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research **ED**

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Learning to Read

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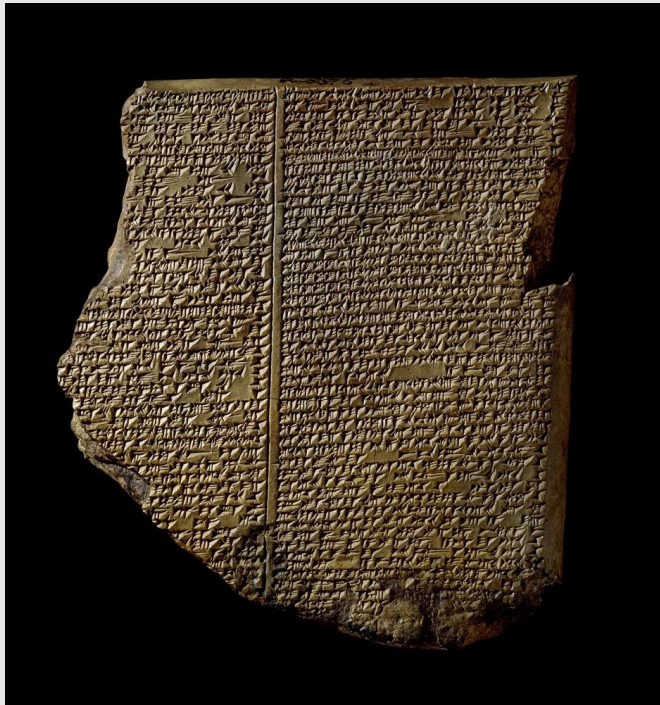


Jess decided to cut and run. She couldn't face what might happen next.

Reading is not “natural”



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Epic of Gilgamesh (7th century BCE)
British Museum CC BY-NC-SA 4.0



The Lindisfarne Gospels
Lindisfarne (8th century)
British Library, Public Domain

“Children are wired for sound, but print is an optional accessory that must be painstakingly bolted on” (Pinker, 1997)

Writing is not intuitive



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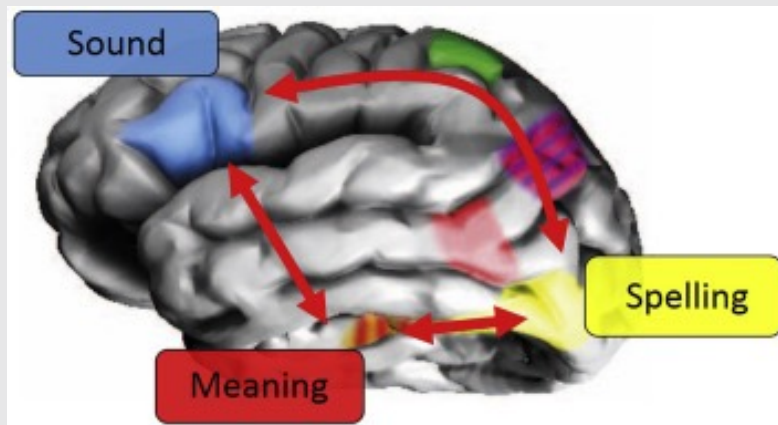
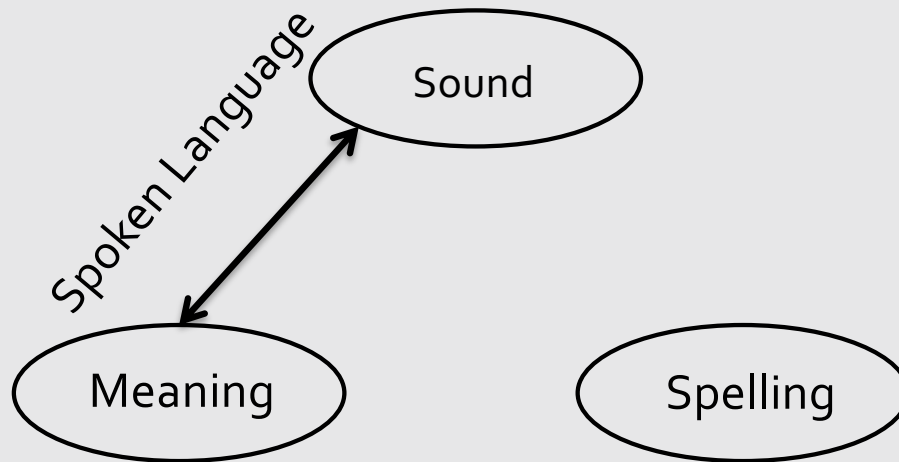
- Spoken language is continuous (no discrete words, sounds)
- Spoken language includes non-lexical acoustic information
- Spoken language includes gesture, audio-visual information
- Spoken language happens in shared contexts

Writing tries to represent this as discrete visual symbols!

Mapping visual symbols to spoken language

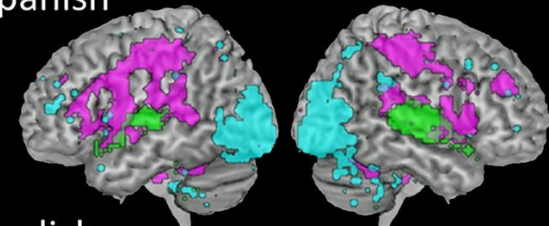


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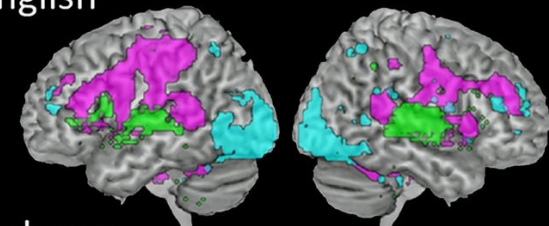


Rastle, 2019, Cortex

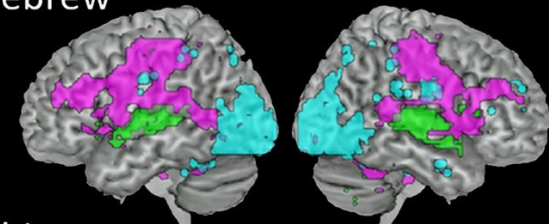
A Spanish



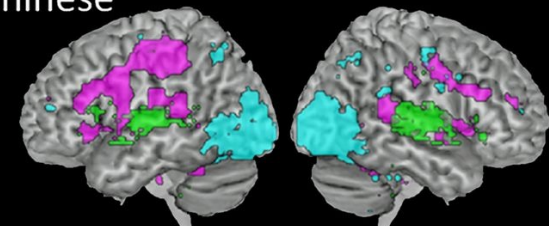
B English



C Hebrew



D Chinese



● Print only ● Speech only ● Overlap

Rueckl et al., 2015, PNAS

Writing is a code for language



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Basic challenge is to link arbitrary visual symbols to language.
Solution will depend on writing system.

	g	n	d	r	m	b	s	o	j	ch	k	t	p	h
ㅏ a	가 ga	나 na	다 da	라 ra	마 ma	바 ba	사 sa	아 a	자 ja	차 cha	카 ka	타 ta	파 pa	하 ha
ㅑ ya	야 ya	냐 na	다 da	랴 ra	마 ma	바 ba	샤 sha	야 ya	자 ja	차 cha	카 ka	타 ta	파 pa	하 ha
ㅓ eo	거 geo	너 neo	더 deo	러 reo	머 meo	베 beo	세 seo	어 eo	저 jeo	쳐 cheo	케 keo	테 teo	페 peo	헤 heo
ㅕ yeo	겨 gyeo	냐 nyeo	더 deo	려 reo	머 meo	베 beo	세 seo	어 yeo	저 jyeo	쳐 chyeo	케 keo	테 teo	페 peo	헤 heo
ㅗ o	고 go	노 no	도 do	로 ro	모 mo	보 bo	소 so	오 o	조 jo	초 cho	코 ko	토 to	포 po	호 ho
ㅛ yo	교 gyo	뇨 nyo	도 do	로 ro	모 mo	보 bo	쇼 sho	요 yo	조 jyo	초 chyo	코 ko	토 to	포 po	호 ho
ㅜ u	구 gu	누 nu	두 du	루 ru	무 mu	부 bu	수 su	우 u	주 ju	추 chu	쿠 ku	투 tu	푸 pu	후 hu
ㅠ yu	gyu	nyu	dyu	ryu	myu	byu	syu	yu	jyu	chyu	kyu	tyu	pyu	hyu
ㅡ eu	게u	네u	데u	레u	메u	베u	세u	에u	जेu	체u	케u	테u	페u	헤u
ㅣ i	기 gi	니 ni	디 di	리 ri	미 mi	비 bi	시 si	이 i	지 ji	치 chi	키 ki	티 ti	피 pi	히 hi
ㅐ ae	가e	나e	다e	라e	마e	바e	사e	아e	자e	차e	카e	타e	파e	하e

ン	ワ	ラ	ヤ	マ	ハ	ナ	タ	サ	カ	ア
n	wa	ra	ya	ma	ha	na	ta	sa	ka	a
		リ		ミ	ヒ	ニ	チ	シ	キ	イ
		ri		mi	hi	ni	chi	shi	ki	i
		ル	ユ	ム	フ	ヌ	ツ	ス	ク	ウ
		ru	yu	mu	fu	nu	tsu	su	ku	u
		レ		メ	ヘ	ネ	テ	セ	ケ	エ
		re		me	he	ne	te	se	ke	e
	ヲ	ロ	ヨ	モ	ホ	ノ	ト	ソ	コ	オ
	o	ro	yo	mo	ho	no	to	so	ko	o



Upper case

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Lower case

a b c d e f g h i j k l m n o p q r s t u v w x y z

English is a particularly difficult code



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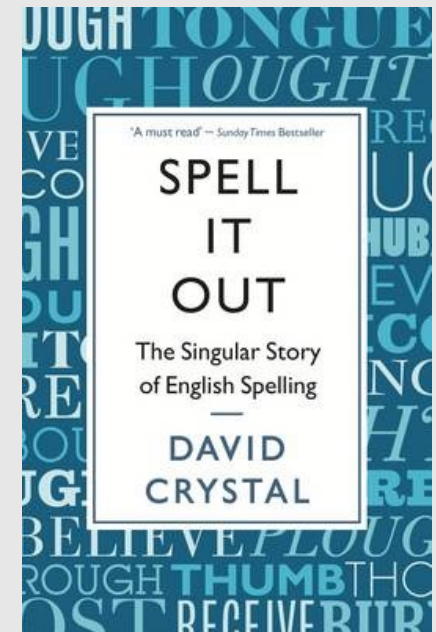
“How are we going to spell forty+ [sounds] with twenty-six letters? That, in a nutshell, is the problem of English spelling.” (Crystal, 2012)

Upper case

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Lower case

a b c d e f g h i j k l m n o p q r s t u v w x y z

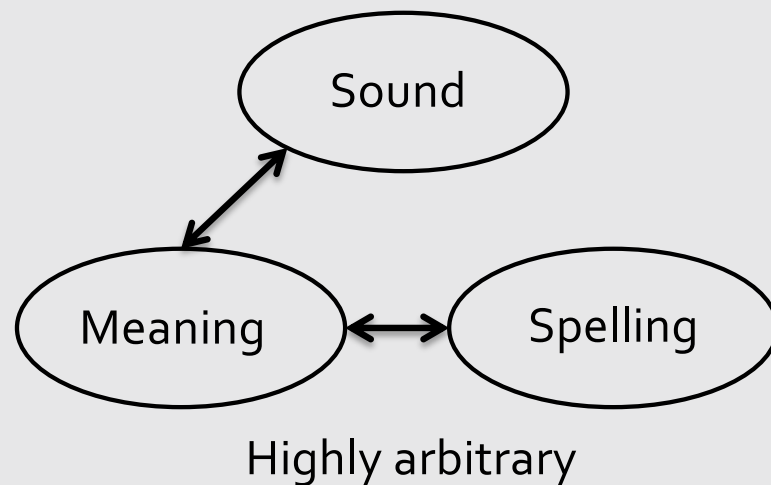


thigh, age, eight, gain

Cracking the written code



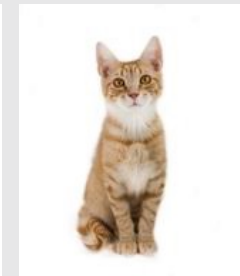
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CUT



CAT



CAN

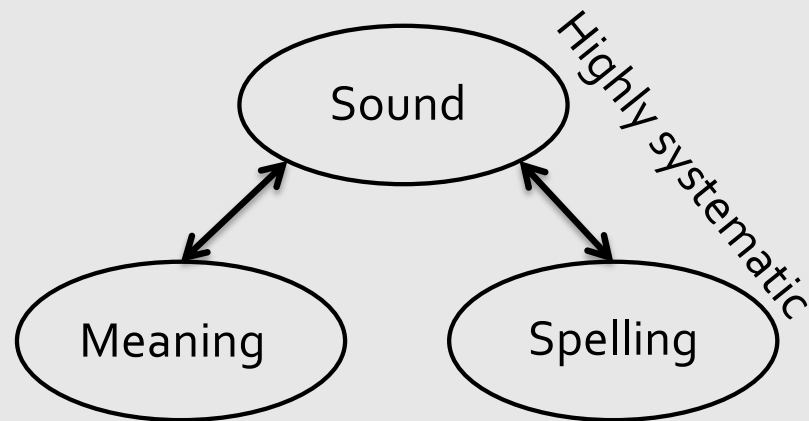


- Arbitrary learning is very hard
- Not possible in languages with very large vocabularies

Cracking the written code



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CUT



CAT



CAN

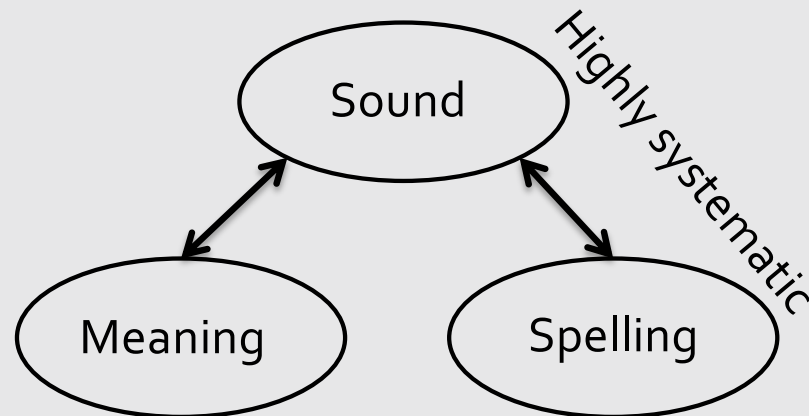


- Enormously efficient!
- Reading comprehension = decoding + spoken language

Cracking the written code



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Sounds mat											
s	a	t	i	p	n	m	d				
g	o	c	k	e	u	r	h				
b	f	l	j	v	w	x	y				
z	qu	ch	sh	th	ng						
ai	ee	oa	oo	ar	or						
ue	ou	oi	er	ie	oy						
ur	ow	ear	air	ure	igh						

Jolly Phonics
Creative Commons Sharealike

‘Phonics’ refers to systematic, explicit instruction on how the alphabet works; what letters are and what they represent.

Isn't English too irregular for phonics?



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HAVE vs save, wave, cave...
PINT vs mint, hint, print

~80% predictable by rule;
irregularity typically affects
one phoneme only.

Table 2. Percentage of words that can be read when pupils have mastered the common exception words and GPCs taught in each program

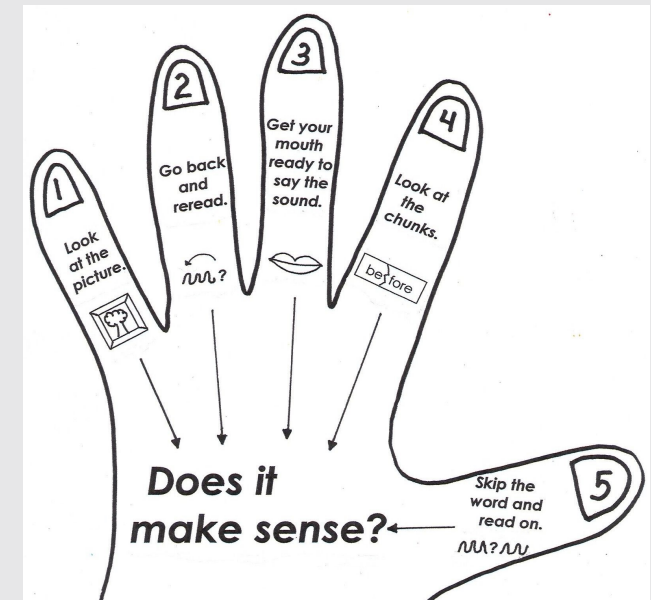
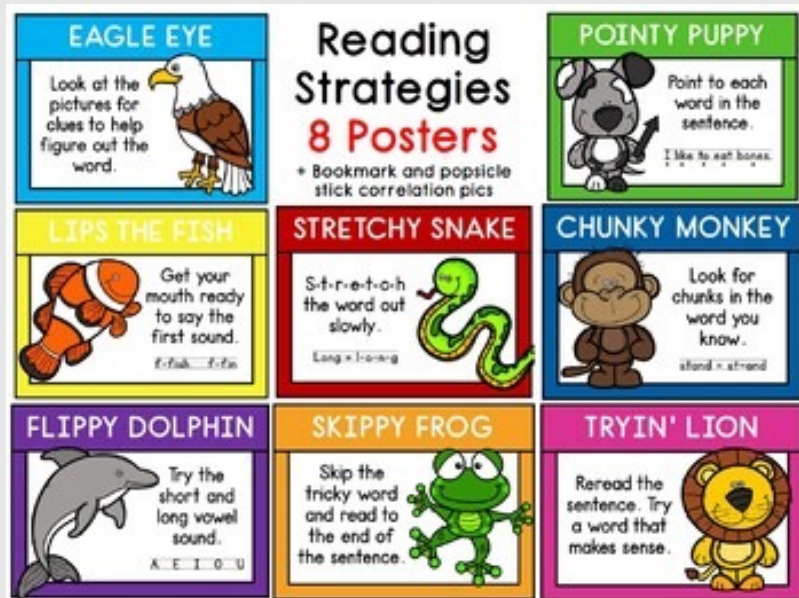
	Optima Reading	Jolly Phonics	Letters & Sounds	RWInc
Number of common exception words taught	58	72	42	58
Number of GPCs taught	60	73	126	103
Total words read	1,137,710 (75.21%)	1,053,192 (69.62%)	1,182,477 (78.17%)	1,118,975 (73.97%)

Based on analysis of ca. 21,000 unique words in real books
for children aged 5-7 (*Solity, 2020*)

How about “other approaches”?



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There is no other path, no “other approaches” to becoming a skilled reader of an alphabetic writing system, than through fluent decoding. Children must know what letters are and what they represent to progress in reading.

Is explicit instruction necessary?



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We sit with our children reading whole books, talking about them, sometimes pointing at whole words, sometimes at letters. We sit with them writing shopping lists, labelling things in their rooms, doing texting on phones, planning holidays looking at pictures and reading out the names of places these are ways in which many people ... have learned in part or whole how to read.” (Rosen, 2013).

The myth of discovery learning



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The image displays a musical score for Chopin's Prelude in A Major. The tempo is marked 'Andantino' and the instrument is 'Piano'. The score is written in 3/4 time with a key signature of one sharp (F#). It begins with a piano (*p*) and *dolce* marking, followed by a *con Pedale* instruction. The first system shows a series of chords and arpeggiated figures. The second system starts with a mezzo-piano (*mp*) marking, followed by a crescendo leading to a mezzo-forte (*mp*) section, then a *rit. e dim.* (ritardando and diminuendo) section, and finally a pianissimo (*pp*) section. The score is presented in two systems, each with a grand staff (treble and bass clef).

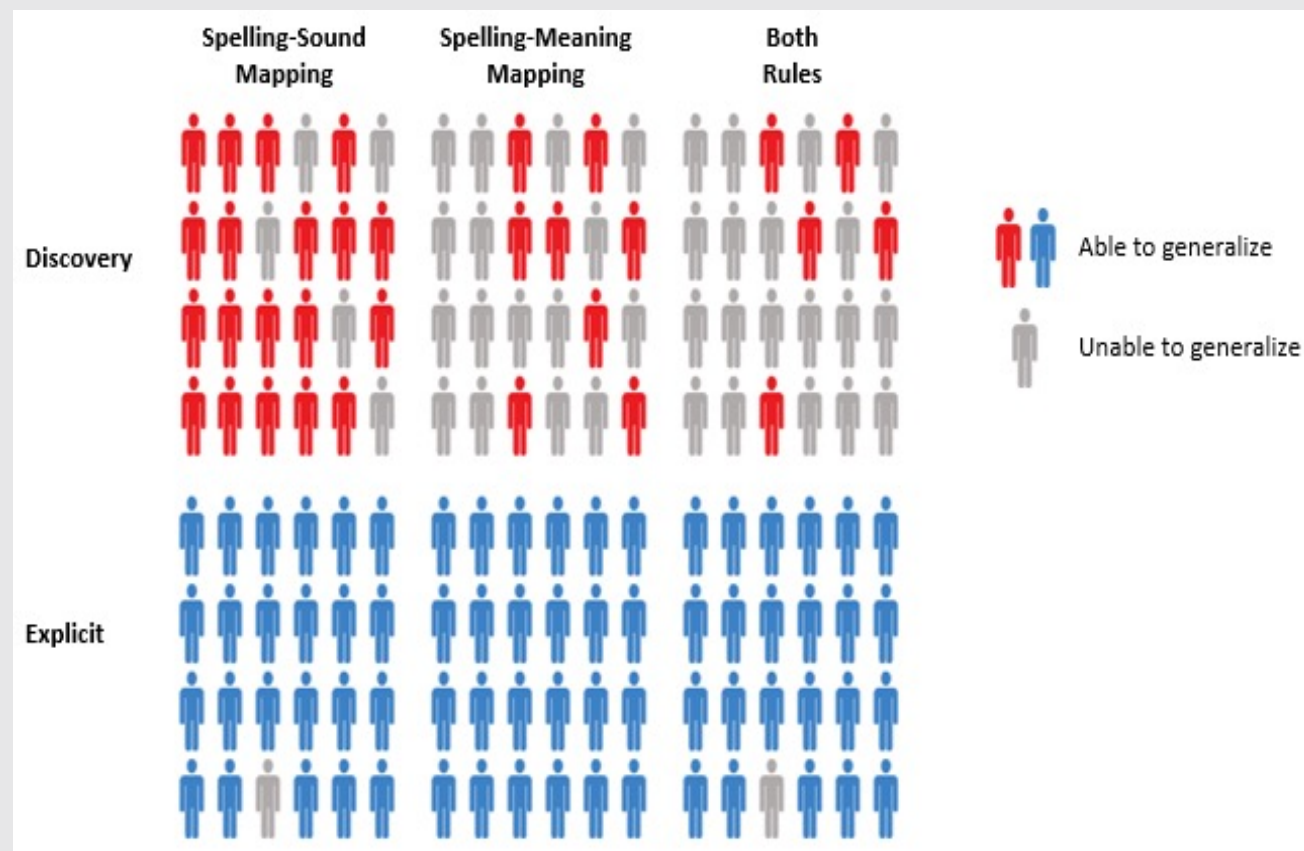
Chopin, Prelude in A Major

Music is a far easier code: no ambiguity about grain size or function; and no inconsistency. If discovery is a viable learning strategy, this should be straightforward.

The power of explicit instruction



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Explicit instruction comprised less than 3% of the total teaching time but transformed outcomes.

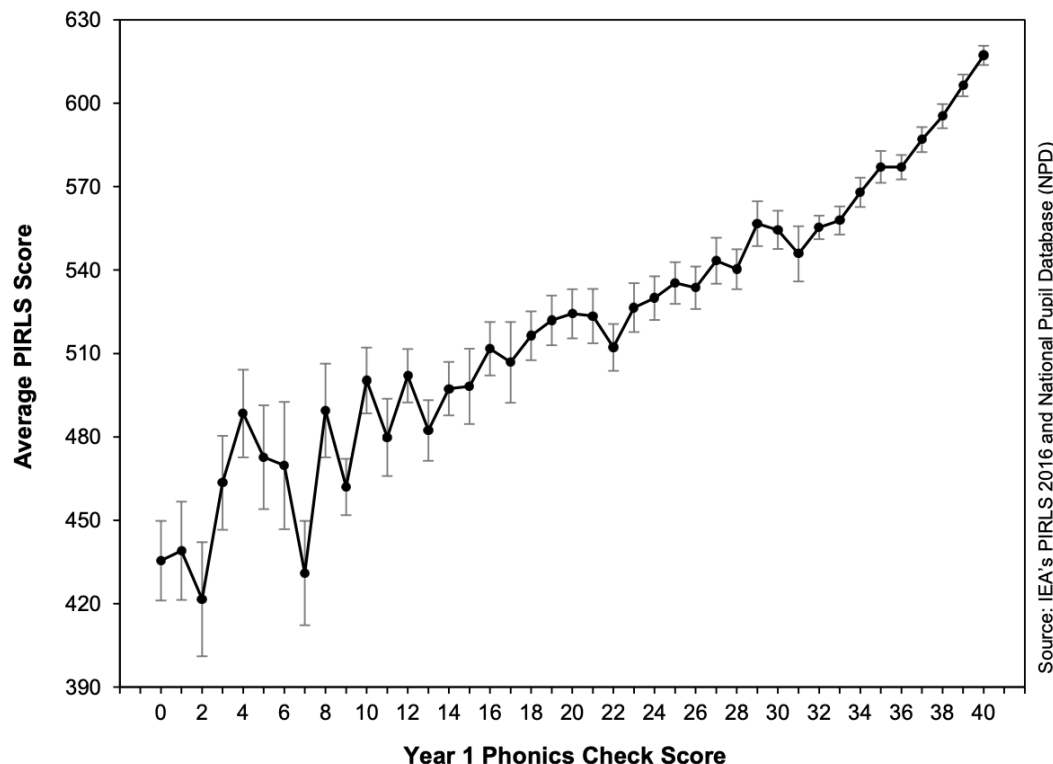
Is phonics all there is to reading?



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No, but it is a necessary foundation!

Figure 4.5 - Performance of England's pupils in PIRLS 2016 by their score in the Year 1 phonics check



Phonics screen score (Yr 1) is the strongest predictor of PIRLS (2016) score (Yr 4)

Stronger than:

- Books in the home
- Welfare status
- Internet connection
- School performance
- Pupil age
- Pupil gender
- Ethnicity
- EAL status
- Pupil has own room

The place of phonics in reading



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Phonics instruction rapidly unlocks the written code; it allows children to access text.

Reading experience is needed to build fluency, and to allow statistical learning to do its job. The latter takes a long, long time!

Motivation, skilled teaching of comprehension, appropriate reading materials all vitally important.



17

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The information in text



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CHAPTER I

I am born

Whether I shall turn out to be the hero¹ of my own life, or whether that station will be held by anybody else, these pages must show. To begin my life with the beginning of my life, I record that I was born (as I have been informed and believe) on a Friday, at twelve o'clock at night. It was remarked that the clock began to strike, and I began to cry, simultaneously.

In consideration of the day and hour of my birth, it was declared by the nurse, and by some sage women in the neighbourhood who had taken a lively interest in me several months before there was any possibility of our becoming personally acquainted, first, that I was destined to be unlucky in life; and secondly, that I was privileged

Charles Dickens

Seit August gilt Deutschland aus britischer Sicht als grünes, also sicheres Reiseland. Diese Meldung löste große Erleichterung bei meiner Familie aus. Meine Tochter, die an einer schottischen Universität studiert und uns zur Weihnachtszeit in Deutschland besucht hatte, konnte bisher wegen diverser Lockdowns und verschärfter Einreisebestimmungen nicht dorthin zurückkehren. Monatelang war sie in Deutschland gestrandet und musste ihr Studium aus der Ferne fortführen.

Die Ausbreitung der Delta-Variante und die Aussicht, nach der Einreise tagelang in einem teuren Quarantäne-Hotel verbringen zu müssen, hatten eine frühere Reise nach Großbritannien verhindert.

- Writing is highly impoverished relative to spoken language; no prosody, gesture, audio-visual information.
- Writing offers different forms of information; e.g. spacing, case, line breaks, visible morphology, highly disambiguating (e.g. Chinese).
- Writing uses richer vocabulary and more complex syntax than spoken language.

I'm Nobody! Who are you?

Are you - Nobody - too?

Then there's a pair of us!

Don't tell! they'd advertise - you know!

How dreary - to be - Somebody!

How public - like a Frog -

To tell one's name - the livelong June -

To an admiring Bog!

Emily Dickinson

Highly visible morphology



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develop
develops
developing
developed
developers
undeveloped
undevelopable
developable
development
developmental
developmentally
antidevelopment
redevelop
predevelop
predevelopment

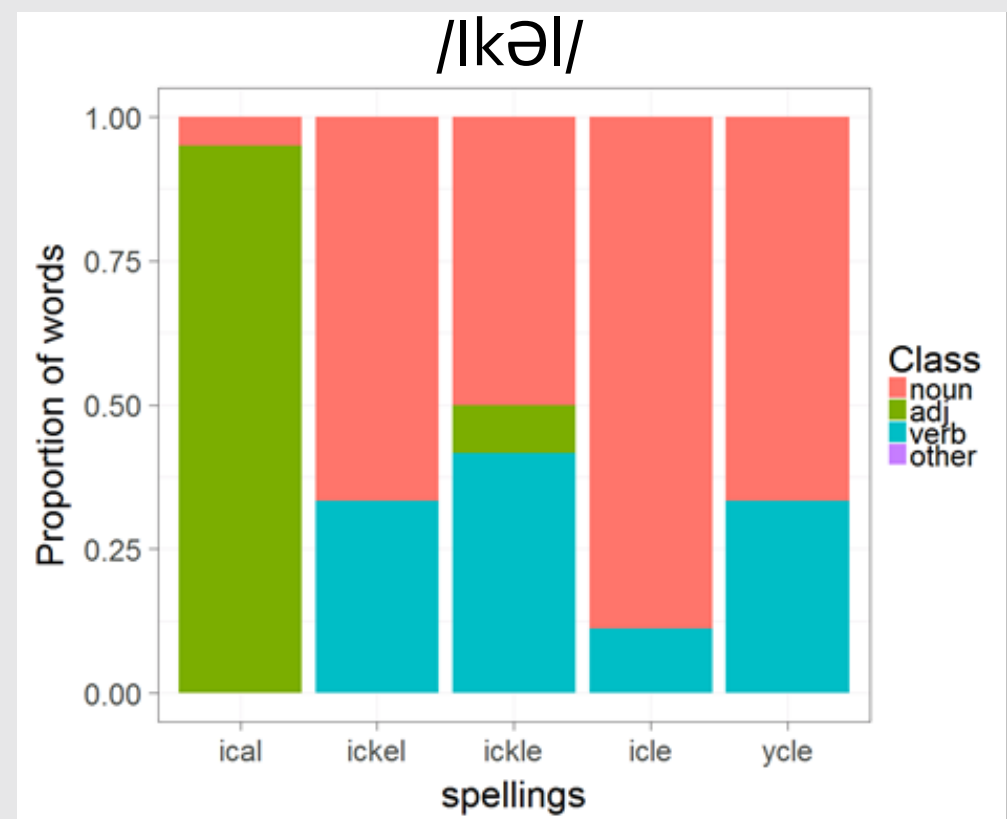
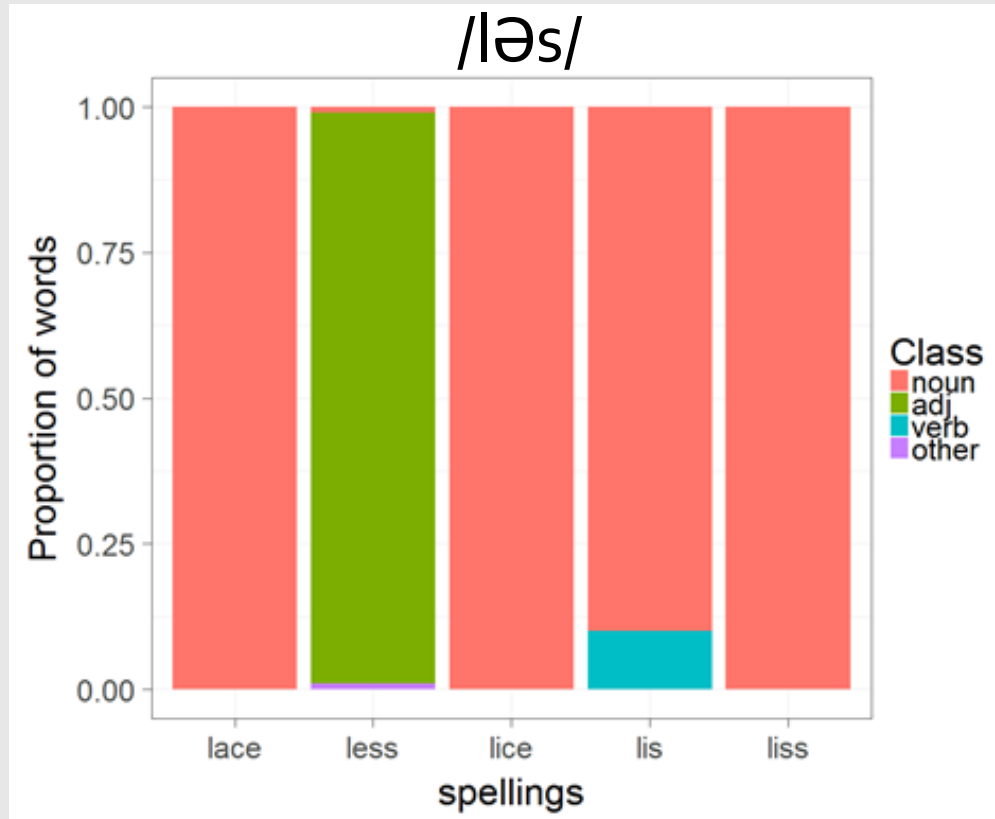
develop
develop s
develop ing
develop ed
develop er s
un develop ed
un develop able
develop able
develop ment
develop ment al
develop ment ally
anti develop ment
re develop
pre develop
pre develop ment

underdeveloped
misdevelopment

Highly visible morphology



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- Letter clusters in English become “reserved” for communicating meaning
- Sensitivity in a variety of reading measures from late adolescence
- Information not available in spoken language

Highly visible morphology



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09:08 Sun 18 Apr

85%

 THE SUNDAY TIMES

NEWS | NEWS

New spelling rools to make English more predictable for pupils

Stephen Linstead, the former civil servant who designed the new system, says it is “a handicap that can stay with them for life”.

TSR changes up to 18 per

herded, kicked snored

hurdid, kict, snord

The richness of text



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Bloody school tomorrow!
Going back tonight ... or tomorrow
morning ?
Tomorrow morning .
What early?
I'm gonna have to get up at four. Get home
by seven .
Have you hurt your eyes ?
Yeah . Rubbing it ... Got eyelash in my eye .
... I get a funny twitch in it . The nerve goes
, phew {laugh} It's horrible when it
{laughing} A bit dodgy !
Yeah. Was the club busy last night ?
Er , yeah it was actually packed , it was
really packed. It was a good night actually.

Bergen Corpus of London
Teenage Language (1993)

Deep in the forest a call was
sounding, and as often as he heard
this call, mysteriously thrilling and
luring, he felt compelled to turn his
back upon the fire and the beaten
earth around it, and to plunge into
the forest, and on and on, he knew
not where or why; nor did he
wonder where or why, the call
sounding imperiously, deep in the
forest.

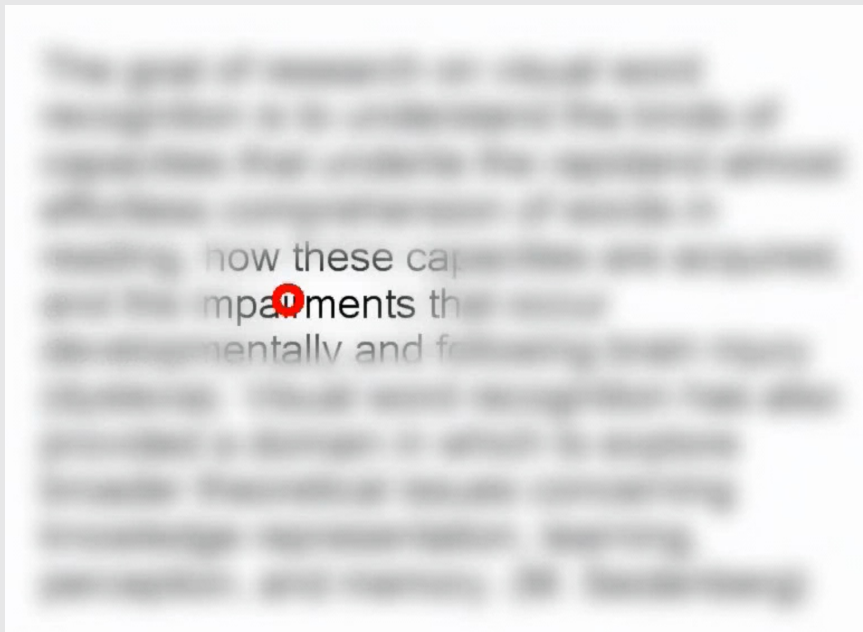
Jack London
The Call of the Wild

Using predictive knowledge about text



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Skilled eye-movement system contributes to reading efficiency



- ✓ Whether to skip the next word
- ✓ Where to land on the next word
- ✓ How long to fixate the next word
- ✓ Whether to regress to a word

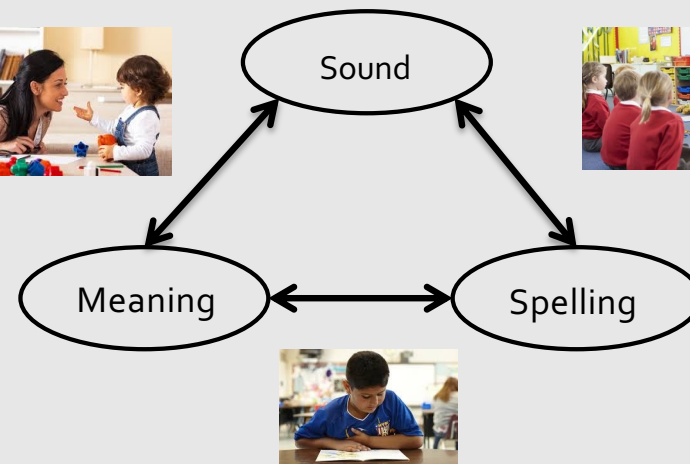
Skilled reading requires predictive knowledge to be deployed incredibly quickly. Eye-movement system becomes tuned to these predictions over many years of text experience.

A revised 'simple view'



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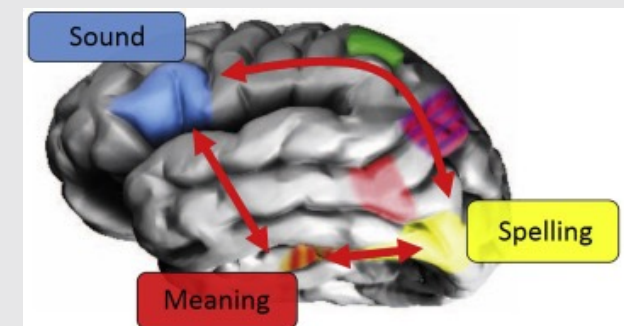
Oral language
foundations



Instruction
(get children
out of the
gate quickly!)



Text experience
(let statistical learning
work its magic!)



Rastle, 2019, Cortex

Barriers to bringing research into classrooms



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Ideology

- Pockets of ideology mean we waste time covering old ground.
- Political allegiances are irrelevant; reading is a scientific problem.

Lack of knowledge

- Lack of deep knowledge that explains the 'why'.
- Shallow knowledge sometimes motivates poor practices.

Evidence base is incomplete

- Science hasn't yet provided all the answers.
- Studies to assess effective classroom methods are hard to do well.
- Studying "what works" does not inform understanding of mechanism.

But ... this is a completely different world to a decade ago!

Some further reading (general)



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Ending the Reading Wars: Reading Acquisition From Novice to Expert

Anne Castles^{1,2}, Kathleen Rastle³, and Kate Nation^{2,4}

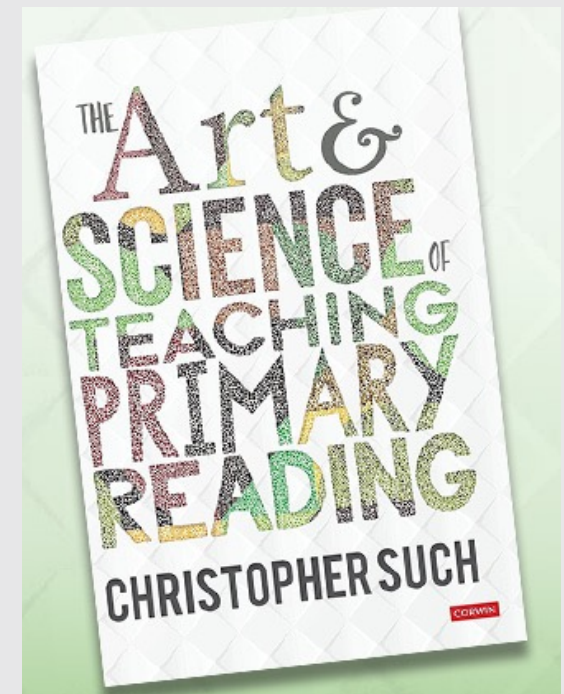
¹Department of Cognitive Science, Macquarie University; ²Australian Research Council Centre of Excellence in Cognition and its Disorders; ³Department of Psychology, Royal Holloway, University of London; and ⁴Department of Experimental Psychology, University of Oxford

Psychological Science in the
Public Interest
2018, Vol. 19(1) 5–51
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DOI: 10.1177/1529100618772271
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rastlelab.com

Emily Hanford



Some further reading (morphology)



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Cortex

Volume 116, July 2019, Pages 45-54



Special issue: Review

The place of morphology in learning to read in English

Kathleen Rastle  

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<https://doi.org/10.1177/1747021819829696>



Invited Prize Paper

EPS mid-career prize lecture 2017: Writing systems, reading, and language

Kathleen Rastle

Open Access

Do subtitles help children to learn to read?



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Use eye-tracking to measure how children engage with subtitled television

Experiment 1: how do these measures change with age / reading ability?

Experiment 2: does 6 weeks of experience with subtitles (min 30 hours) influence these measures or standard tests of reading ability?

We need your help!

Thank you!
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