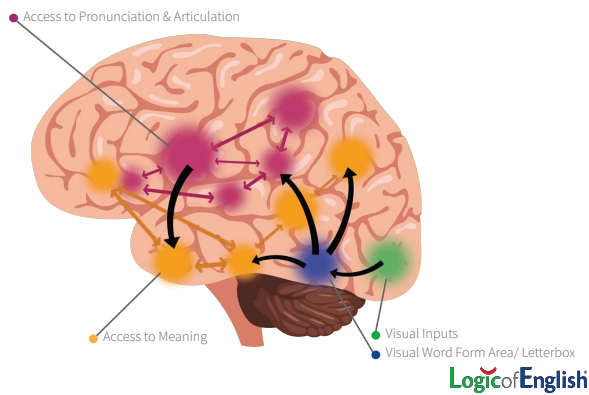


How the Brain Learns to Read and What it Means for Classroom Instruction

Possible Conflicts of Interest

Founder and CEO of Logic of English

Author of Foundations, Essentials, Rhythm of Handwriting, Sounding out the Sight Words, Uncovering the Logic of English



Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=2SGi3-kLdo>.

National Reading Panel



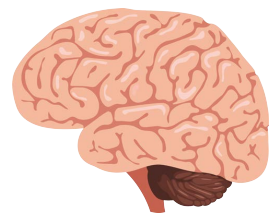
- Phonemic Awareness
- Systematic Phonics
- Fluency
- Vocabulary Development
- Reading Comprehension

Simple View of Reading

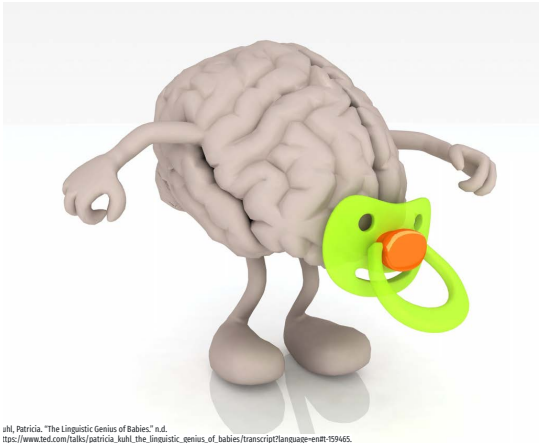


Farrell, Linda, Marcia Davidson, Michael Hunter, and Tina Osenga. "The Simple View of Reading." n.d. <https://www.ccl.org/the-simple-view-of-reading/>.

The brain uses the **same regions** for **listening** comprehension as for **reading** comprehension

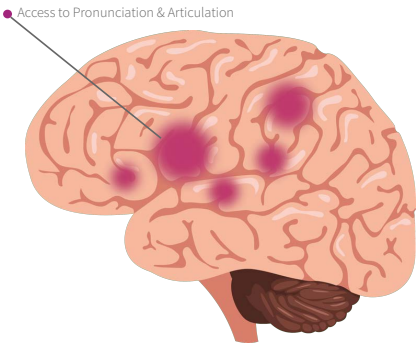


When students have mastered **decoding skills**, they will be able to read and comprehend at the same level they can listen and comprehend.

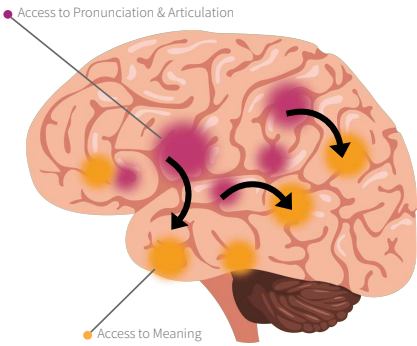


Baby brains are constantly taking statistics from their environment.

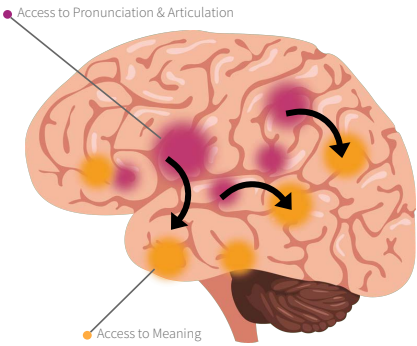
uh, Patricia. "The Linguistic Genius of Babies." n.d. https://www.ted.com/talks/patricia_kuhl_the_linguistic_genius_of_babies/transcript?language=en-GB.



The brain codes the sounds of the language.



The sound area is then connected to the area of the brain that stores meaning.



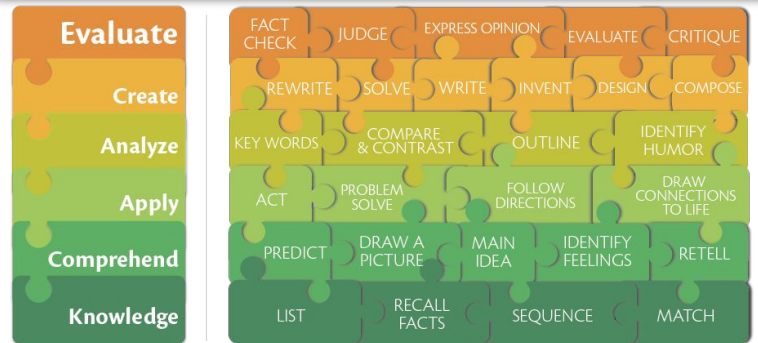
Speech is the starting point for reading.



Step One: Read books aloud!

LogicofEnglish

Bloom's Taxonomy of Learning



Remember:

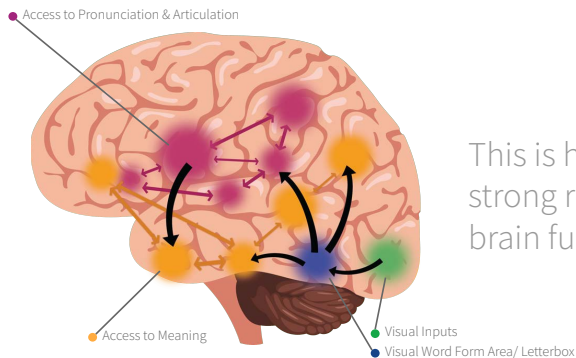
Comprehension skills can be developed by both **reading** printed texts and by **listening** to texts be read aloud by someone else.

LogicofEnglish



How does the brain learn to read?

LogicofEnglish



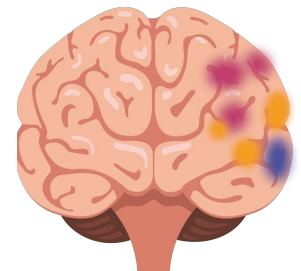
This is how a strong reader's brain functions.

LogicofEnglish

Struggling Reader



Strong Reader



LogicofEnglish

Dehaene, Stanislas. "How the Brain Learns to Read" n.d. <https://www.youtube.com/watch?v=25Gj3-kLdo>.

Study: Teaching Adults

GROUP 1

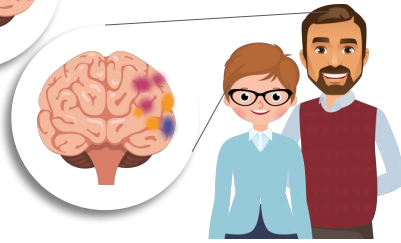
Learn shapes that map to whole words



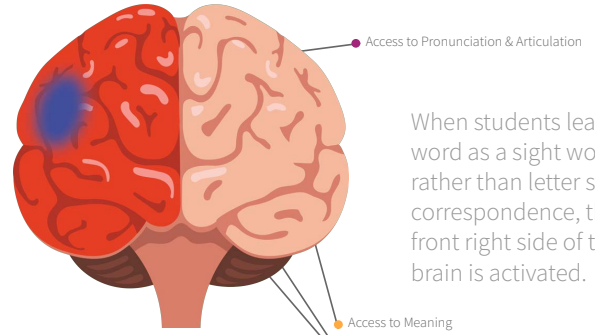
Wong, May. "Stanford Study on Brain Waves Shows How Different Teaching Methods Affect Reading Development." *Stanford News*, March 28, 2015. <https://www.stanford.edu/news/academic/2015/03/28/032815-reading-brain-032815>

GROUP 2

Learn shapes that map to sounds



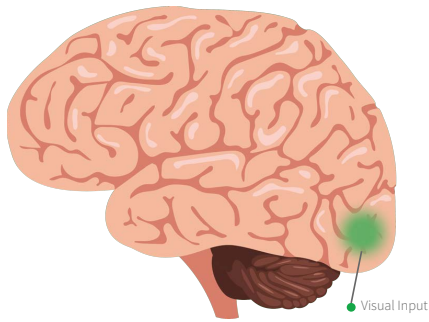
Wong, May. "Stanford Study on Brain Waves Shows How Different Teaching Methods Affect Reading Development." *Stanford News*, March 28, 2015. <https://www.stanford.edu/news/academic/2015/03/28/032815-reading-brain-032815>



When students learn a word as a sight word rather than letter sound correspondence, the front right side of the brain is activated.

Access to Meaning
Visual Inputs & Visual Word Form Area

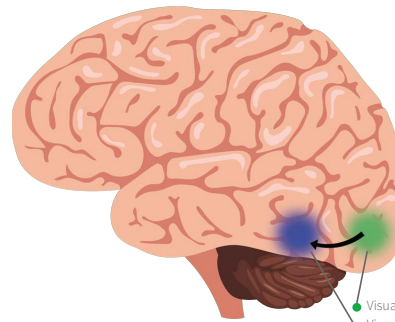
LogicofEnglish



Reading starts as a visual input.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

LogicofEnglish

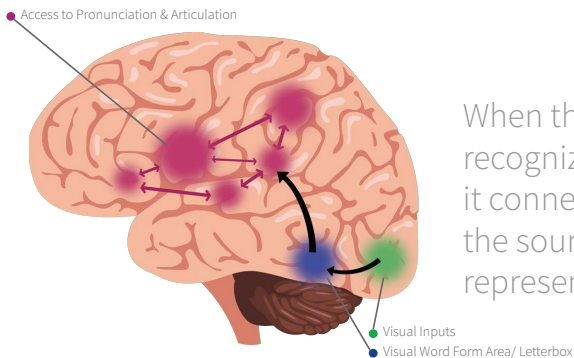


It then enters the **letterbox** region, or the visual word formation area.

Visual Inputs
Visual Word Form Area/ Letterbox

LogicofEnglish

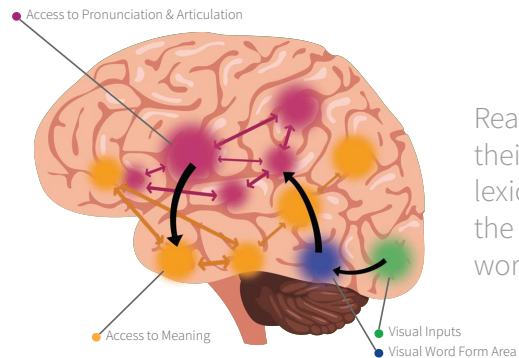
Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.



When the brain recognizes a letter it connects it to the sound it represents.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

LogicofEnglish



Readers then use their auditory lexicons to recognize the meaning of the word.

Dehaene, Dr. Stanislas. "Lecture by Dr. Stanislas Dehaene on 'Reading the Brain.'" April 30, 2013. <https://www.youtube.com/watch?v=M5y685WqYk>.

LogicofEnglish

5

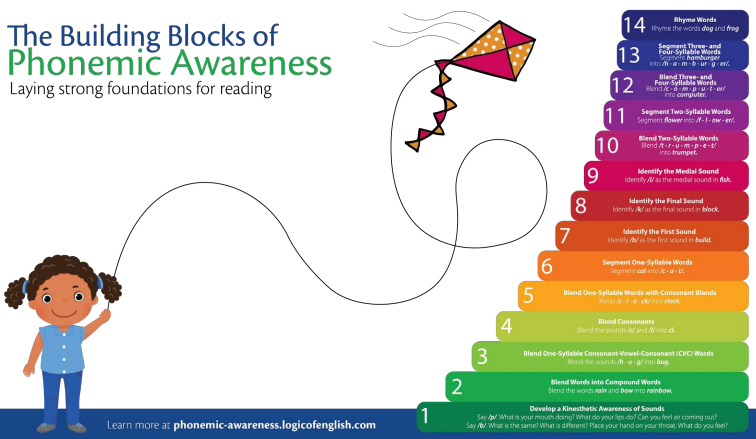
- Phonemic Awareness
- Systematic Phonics
- Fluency
- Vocabulary Development
- Reading Comprehension

Phonemic Awareness

The understanding that words are comprised of individual sounds.

The Building Blocks of Phonemic Awareness

Laying strong foundations for reading



A Kinesthetic Awareness of Sounds

Voiced and Unvoiced

S Z

Blend Two Words into a Compound Word



LogicofEnglish

Blend Two Words into a Compound Word

LogicofEnglish



LogicofEnglish

Blend One-syllable CVC Words

LogicofEnglish



LogicofEnglish

Blend One-syllable CVC Words

LogicofEnglish



ofEnglish

Blend One-Syllable CCVC and CVCC Words

LogicofEnglish



Hear it! Do it!

LogicofEnglish

Segment One-Syllable Words

LogicofEnglish



LogicofEnglish

Blend Two-Syllable Words

LogicofEnglish



LogicofEnglish

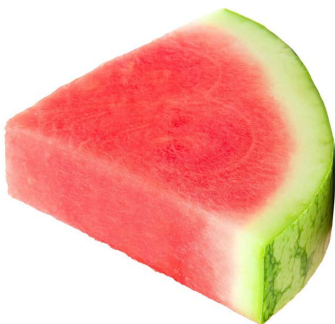
Blend Two-Syllable Words

LogicofEnglish



Blend Three- and Four-Syllable Words

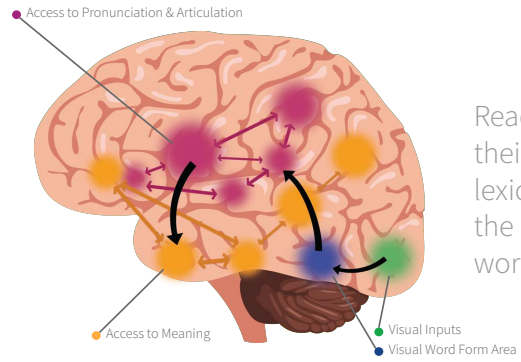
LogicofEnglish



LogicofEnglish

Blend Three- and Four-Syllable Words

LogicofEnglish



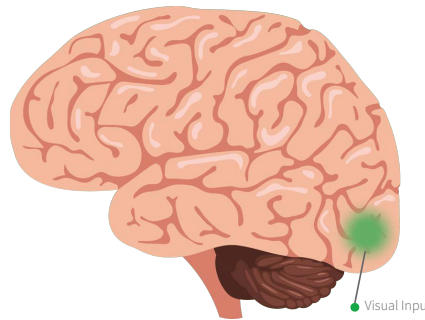
Readers then use their auditory lexicons to recognize the meaning of the word.

Dehaene, Dr. Stanislas. "Lecture by Dr. Stanislas Dehaene on 'Reading the Brain.'" April 30, 2013. <https://www.youtube.com/watch?v=M5y6854tq1k>.

LogicofEnglish

Fluency

Mastery of the skills of phonemic awareness to the point of automaticity.

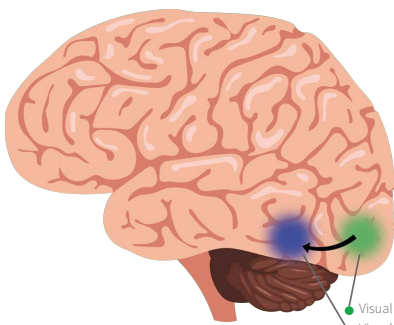


Reading starts as a visual input.

LogicofEnglish

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

LogicofEnglish



It then enters the **letterbox** region, or the visual word formation area.

Visual Inputs
Visual Word Form Area/ Letterbox

LogicofEnglish

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

午飯吃湯

LogicofEnglish

Phonograms

phono - sound
gram - picture

LogicofEnglish

d

LogicofEnglish

sh

LogicofEnglish

igh

LogicofEnglish

eigh

LogicofEnglish

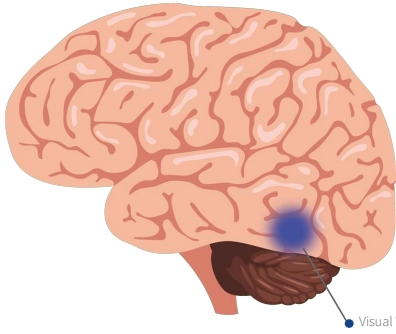
dog

/Dee-Oh-Gee/

/d-o-g/



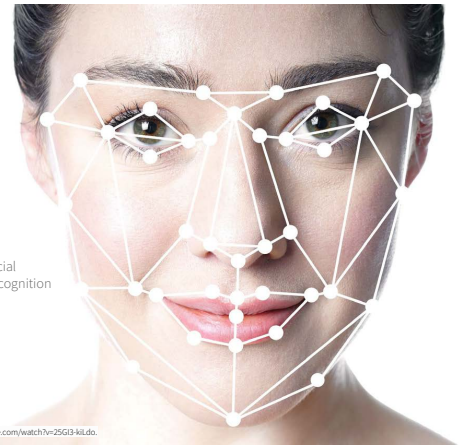
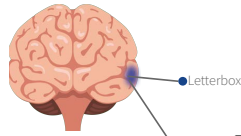
LogicofEnglish



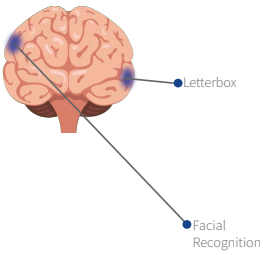
The **Letterbox**:
the visual word
form area

LogicofEnglish

Dehaene, Dr. Stanislas. "Lecture by Dr. Stanislas Dehaene on 'Reading the Brain.'" April 30, 2013. <https://www.youtube.com/watch?v=M5y685v4qYk>



Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25Gj3-kLd0>



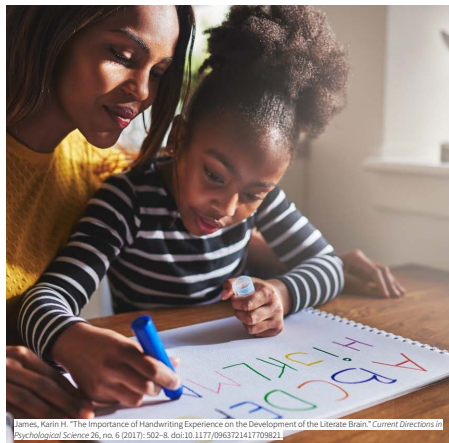
Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25Gj3-kLd0>



Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25Gj3-kLd0>

b d
p q

LogicofEnglish



The way to
overcome this is
by teaching
handwriting!

LogicofEnglish

James, Karin H. "The Importance of Handwriting Experience on the Development of the Liberate Brain." *Current Directions in Psychological Science* 26, no. 6 (2017): 502-8. doi:10.1177/096372141709821

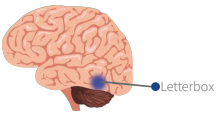
“The motor experience of manually creating letterforms helps children discriminate the essential properties of each letter, which leads to more accurate representations bolstering both skilled letter recognition and later reading fluency.”

n n

Gimenez, Paul, Nicole Bugescu, Jessica M. Black, Roeland Hancock, Kenneth Pugh, Masanori Nagamine, Emily Kutner, et al. "Neuroimaging Correlates of Handwriting Quality as Children Learn to Read and Write." *Frontiers in Human Neuroscience* 8 (2014): 155. doi:10.3389/fnhum.2014.00155.

LogicofEnglish

n h



the lETtEr bOX ReGlOaN rEcoGNiZes
wORdS rEGARdLEsS oF cAsE.

LogicofEnglish

Dehaene, Dr. Stanislas. "Lecture by Dr. Stanislas Dehaene on 'Reading the Brain.'" April 30, 2013. <https://www.youtube.com/watch?v=M5y685vNqYk>.



Word Shape is **not** relevant to reading.

large
 paint
 stomp

LogicofEnglish

Systematic Phonics

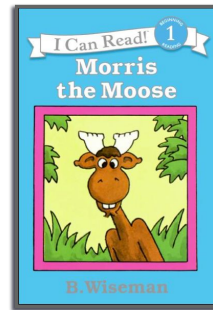
Fluency

Phonemic Awareness





*we teach
 phonics?*

Read Books

One **the** moose
 a .
 You are a **moose**
 said.



LogicofEnglish

Aa  Apple	Bb  Butterfly
Cc  Carrot	Dd  Drum

Incomplete Phonics

LogicofEnglish

Exceptions

LogicofEnglish



Human memory
is limited to approximately
2,000 sight-sound symbols.

1,000,000 words
English

50% Exceptions!

500,000 Words!

An average
five-year-old knows
13,000 words.



6,500
Exceptions!!!

Exceptions! 1,000,000 words English

LogicofEnglish

Explain **98%**
of **English** words

LogicofEnglish

75 Phonograms
31 Spelling Rules

LogicofEnglish

Systematic Phonics

An **accurate** written code which
translates sounds into
a visual image.

LogicofEnglish



S

LogicofEnglish

1st 100 Fry Words

its some
see this
so said
first

S

LogicofEnglish

his

LogicofEnglish

is

LogicofEnglish

1st 100 Fry Words

is words
was use
as these
his has

S

LogicofEnglish



th

LogicofEnglish

1st 100 Fry Words

with

th

LogicofEnglish

1st 100 Fry Words

the their
that then
they them
this these
there than

th

LogicofEnglish

a



LogicofEnglish

a



LogicofEnglish

1st 100 Fry Words

ă

as
at
have
had
an
has
am

ā

make

ä

all
water
called

LogicofEnglish

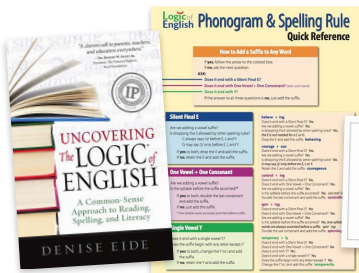
1st 300 Fry Words

all small
water father
called always
want walk
also talk

a

LogicofEnglish

Teach **All** Phonogram
the Sounds!



ch

/ch-k-sh/
child school chef

LogicofEnglish

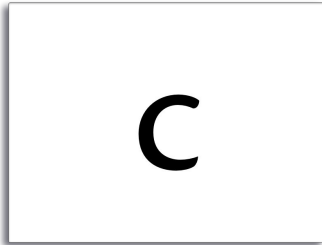


c

LogicofEnglish

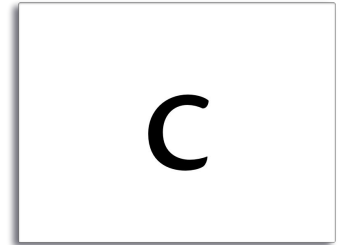
place
sentence
face
since
piece
space

voice
notice
certain



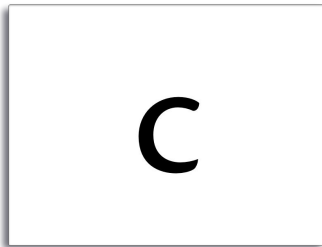
LogicofEnglish

city
decided
circle
exercise
decimal
exciting



LogicofEnglish

cylinder
cycle
cypress
spicy

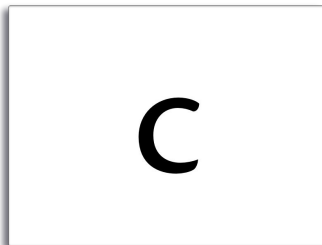


LogicofEnglish

C always softens to /s/
when followed by an
E, I, or Y.

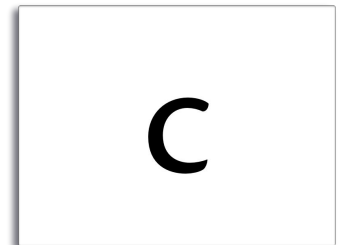
LogicofEnglish

can
cold
cut



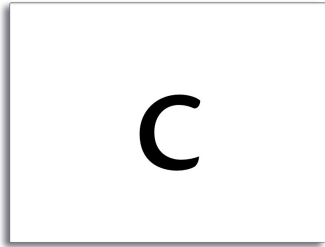
LogicofEnglish

close
cried
object



LogicofEnglish

arc
music
comic



LogicofEnglish

C always softens to /s/
when followed by an
E, I, or Y.
Otherwise, **C** says /k/.

LogicofEnglish



cease
cedar
celiac

ulcer
absence
alliance

discipline
dulcimer
elucidate

cynical
cyst
cytoskeleton

6,000
C softens to /s/

deceive
excellent
receive

citrus
civilization
concise

cyanide
cyclops
cylinder

redundancy
recycle
vibrancy

cease
cedar
celiac

ulcer
absence
alliance

discipline
dulcimer
elucidate

cynical
cyst
cytoskeleton

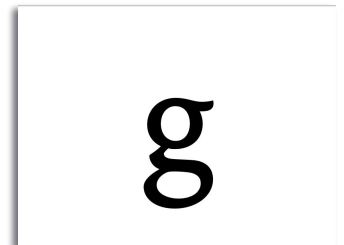
10,000
C says /k/

deceive
excellent
receive

citrus
civilization
concise

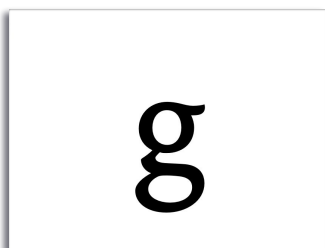
cyanide
cyclops
cylinder

redundancy
recycle
vibrancy



LogicofEnglish

gem
gentle
large



LogicofEnglish

giant
region
gibberish



LogicofEnglish

gym
biology
spongy



LogicofEnglish

get
gift
foggy



LogicofEnglish

G may soften to /j/
when followed by an
E, I, or Y.

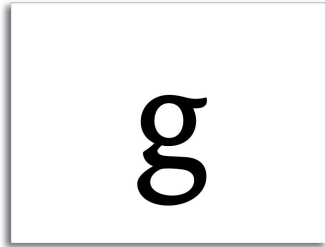
gap
got
gum



LogicofEnglish

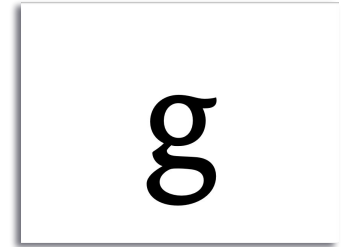
LogicofEnglish

glad
grand
wiggle



Log^oofEnglish

egg
peg
log



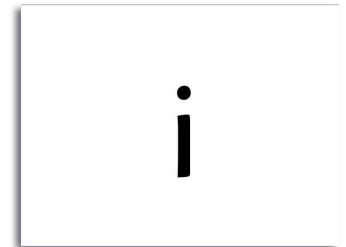
Log^oofEnglish

G may soften to /j/
when followed by an
E, I, or Y.
Otherwise, **G** says /g/.

Log^oofEnglish

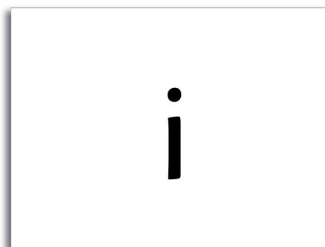
Fry Words

machine
material
radio



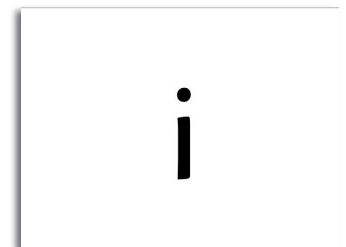
Log^oofEnglish

patio
cheerio
curio
colonial
police
amino
chlorine
atrial
custodial



Log^oofEnglish

onion
stallion
opinion
medallion
familiar
peculiar



Log^oofEnglish

ō

on
not

ō

so
go
no

ö

to
do
into
two
who

qu

ū

cute unit
use particular
music huge

ū

numeral blue
true solution
rule

ü

put pushed
full carefully
pulled beautiful

er

augh

Systematic Phonics

An **accurate** written code which translates sounds into a visual image.

LogicofEnglish

Spelling Rules

LogicofEnglish

Long Vowels

What is the most common reason for a vowel to say its long sound?

LogicofEnglish

Silent Final
~~E~~

LogicofEnglish

Critical Thinking Skills

bag
bā gel

tot
tō tal

bend
bē

hum
hū man

LogicofEnglish

A E O U

usually say their **long sounds**
at the end of the syllable.

LogicofEnglish

he so
be go
we no
she

Rule 4

A E O U usually say
their long sounds at
the end of the syllable.

picnic + ing = picnicking

C always softens to /s/
when followed by an
E, I, or Y.

garlic + y = garlicky

C always softens to /s/
when followed by an
E, I, or Y.

cape
pete
ripe
robe

The **vowel** says
its **long sound**
because of the **E**

LogicofEnglish

50%
Exceptions!

LogicofEnglish

have
give
solve
mauve
comprehensive

LogicofEnglish

English words
do not end in
V!

LogicofEnglish



LogicofEnglish

1st 400 Fry Words

have
give
move
above
leave

LogicofEnglish

true
blue
value
continue
residue

LogicofEnglish

Fry Words

true
blue
continue
value

LogicofEnglish

English words
do not end in
V or **U**.

LogicofEnglish

morewords.com

1431
words!

LogicofEnglish

Fry Words

voice	dance
sentence	difference
since	distance
piece	practice
force	experience
notice	substance
surface	

LogicofEnglish

The **C** says /s/
because of the **E**.

LogicofEnglish

~~Drop the **E** when adding **-ing**.~~

LogicofEnglish

Drop the **E**
when adding a
vowel suffix.

LogicofEnglish

like + ing = liking

LogicofEnglish

service + ing = servicing

LogicofEnglish

service + able = serviceable

LogicofEnglish

C always softens to /s/
when followed by an
E, I, or Y.

LogicofEnglish

notice + able = noticeable

LogicofEnglish

C always softens to /s/
when followed by an
E, I, or Y.

LogicofEnglish

Drop the **E**
when adding a
vowel suffix.

only if it is allowed by other spelling rules

LogicofEnglish

There are
9 reasons
for a
silent final E

LogicofEnglish

-tion

LogicofEnglish

invention

LogicofEnglish

action

Log^oofEnglish

function

Log^oofEnglish

confusion

Log^oofEnglish

explosion

Log^oofEnglish

mission

Log^oofEnglish

suspicion

Log^oofEnglish

ti

LogicofEnglish

ci

LogicofEnglish

si

LogicofEnglish

face
facial

ci

LogicofEnglish

space
spacious

ci

LogicofEnglish

express
expression

si

LogicofEnglish

confess
confession

si

LogicofEnglish

locate
location

ti

LogicofEnglish

inspect
inspection

ti

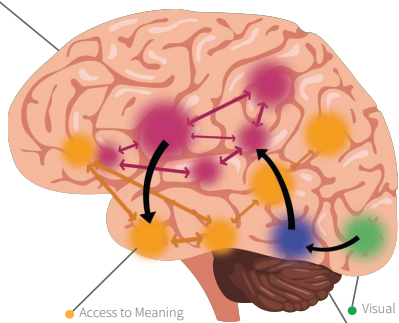
LogicofEnglish

Teach Spelling Rules that work.

English words do not end in I, U, V, or J.

LogicofEnglish

Access to Pronunciation & Articulation



as /ăz/

Teaching letter sound correspondences is the fastest way to acquire the ability to read and comprehend..

Visual Inputs
Visual Word Form Area/ Letterbox

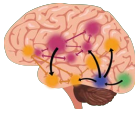
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Fluency

Mastery of the skills of systematic phonics to the point of automaticity.

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Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25Gj3-kILdo>.

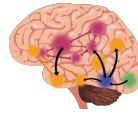


Beginning readers read serially: **one phonogram at a time.**

I had soup for lunch.



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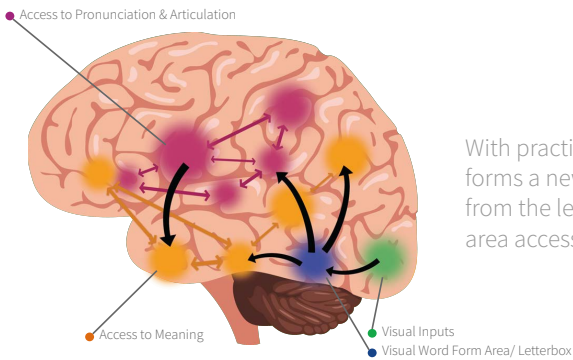


As they progress, reading serially goes away and they begin to process in parallel.

I had soup for lunch.

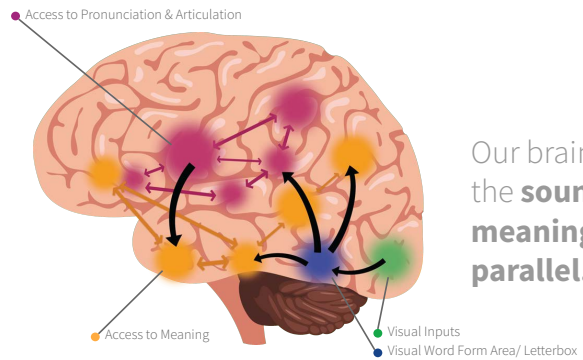


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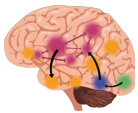
With practice, the brain forms a new direct route from the letter box to the area accessing meaning.

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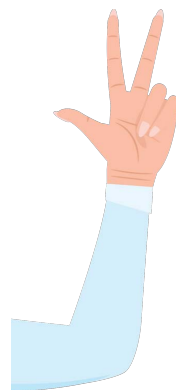
Our brains process the **sounds and meaning in parallel.**

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Once they know the letter sound correspondences, emerging readers can self teach fluency.

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Spelling Analysis

LogicofEnglish

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

Dehaene, Stanislas. "How the Brain Learns to Read." n.d. <https://www.youtube.com/watch?v=25G3-kLd0>.

qu i l t

quilt

s er v e

serve

r o s e

rose

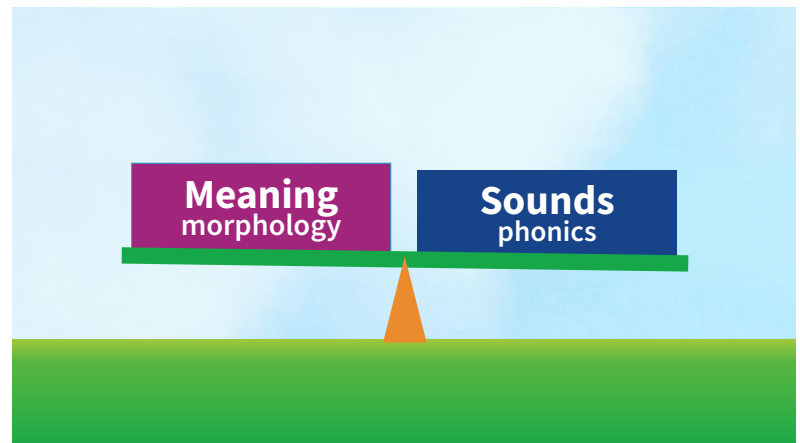
d augh t er

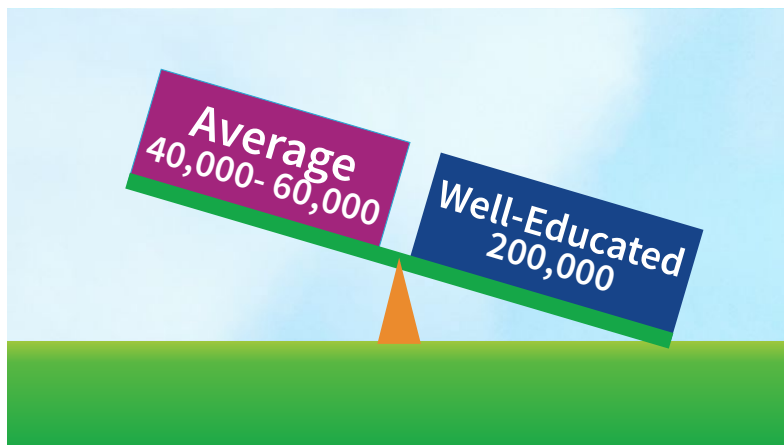
daughter

morpho-phonemic

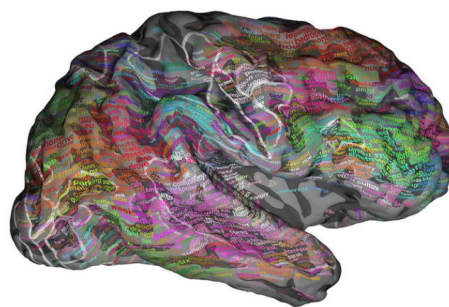
morpho - meaning

phonemic - sounds





Words are grouped by meaning



MRI scans suggest words stimulate different regions of the brain depending on their meaning.
Alexander Kuhn/Reuters
<https://www.npr.org/sections/health-shots/2016/04/27/475871745/scans-show-the-brain-groups-words-by-meaning>

Morpho-phonemic

Morpho-phonemic

Morphemes

Units of meaning

cats

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Morpho-phonemic

Vocabulary Development

revisited

tract

LogicofEnglish

Vocabulary Development



tract
=
pull

Vocabulary Development



tractor

Vocabulary Development



re**tract**

Vocabulary Development



con**tract**

Vocabulary Development



con**tract**or

Vocabulary Development



ex**tract**

Vocabulary Development

Derivatives of **tract**



distract

abstract
abstracted
abstractedness
abstractednesses
abstracter
abstracters
abstractest
abstracting
abstraction
abstractionism
abstractionist
abstractionists
abstractions
abstractive
abstractly
abstractness
abstractnesses
abstractor
abstractors
abstracts
attract
attractant
attractants
attracted
attracting
attraction

attractions
attractive
attractively
attractiveness
attractivenesses
attractor
attractors
attracts
contract
contracted
contractibility
contractible
contractile
contractility
contracting
contraction
contractual
contractuals
contractive
contractor
contractors
contracts
contractual
contractually
detract
detracted

detracting
detraction
detractions
detractive
detractively
detractor
detractors
detracts
distract
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distractibility
distractible
distracting
distractingly
distraction
distractions
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distracts
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extractability
extractable
extracted
extracting
extractions

extractive
extractives
extractor
extractors
extracts
intractabilities
intractability
intractable
intractably
protract
protractile
protracting
protractingly
protraction
protractions
protractive
protractor
protractors
protracts
retract
retractable
retracted
retracting
retractingly
retractingly

retraction
retractions
retractor
retractors
retracts
semiabstract
semiabstraction
semiabstractions
subcontract
subcontracted
subcontracting
subcontractor
subcontractors
subtracts
subtracted
subtractor
subtractors
subtracting
subtraction
subtractions
subtractive
subtracts
tract
tractabilities
tractability

tractable
tractableness
tractably
tractale
tractates
traction
tractional
tractions
tractive
tractor
tractors
tracts
unattractive
unattractively

Tricky Word

two

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Tricky Word



twin

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2X

twice

LogicofEnglish

12

twelve

LogicofEnglish

20 twenty

LogicofEnglish

2 two

LogicofEnglish

twin
twice
twelve
twenty
two

LogicofEnglish

to
too
two

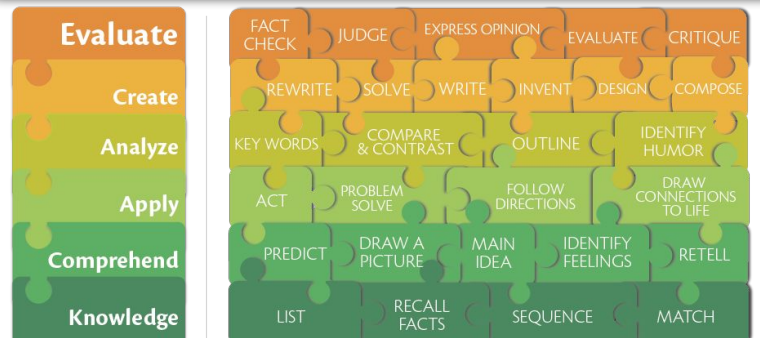
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Comprehension Skills

Strategies a reader may employ to better comprehend a text.

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Bloom's Taxonomy of Learning



Read & Comprehend

- Physics
- Astronomy
- Earth Science
- Biology
- Anatomy
- Math
- Engineering
- History
- Business
- Economics
- Government
- Cultural Studies
- Psychology
- Computer Science
- Literature
- Linguistics

Vocabulary Development

Comprehension Skills

Vocabulary Development

Comprehension Skills

Fluency

Fluency

Systematic Phonics

Systematic Phonics

Fluency

Fluency

Phonemic Awareness

Phonemic Awareness

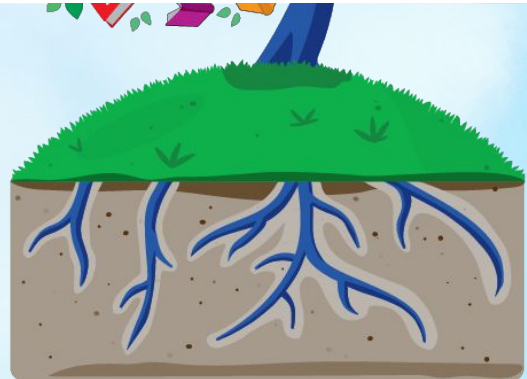
Foundation



Foundation



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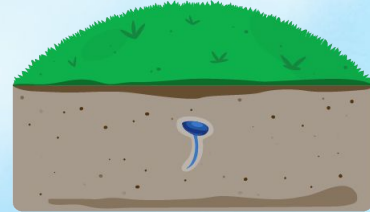
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It all begins with a **seed!**



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Phonemic Awareness



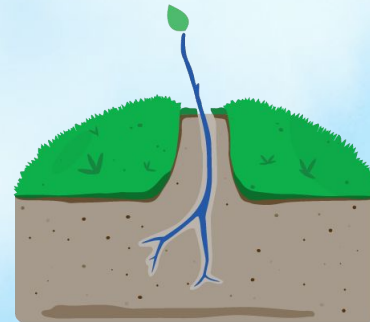
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Systematic Phonics



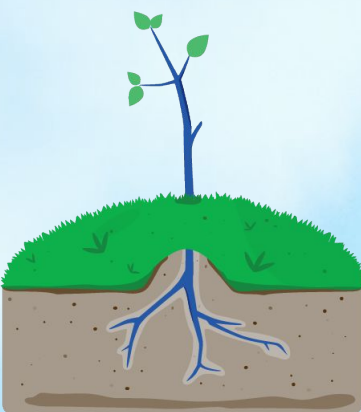
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Fluency



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Vocabulary



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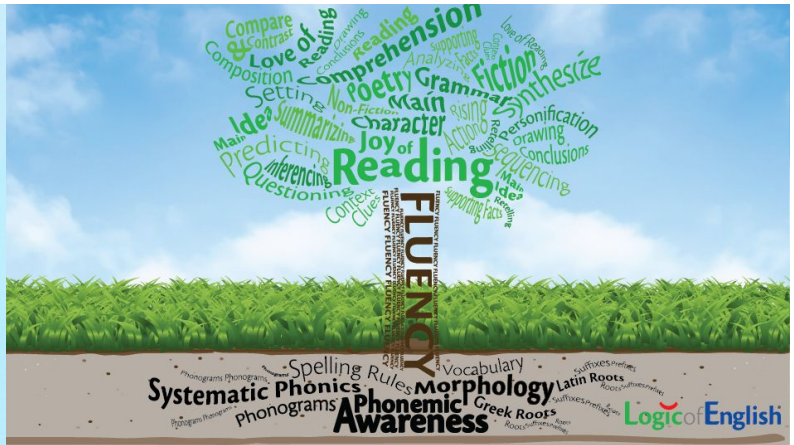
Comprehension Skills



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Simple View of Reading



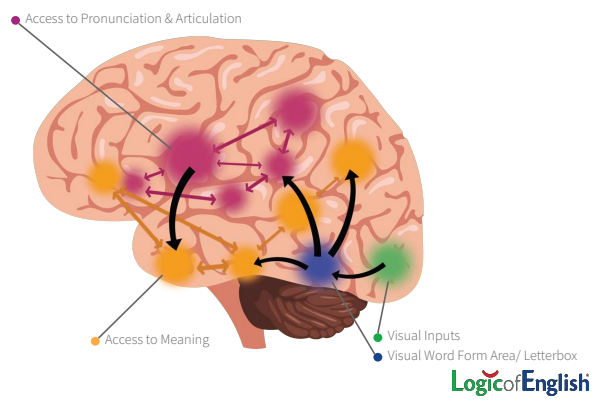
Farrell, Linda, Marcia Davidson, Michael Hunter, and Tina Osenga. "The Simple View of Reading," n.d. <https://www.cdf.org/the-simple-view-of-reading/>.

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National Reading Panel



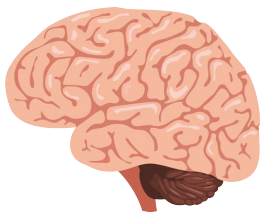
- Phonemic Awareness
- Systematic Phonics
- Fluency
- Vocabulary Development
- Reading Comprehension



Dehaene, Stanislas. "How the Brain Learns to Read" n.d. <https://www.youtube.com/watch?v=25Gj3-kLdo>.

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The brain uses the **same regions** for **listening** comprehension as for **reading** comprehension



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Phonemic Awareness

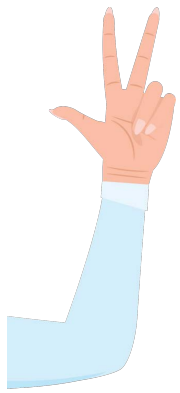
The understanding that words are comprised of individual sounds.

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Systematic Phonics

An **accurate** written code which translates sounds into a visual image.

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Spelling Analysis

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morphemes
units of meaning

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