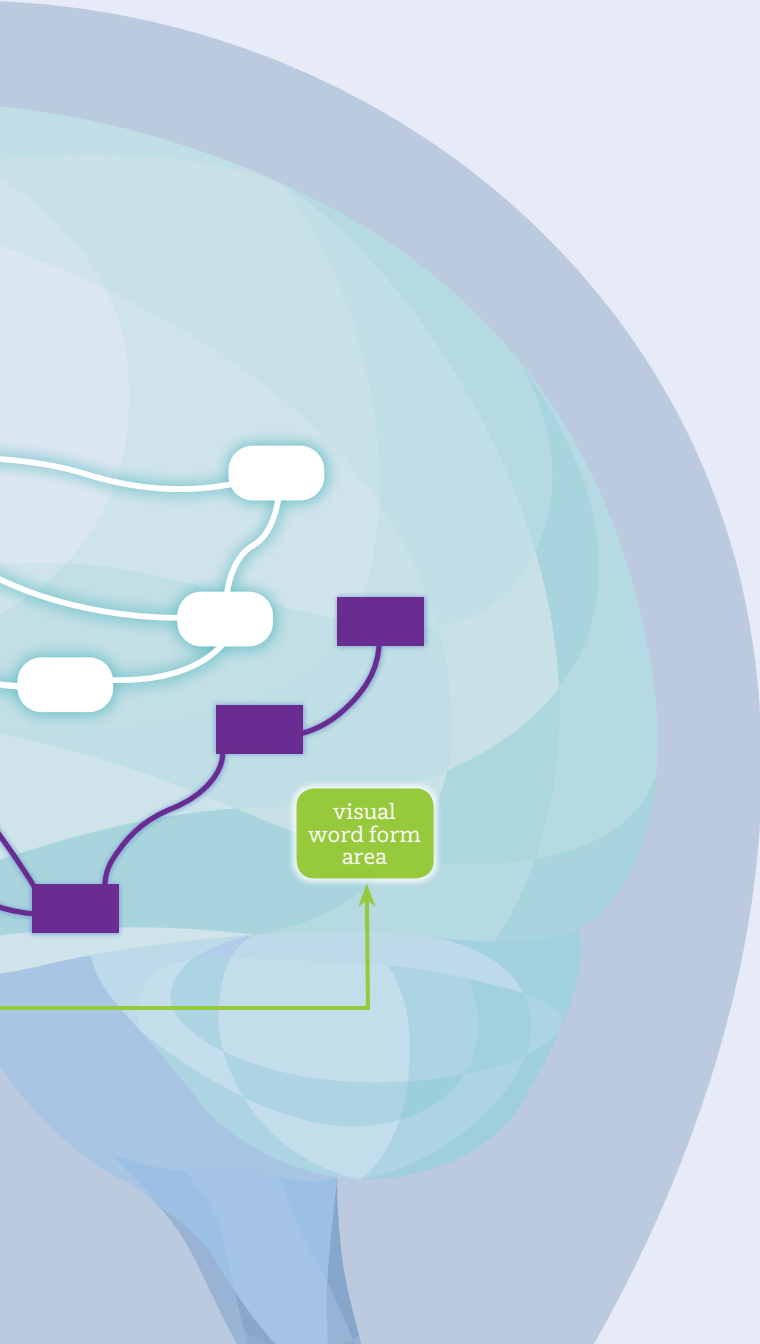
Something miraculous is going on here. We know everyone is born with the language part of the brain—the speech and meaning parts. You learn to speak and to understand spoken language simply by being around other people who speak for a few years.

And we know everyone is born with the visual part of their brain. We easily recognize shapes, objects, places, and faces. (There's a whole area of the brain devoted to faces.)

speech

meaning

visual
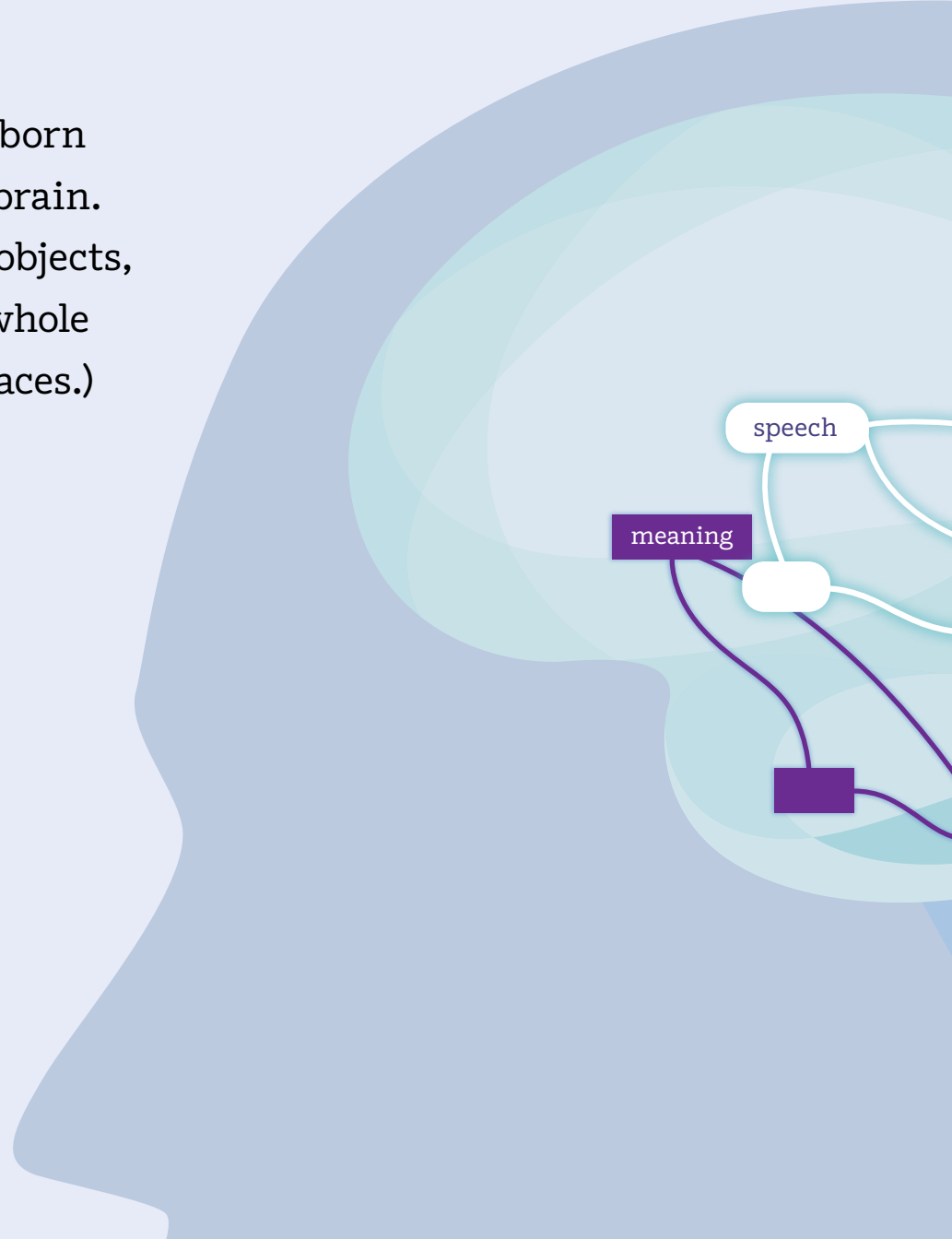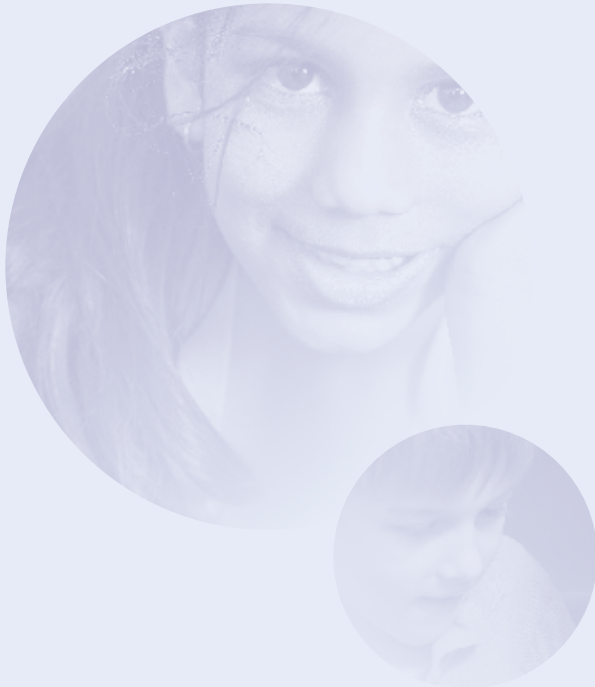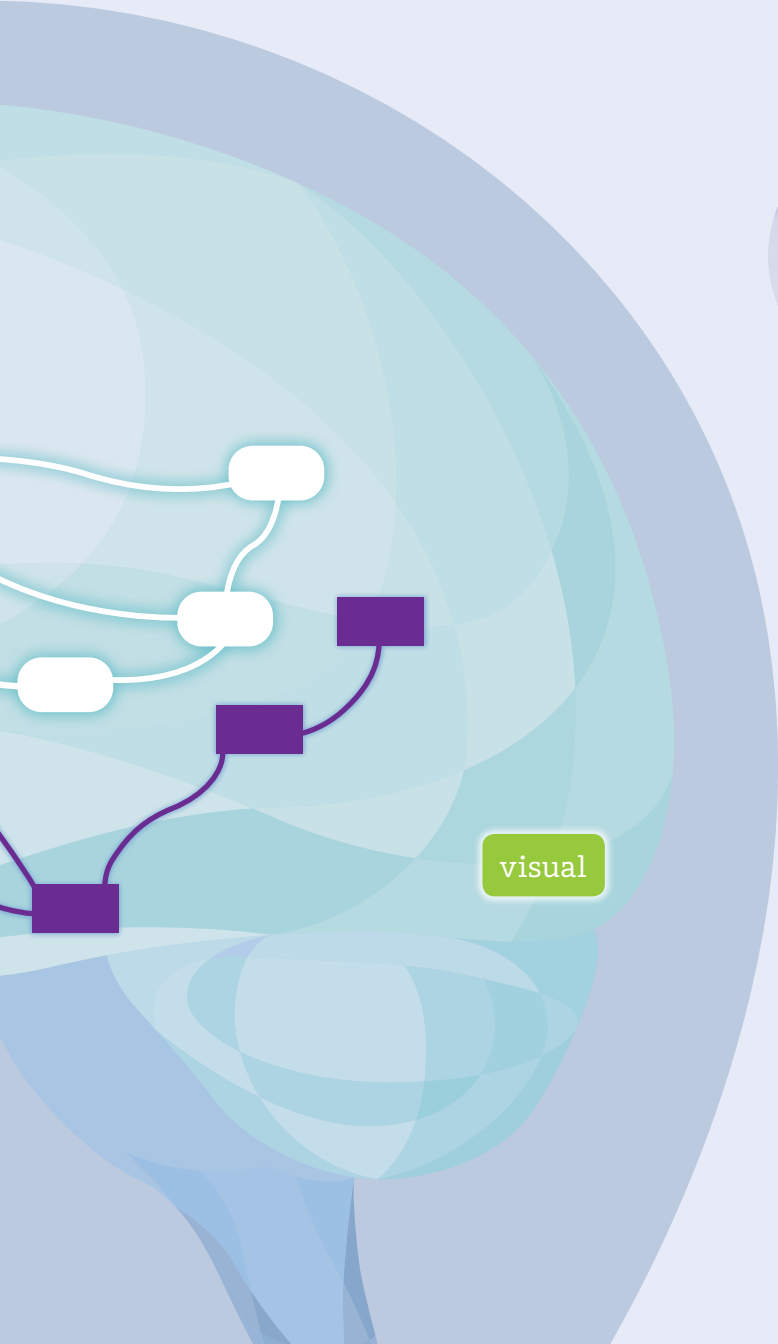
But no one is born
with the connections
between vision and
speech, the connections
that enable reading.

Reading, after all, is a fairly recent invention. The earliest known writing is from Mesopotamia around 3200 B.C. That's far too recent for the skill of reading to have become part of the brain's structure from birth.

speech

meaning
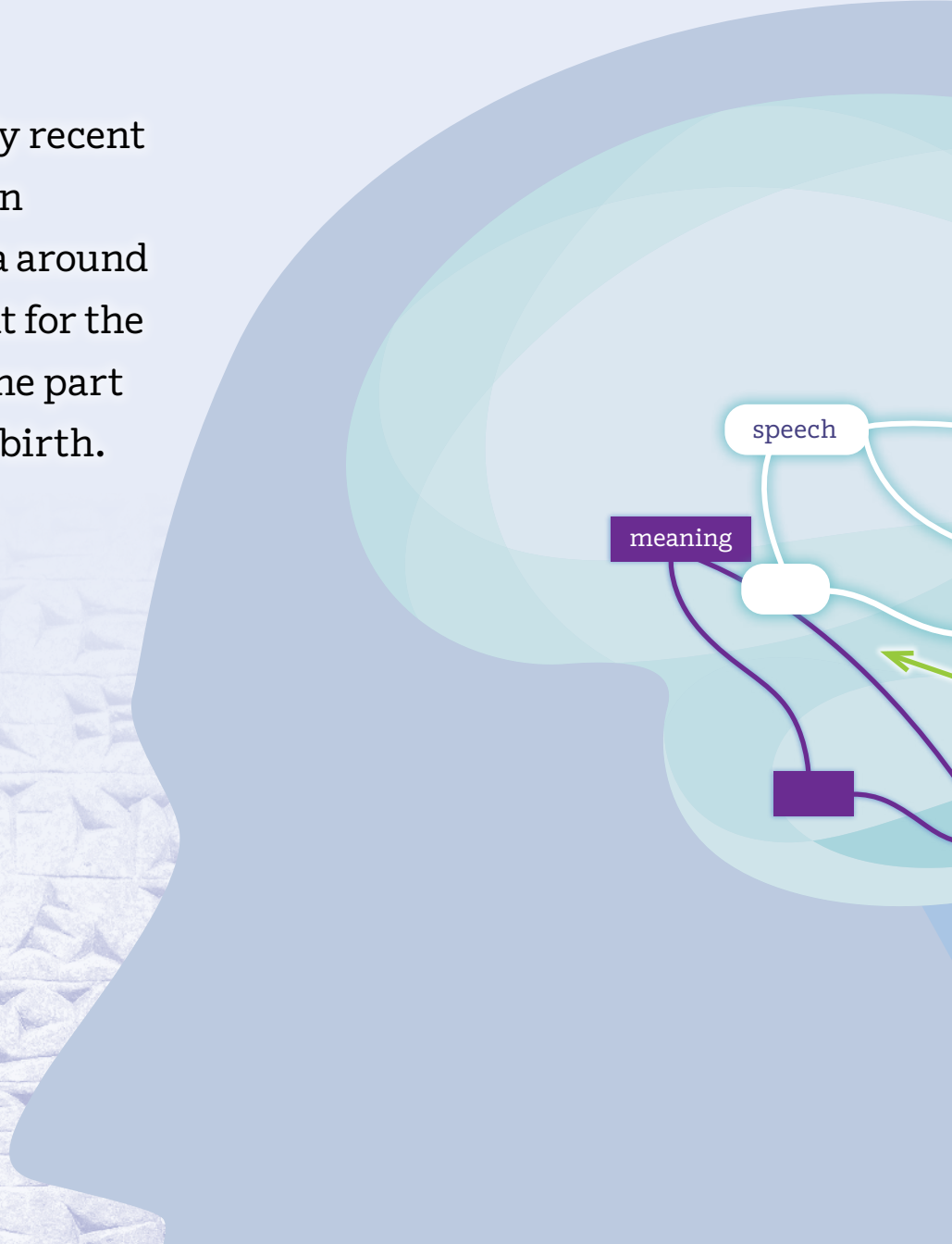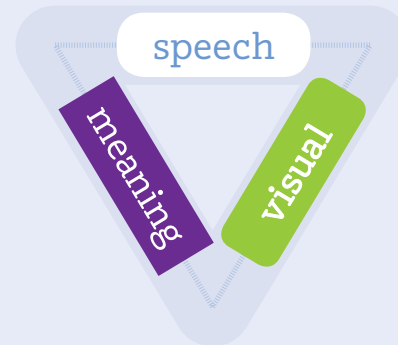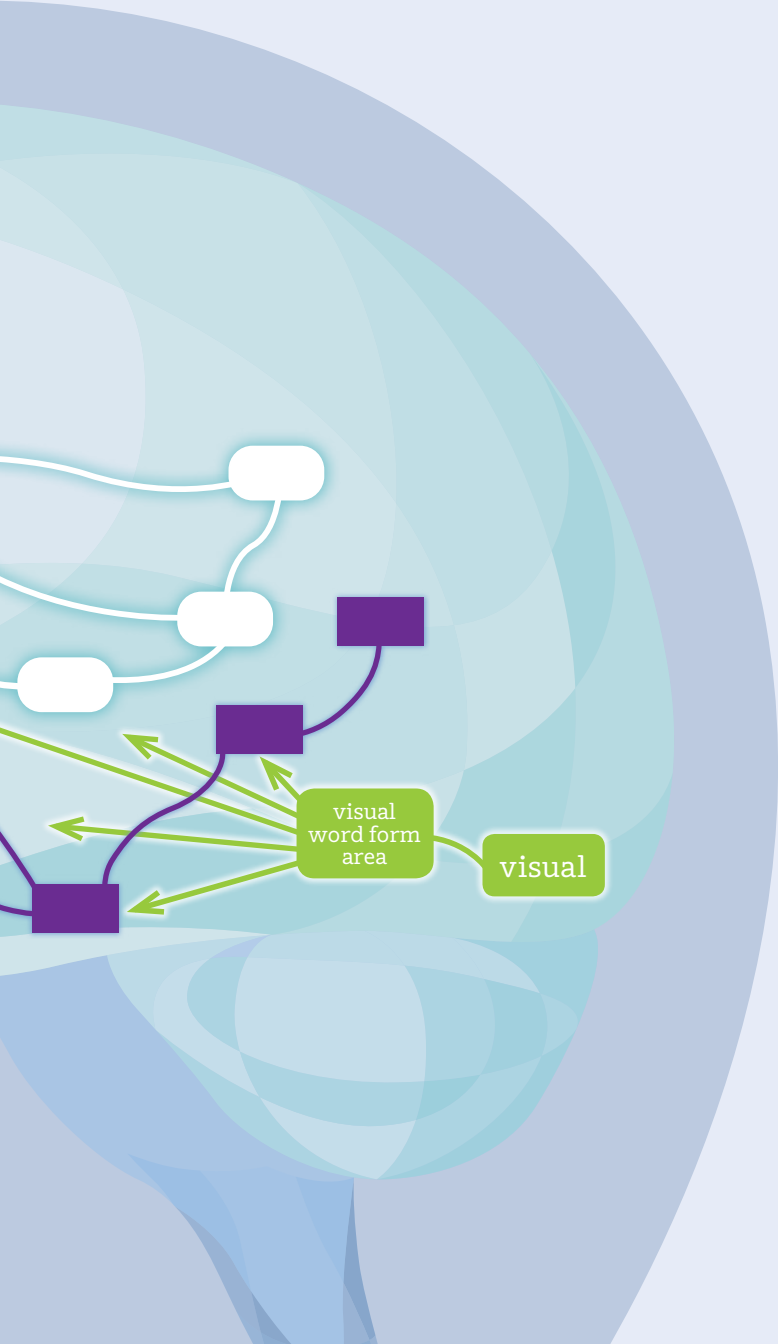
Instead, you have to build the visual word form area of your brain one connection at a time. You have to learn that *p* stands for the sound at the start of *pen* (usually) and *ough* stands for the sound at the end of *though* (sometimes).

speech

meaning

visual word form area

visual
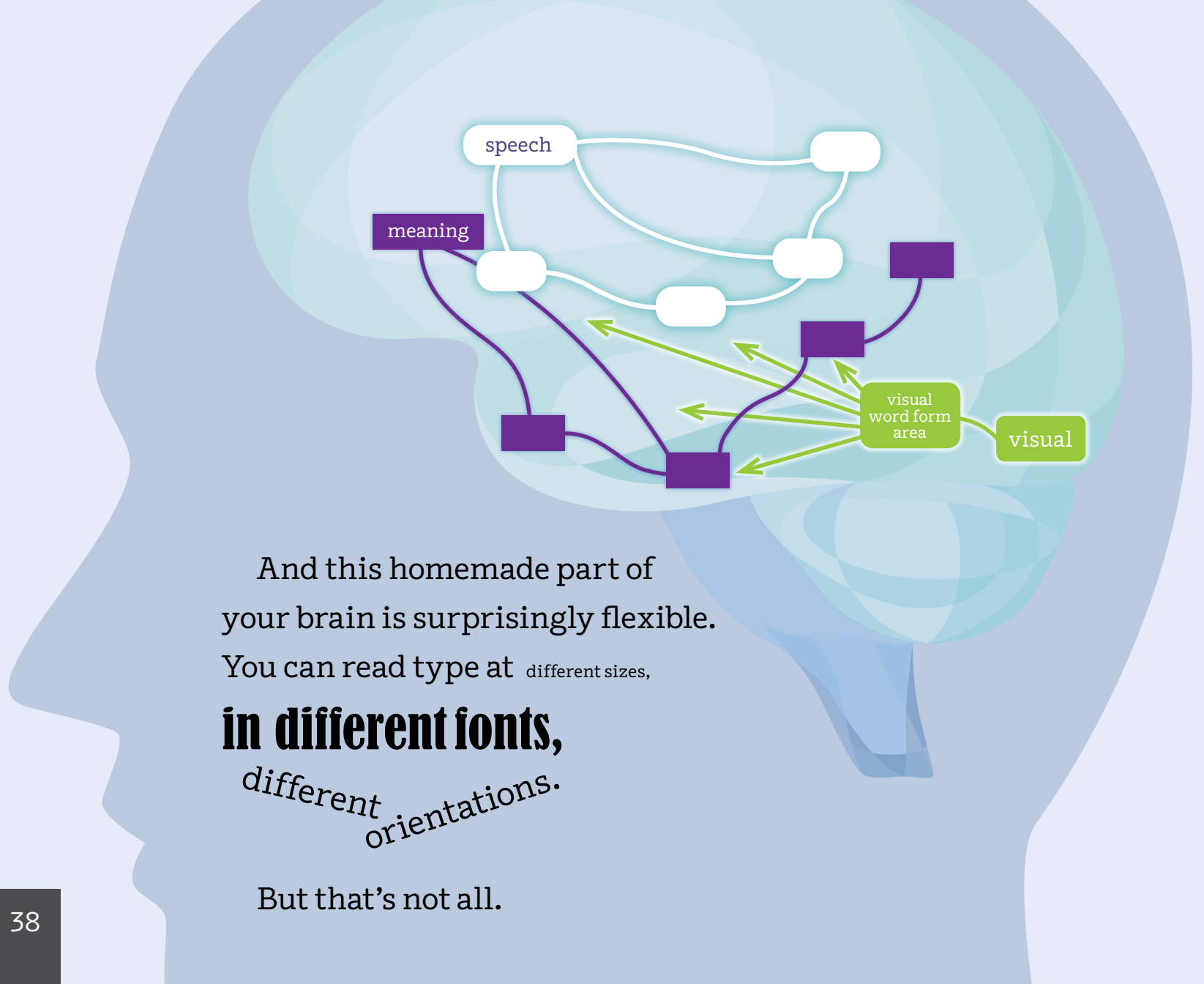
And this homemade part of your brain is surprisingly flexible. You can read type at different sizes, **in different fonts,** different orientations.

But that's not all.

You can read handwriting, for instance.
Even when the writer is a medical professional.

You can raed steennecs in wchih the leetrts of erevy wrod hvae been mxied up, epcxet for the fsirt and lsat ltetres.

AnD sEnTeNcEs WiTh AlTeRnAtInG uPpEr AnD lOwEr CaSe LeTtErS, tHoUgH yOu HaVe NeVeR sEeN wOrDs PrInTeD lIkE tHiS bEfOrE.
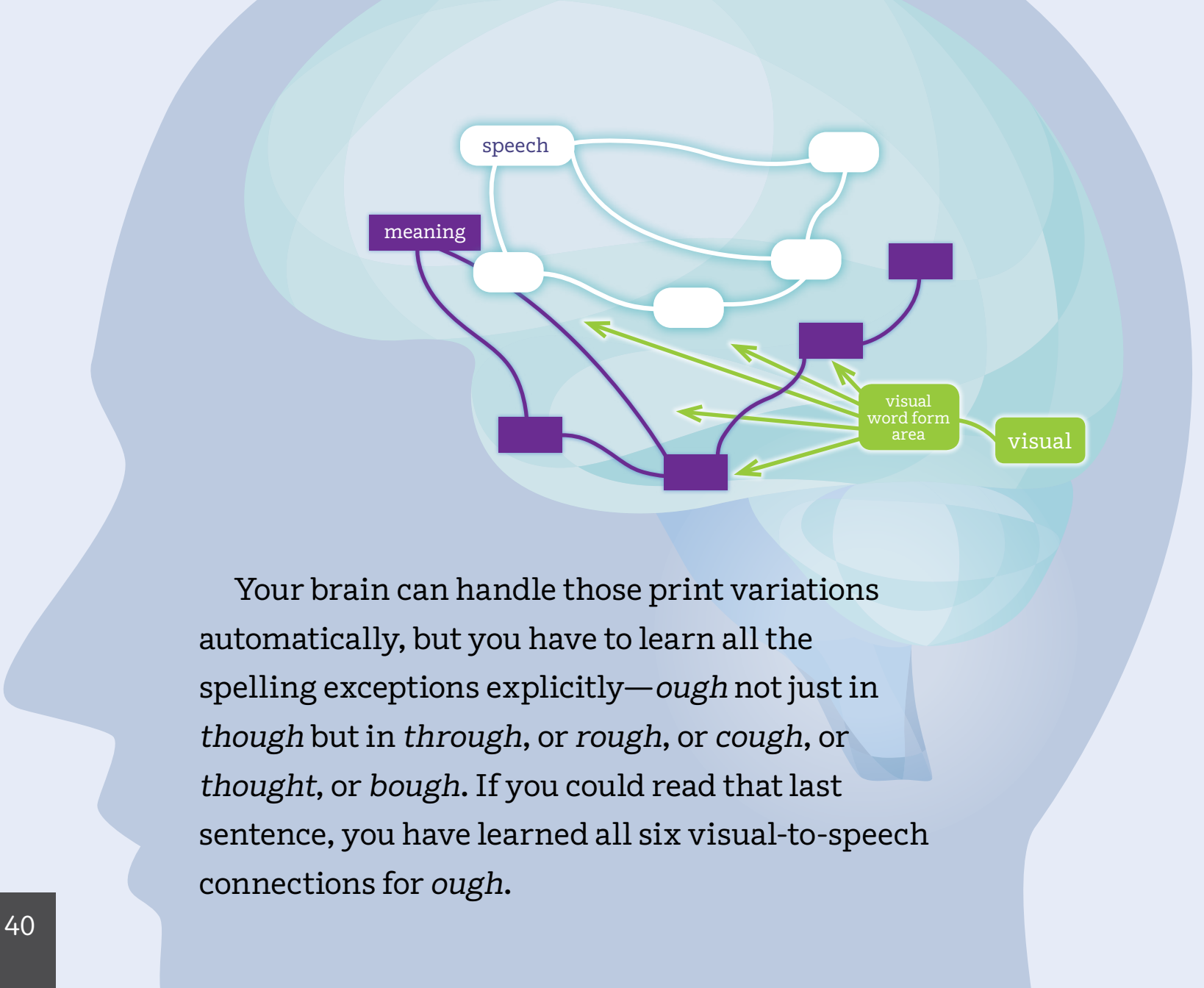
Your brain can handle those print variations automatically, but you have to learn all the spelling exceptions explicitly—*ough* not just in *though* but in *through*, or *rough*, or *cough*, or *thought*, or *bough*. If you could read that last sentence, you have learned all six visual-to-speech connections for *ough*.
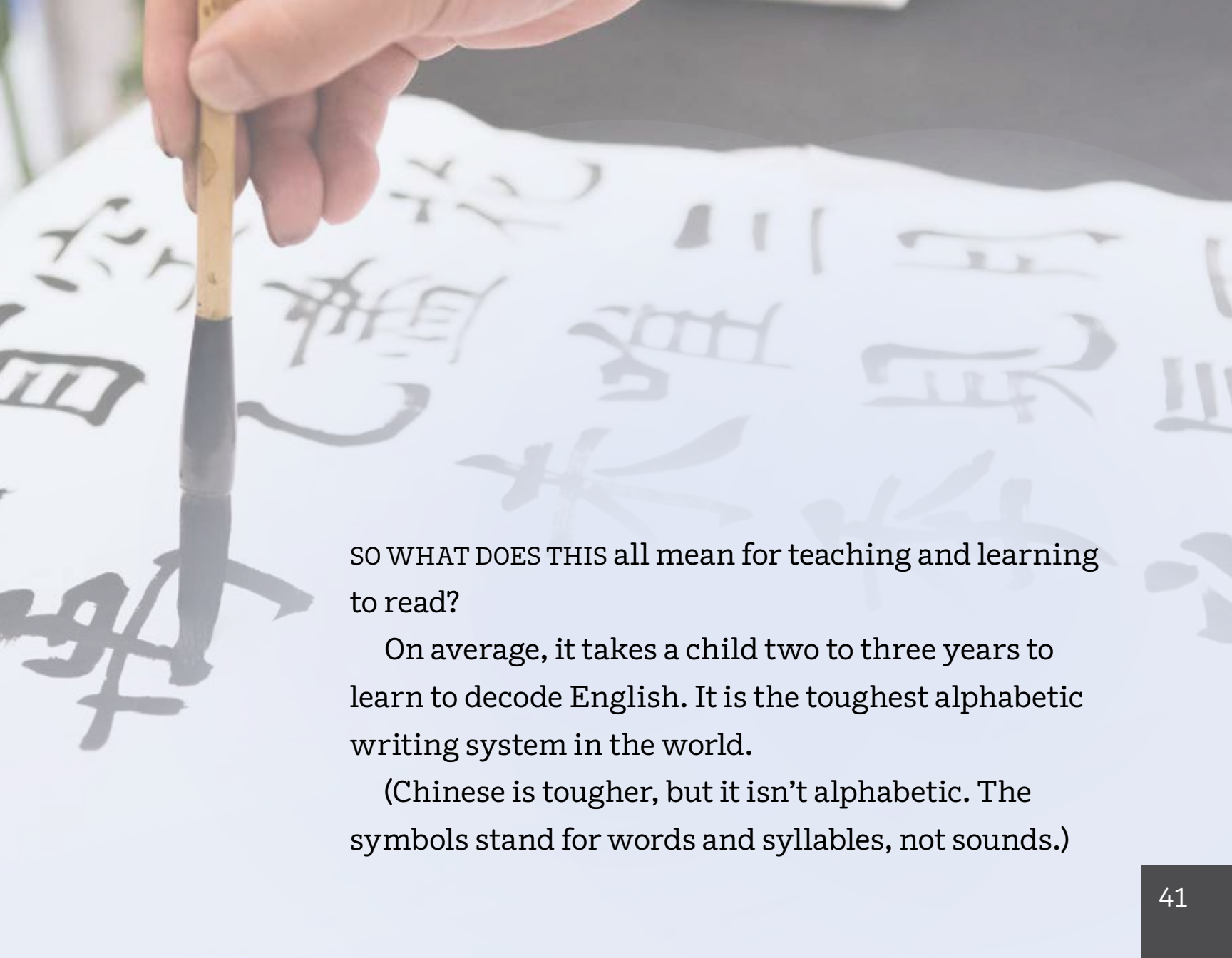
SO WHAT DOES THIS all mean for teaching and learning to read?

On average, it takes a child two to three years to learn to decode English. It is the toughest alphabetic writing system in the world.

(Chinese is tougher, but it isn't alphabetic. The symbols stand for words and syllables, not sounds.)

In Finland, where there are no exceptions—each letter always stands for the same sound—children take only a few months to learn to decode. Learning to decode in English is enormously harder. Every child needs a lot of practice.

Nyt voit lukea Suomi.
"Nuht voh-it loo-key-a Soo-oh-mi."

Translation: Now you can read Finnish.

There are no shortcuts. You can't just learn to recognize every word on sight. There are too many of them.

And you would never be able to figure out words like Brobdingnag and Glubdubdrib.

But fortunately, like a muscle, you can grow your brain with practice.

Heikki Lyytinen, a Scandinavian neuroscientist, showed that the visual word form area begins to appear in the brain scans of non-readers after as little as five hours of training in decoding.[10]

before

after

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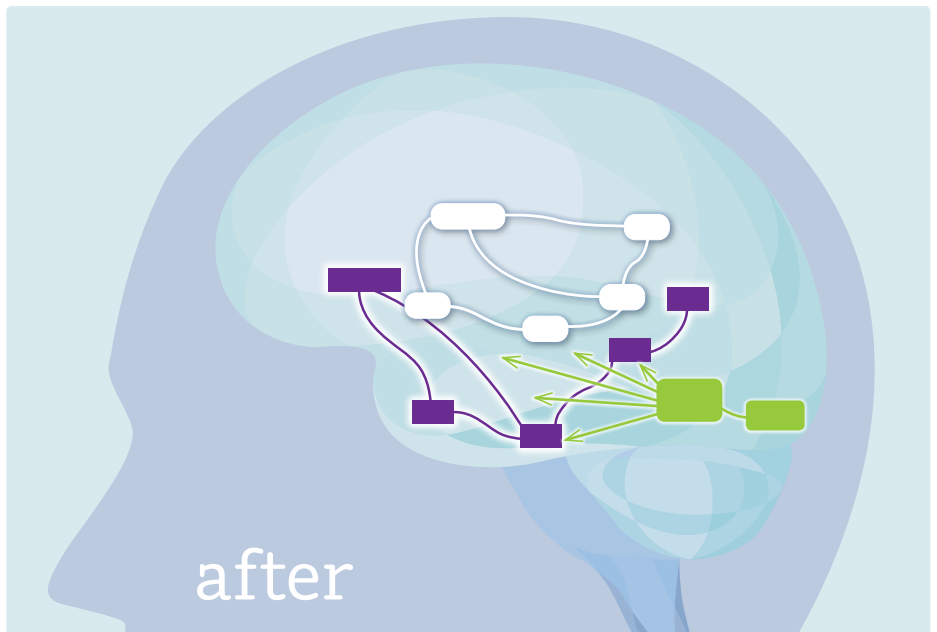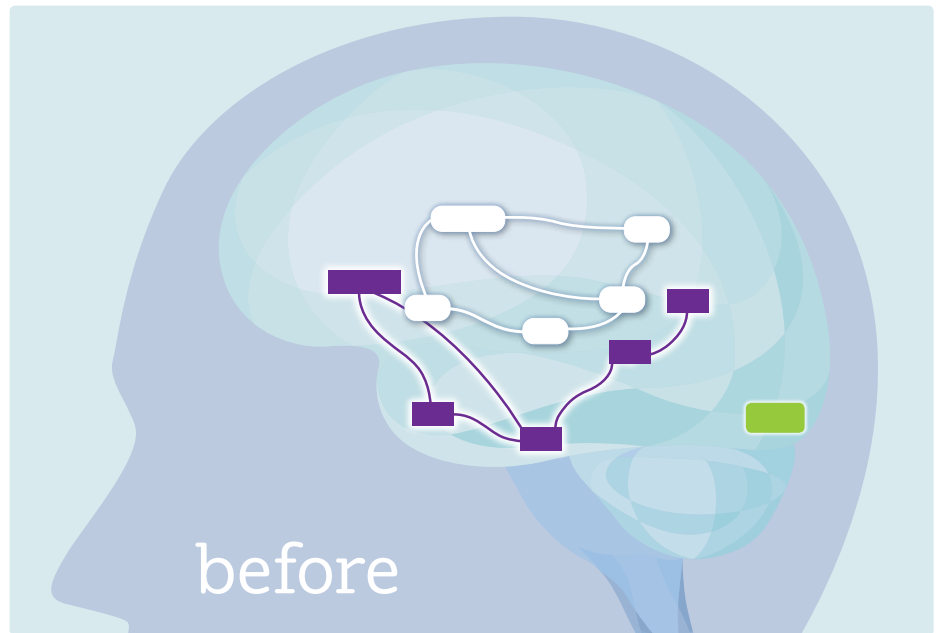
[10] Brem et al. (2010)

Practicing decoding doesn't mean flipping through beautiful books or listening to someone else read. Expert pianists and tennis players don't become expert by watching someone else play.

They practice deliberately, focusing on their weakest skills and working hard to improve them.

LEGENDARY RESEARCHER JEANNE CHALL[11]
described the transition from word
recognition to fluent reading as one
of 'becoming unglued from print.'
That is a critical moment but it is, of
course, just the first step on the journey
towards reading at college level.

[11] Chall (1983)

Featured mCLASS:Reading 3D DIBELS Next Reports

Your Students' Latest Composite Scores

Your Students' Latest TRC Proficiency Ratings

Measure: TRC Proficiency Level
Time: All periods this year

Comparing Measures (New!)

Measure: All Reading 3D Measures
Time: Most Recent
Population: Your students

    At the Center for Early Reading, we have analyzed data from a decade of tracking students' pathways in early reading.
    We identified schools that get outsized results. Then we called them and asked what they were doing. We found five patterns (so far).

1. Start early.

Schools that deliver the strongest results work hard to get kids on track—and often ahead—in kindergarten. Why? Those who get through the decoding stage by age eight begin building vocabulary and background knowledge through reading itself.

These schools reason that it's easier to get students ahead from the start than to try to catch them up later.

2. Surround kids with books.

Reading at the right level improves decoding, vocabulary, knowledge, and stamina.

In a recent study,[12] students who read an extra seven minutes per day in class had substantially higher reading rates than other students. Those minutes add up to 160,020 additional words read in each school year. And reading volume is more important than even cognitive ability in building knowledge.[13]

160,020 additional words
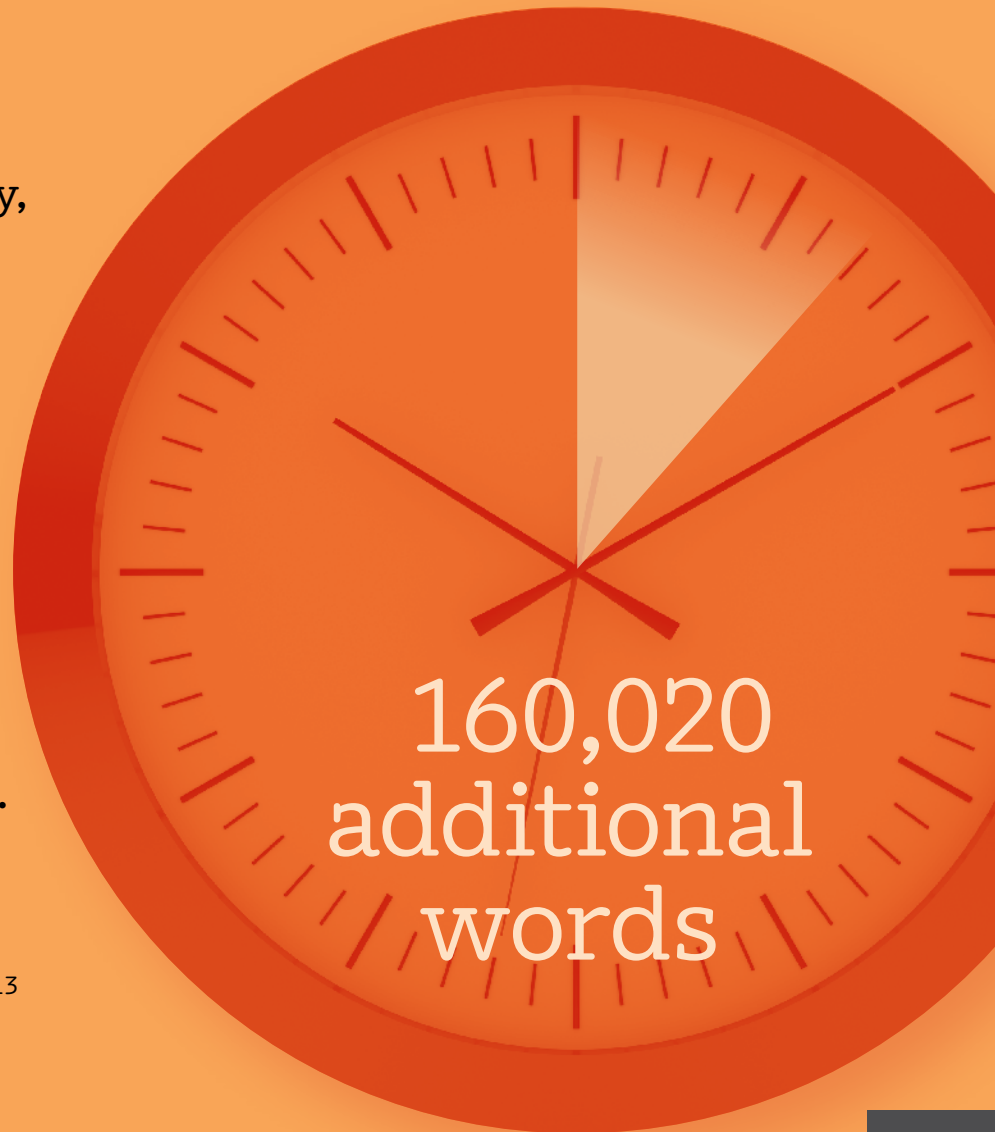
[12] Kuhn & Schwanenflugel (2009)
[13] Sparks et al. (2014)

3. Measure.

All schools collect data; the best ones think of it as *measurement*. For instance, they measure whether an intervention is having the expected impact. If not, they introduce new, temporary measures for attendance, perhaps, or fidelity of implementation. They are constantly tinkering and learning. They describe themselves as never satisfied.

4. Create a support team.

One of the most effective practices we found is for principals to appoint a cross-classroom team responsible for ensuring students who need extra support get it. Even with the best of intentions, classroom teachers struggle to reach everyone.

The team bases its decisions on careful data analysis and makes sure extra resources are found, whatever it takes.
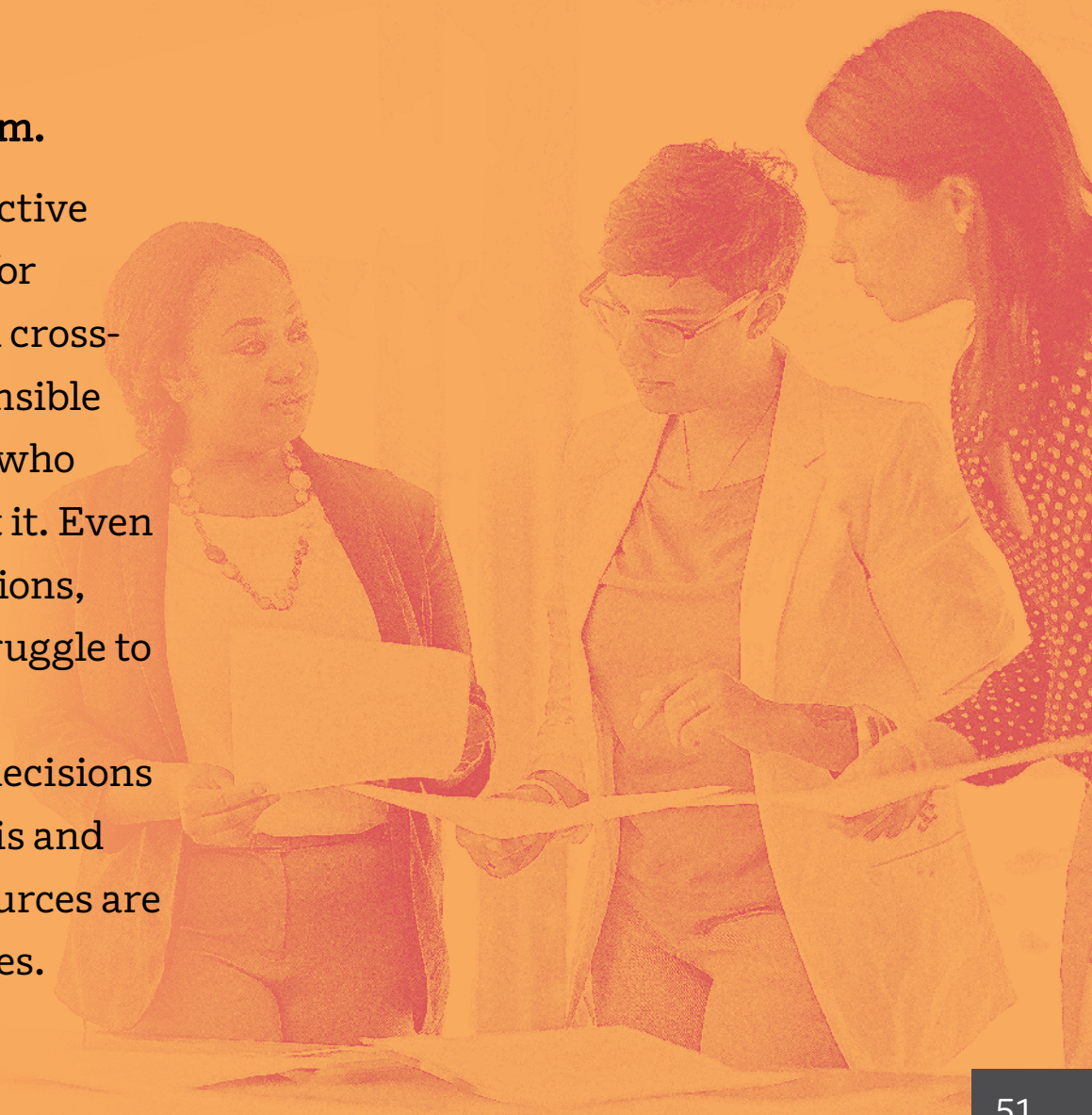
5. Beat summer.

Summer is brutal. Students often lose as much as half the hard-won gains from the entire school year over the summer weeks. The loss is especially steep for students from poor households. And yet even a few minutes of reminder exercises every week can reverse the losses—just like regularly using a muscle prevents atrophy.

Reading at a college-entry level is a virtuoso performance. Even reading on level by third grade requires a constellation of successes—from mastering the mysterious sound-spelling patterns of English to the painstaking accumulation of vocabulary and knowledge. A single verb, *to read*, seems inadequate. Achieving this noble goal— effortless reading, and love of reading, for all—is one of the great social undertakings of our time.

Some suggestions for further reading

Stanilas Dehaene's *Reading in the Brain: The New Science of How We Read* is the most up-to-date, definitive book on the neuroscience of reading. Dehaene is a professor at the Collège de France with a writing style that is surprisingly accessible to laypeople. You can also find presentations by him covering the same material on YouTube.

The Reading Mind: A Cognitive Approach to Understanding How the Mind Reads is a new, engaging explanation of the psychology of reading from University of Virginia professor, Dan Willingham. In prose aimed at teachers it starts with a single E. L. Doctorow sentence and unpacks what the mind does in order to understand it.

The bible of explicit reading instruction—especially phonics—is Douglas Carnine's *Direct Instruction Reading*.

For more depth on just about every topic related to reading, *The Science of Reading: A Handbook* is a powerful collection of papers edited by Margaret Snowling and Charles Hulme. Not for the faint of heart.

Finally, a readable guide to the problems of struggling readers aimed at parents and educators is Sally Shaywitz's *Overcoming Dyslexia*. Shaywitz is co-director of the Yale Center for Dyslexia & Creativity and a leading expert on dyslexia.

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