

Developmental disorders of reading and language:
understanding, assessment, treatment and treatment
evaluation

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Overview

- The basic approach
- The Reading System of skilled readers: What is it like?
- The reading system: some of its developmental difficulties
 - The normal course of learning to read
- Assessment of basic reading difficulties
- Case studies of two types of difficulty in learning to read.
- Causes and treatments for these two types of difficulty in learning to read.

The basic approach

The basic approach:

- Reading is not a single mental process. It depends on many different mental subskills. Some of these are:

- letter recognition
- word recognition
- knowledge of letter-sound rules
- word comprehension

and there are others.

- Therefore, to become a skilled reader the child needs to learn all of these subskills.

- So if a child has a problem in learning any of these subskills, learning to read will not proceed normally.

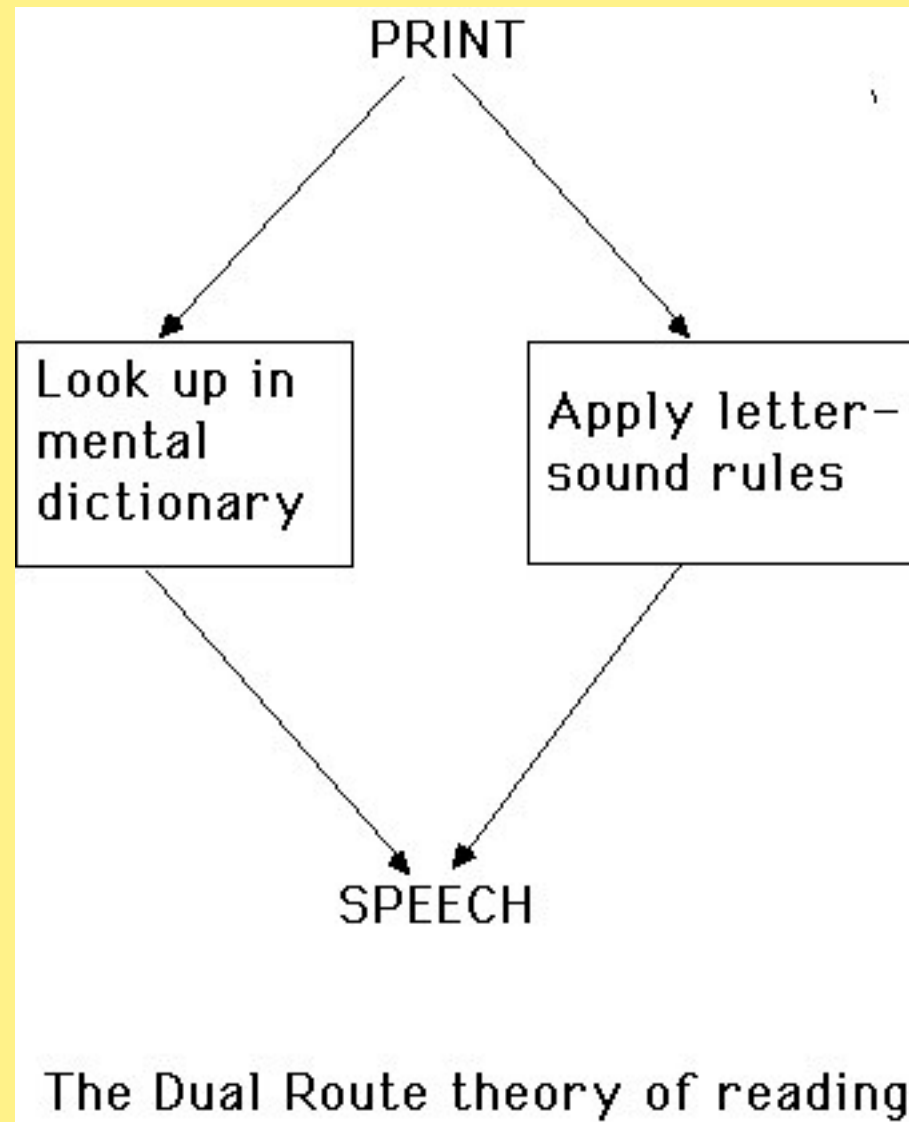
- Therefore it must be true that children's reading difficulties will come in various different forms, depending on which subskill the child is having difficulty learning.

Understanding children's reading difficulties

- Children's reading difficulties will come in various different forms, depending on which subskill the child is having difficulty learning.
- If so, we won't be able to make sense of children's reading difficulties unless we know what these subskills are.
- What are the various mental subskills that skilled readers possess that allow them to be skilled readers?
- This set of mental subskills I will refer to as the **READING SYSTEM**.

The Reading System of skilled readers:
What is it like?

Two ways of reading aloud



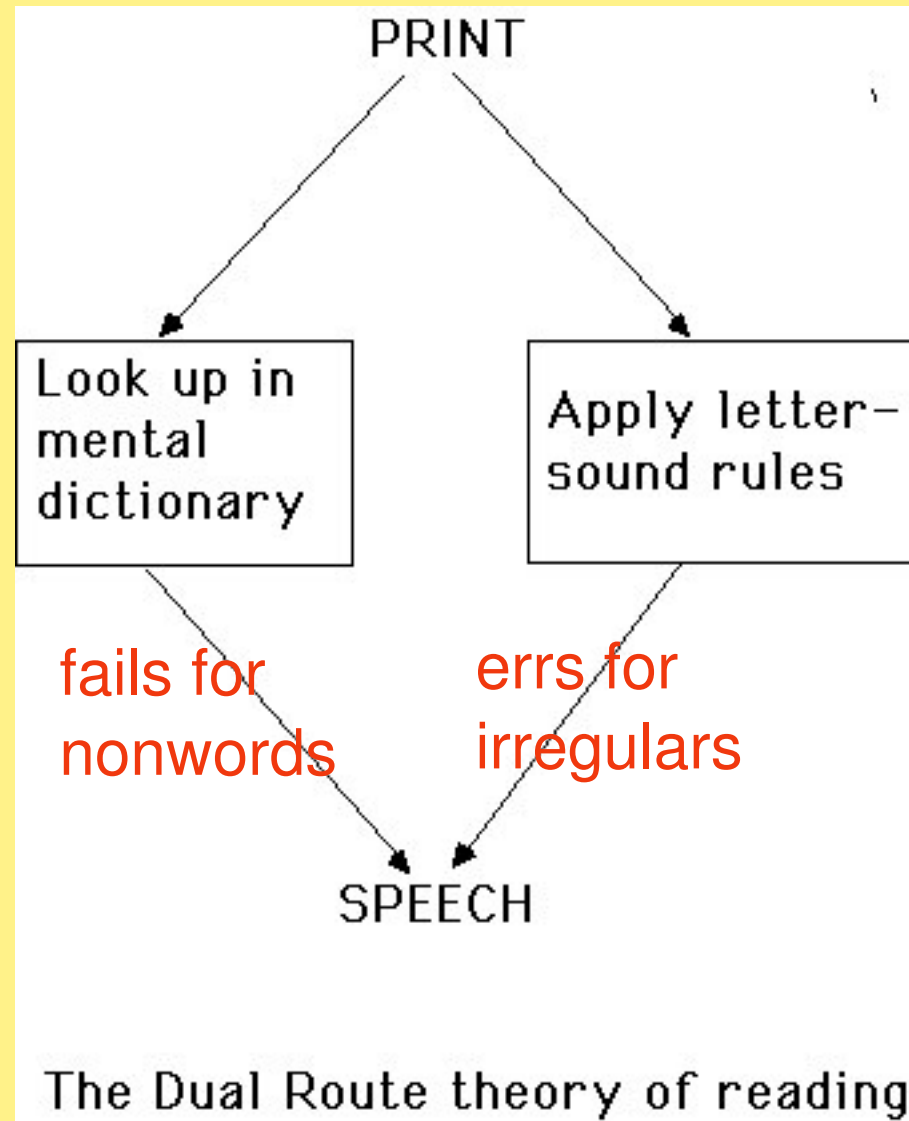
A crucial distinction: regular vs irregular words

regular	irregular
TROUT	YACHT
RUB	SEW
MEET	AUNT
DOOM	BLOOD

Another crucial distinction: nonwords vs words

word	nonword
TROUT	TROOM
RUB	REET
MEET	MUB
DOOM	HOUT

Two ways of reading aloud



The reading system: two elementary ideas

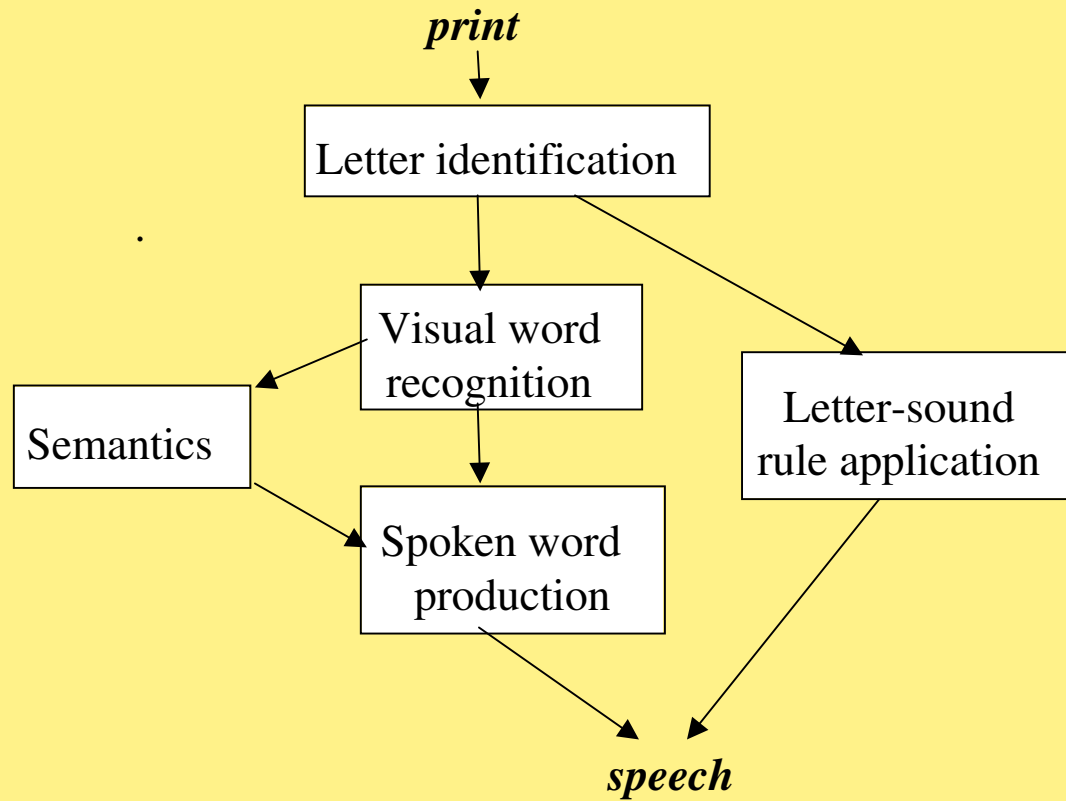
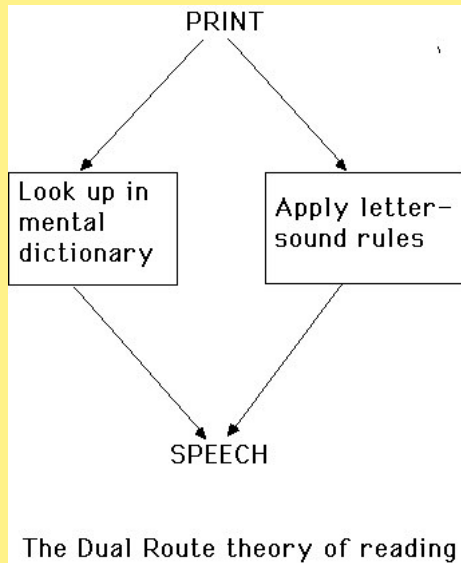
FIRST IDEA

- Irregular words like YACHT can only be read aloud via the dictionary lookup system;
- skilled readers can read irregular words aloud;
- therefore skilled readers possess the dictionary lookup procedure for reading aloud

SECOND IDEA

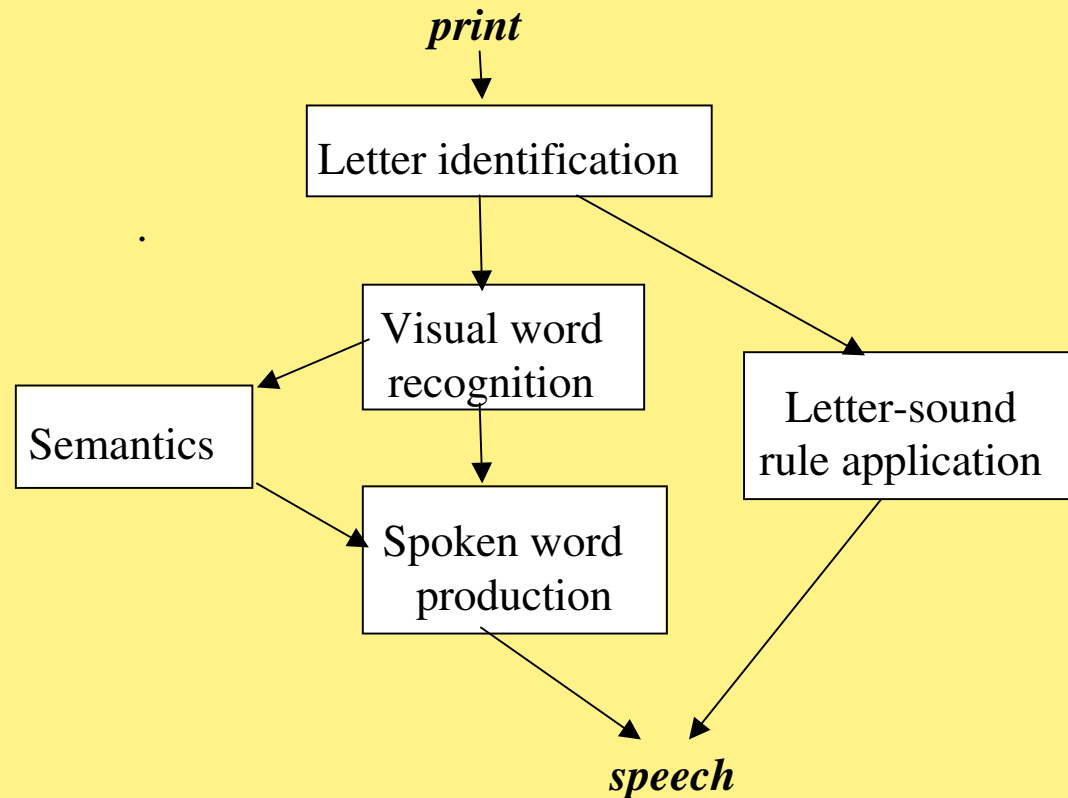
- Nonwords like TROOM can only be read aloud via letter-sound rules;
- skilled readers can read nonwords aloud;
- therefore skilled readers possess the letter-sound rule procedure for reading aloud

The reading system: a little more sophistication



Elaboration of the dual route model of reading

The reading system: a little more sophistication

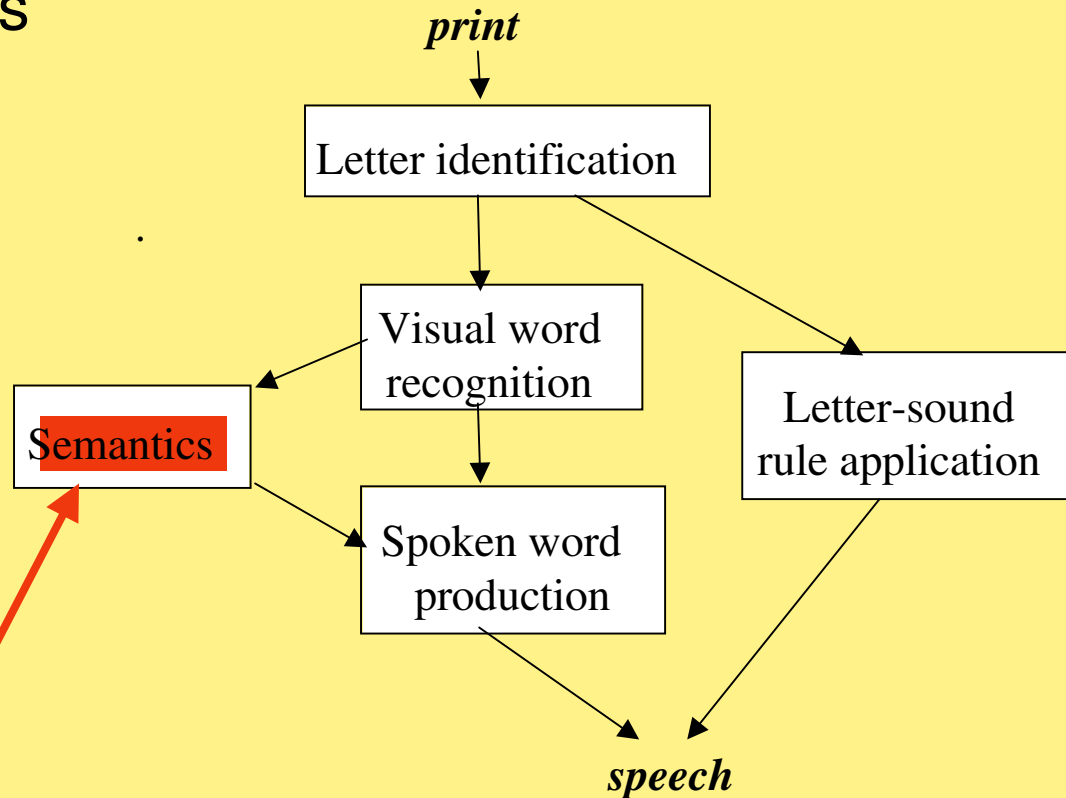


Elaboration of the dual route model of reading

- Skilled readers possess all five of these subskills
- A child who is having difficulty in acquiring any one of these subskills will have a reading difficulty

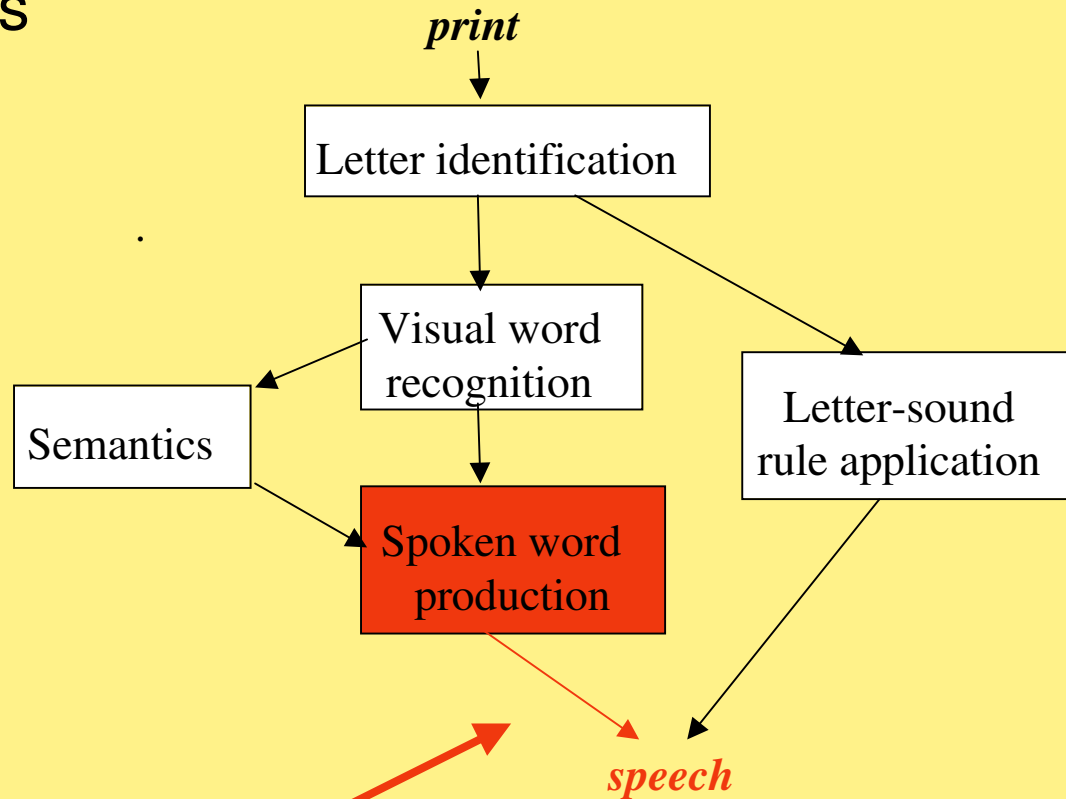
The reading system: some of its
developmental
difficulties

The reading system: some of its developmental difficulties



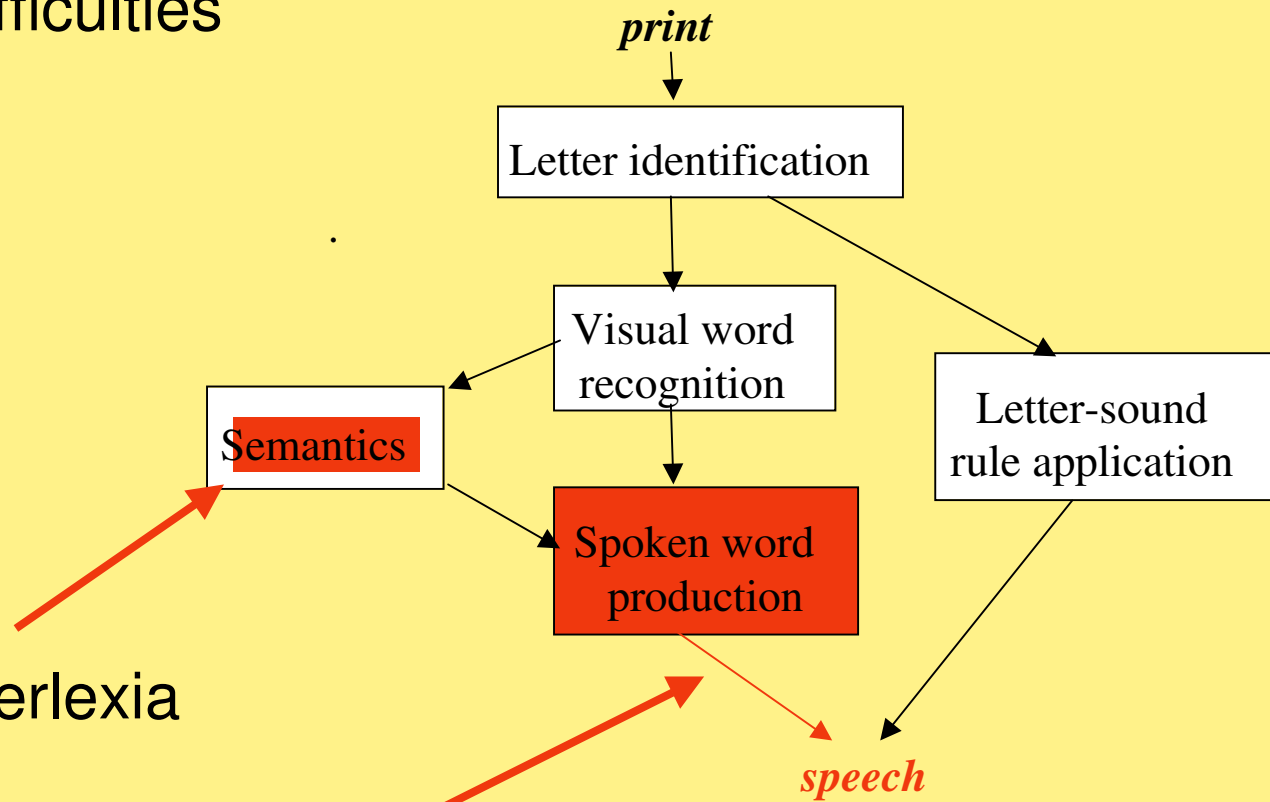
Hyperlexia: a developmental difficulty in acquiring word meanings (often seen in autism). Will affect reading comprehension but not reading aloud

The reading system: some of its developmental difficulties



Developmental dyspraxia of speech: a developmental difficulty in speech production. Will affect reading aloud but not reading comprehension.

The reading system: some of its developmental difficulties

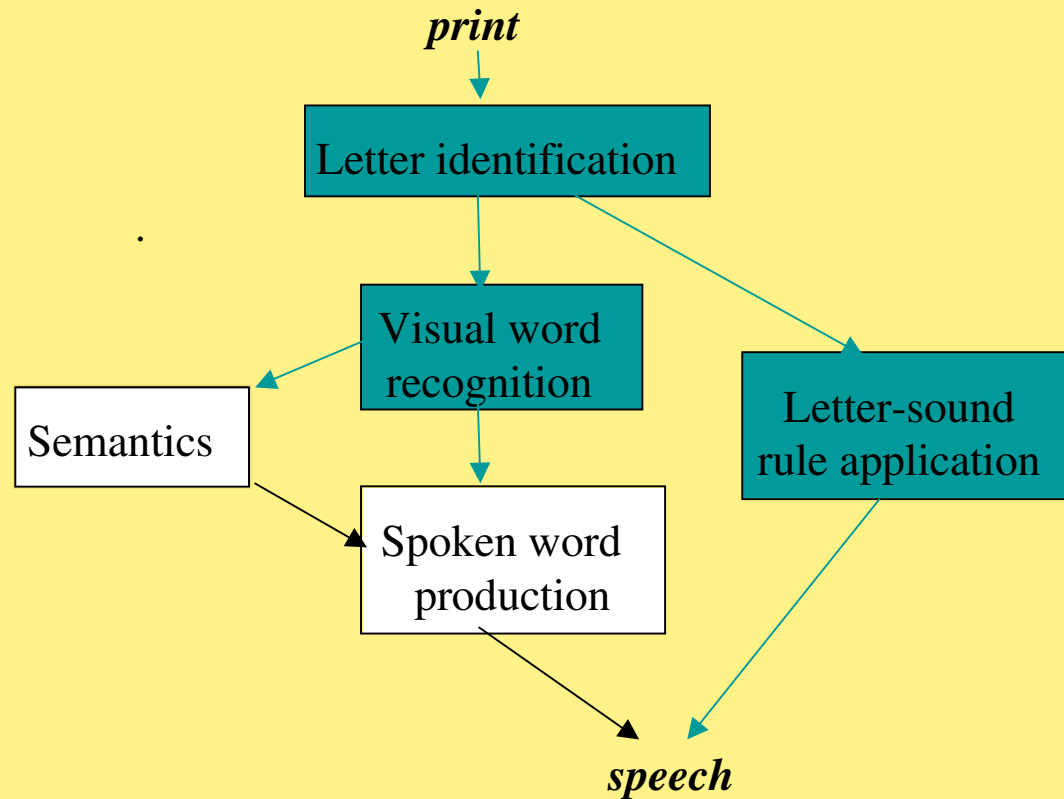


Hyperlexia

Developmental dyspraxia of speech:

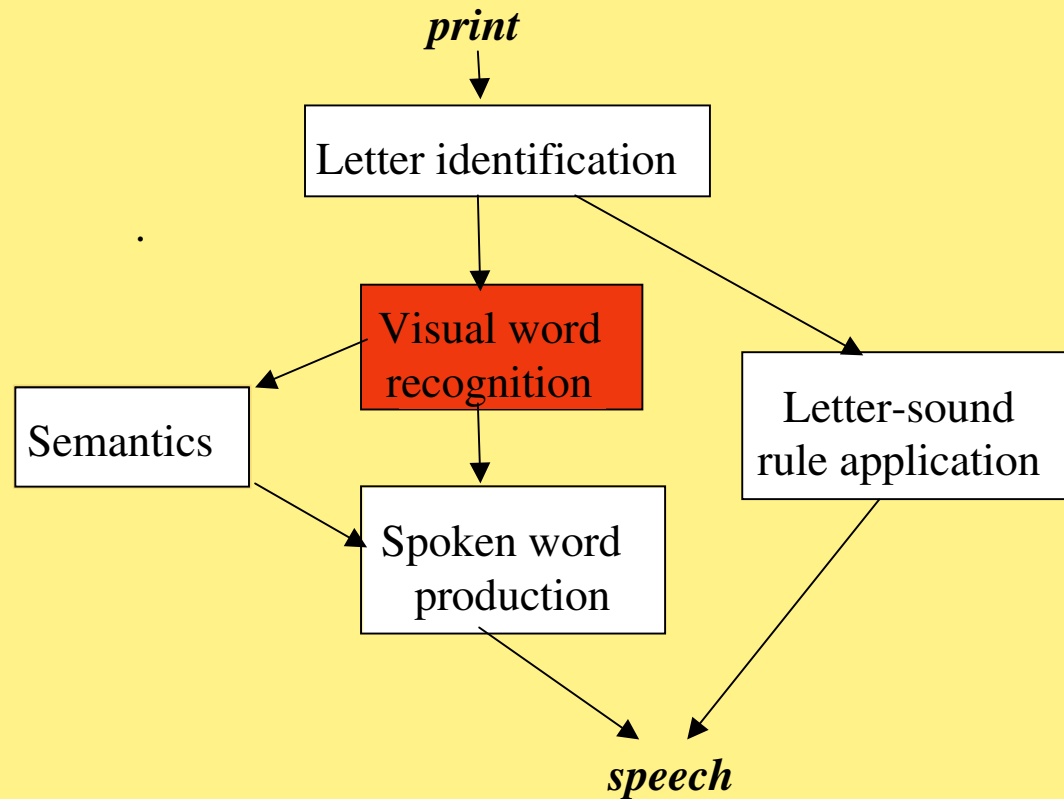
Although both affect reading in some way, they also affect spoken language, so are not specific reading difficulties.

The reading system: specific reading difficulties



If a developmental difficulty is specific to reading, it would have to affect only the green components here - one or more of them.

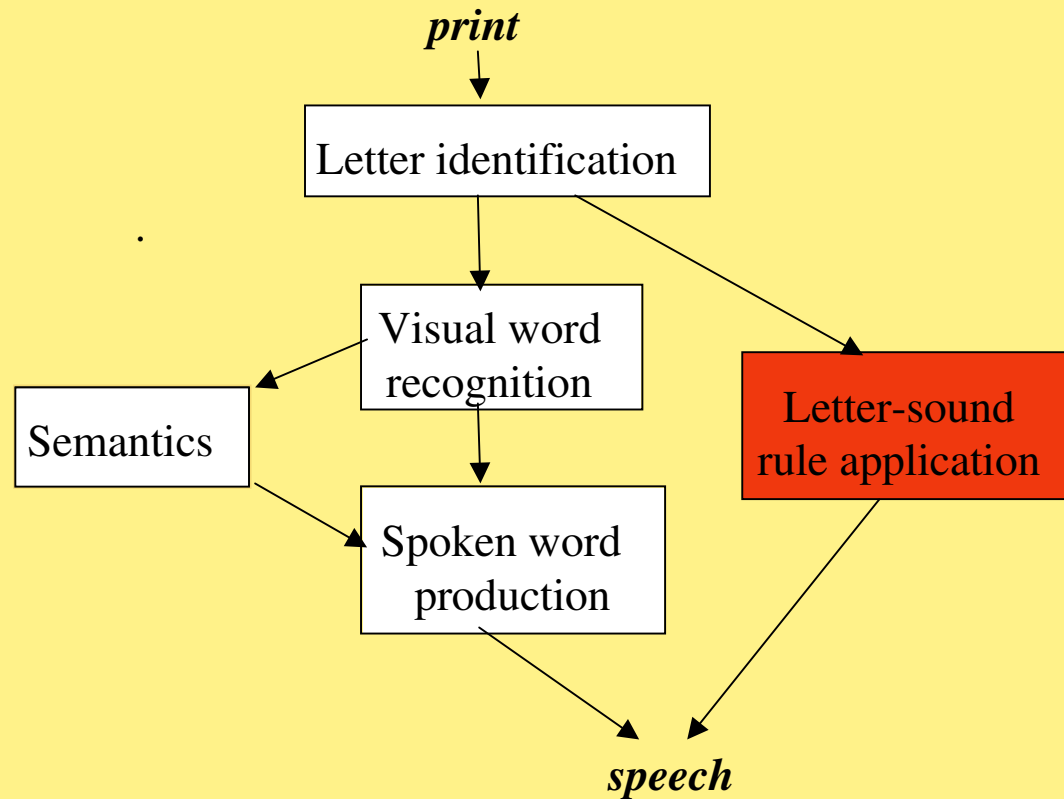
The reading system: one specific reading difficulty



What would this child's reading be like?

- Nonwords ✓
 - Regular words ✓
 - Irregular words X
- "Developmental surface dyslexia"

The reading system: another specific reading difficulty



What would this child's reading be like?

- Nonwords X
 - Regular words ✓
 - Irregular words ✓
- “Developmental phonological dyslexia”

The normal course of learning to read

The normal course of learning to read.

As children learn to read, they generally go through these four stages:

- Develop a small sight vocabulary, then
- Learn how to sound out, then
- Use sounding out to build up a bigger sight vocabulary, then eventually
- Give up sounding out so as to become a fast and fluent reader.

The normal course of learning to read.

As children learn to read, they generally go through these four stages:

- Develop a small sight vocabulary

elephant → “television”

yellow → “balloon”

The normal course of learning to read.

As children learn to read, they generally go through these four stages:

- Develop a small sight vocabulary

elephant	→	“television”
“Why?”		“It’s the long one”
yellow	→	“balloon”
“Why?”		“It’s got two sticks”

At this stage, children are not using letters to read, but gross visual features. They don’t have a Reading System yet.

The normal course of learning to read.

As children learn to read, they generally go through these four stages:

- Develop a small sight vocabulary, then
- Learn how to sound out

A crucial fact:

A seven-year-old child may have a sight vocabulary of perhaps 50 words, but an auditory vocabulary of perhaps 10,000 words

So it will constantly be the case that such children will be seeing words in print that they have never seen before but which they'd instantly recognise if they heard the word.

A crucial fact:

A seven-year-old child may have a sight vocabulary of perhaps 50 words, but an auditory vocabulary of perhaps 10,000 words

So it will constantly be the case that such children will be seeing words in print that they have never seen before but which they'd instantly recognise if they heard the word.

What a huge help it would be if these children could pronounce these unfamiliar words to themselves. That would allow them to use their large auditory vocabularies to recognise the words.

That's the reason why sounding-out is so important.

The normal course of learning to read.

As children learn to read, they generally go through these four stages:

- Develop a small sight vocabulary, then
- Learn how to sound out, then
- Use sounding out to build up a bigger sight vocabulary.

Sounding out is a crucial aid to building up a big sight vocabulary. Nevertheless, the child must eventually give it up, because:

- It makes reading very slow
- It cause confusion between SAIL and SALE
- It fails for irregular words

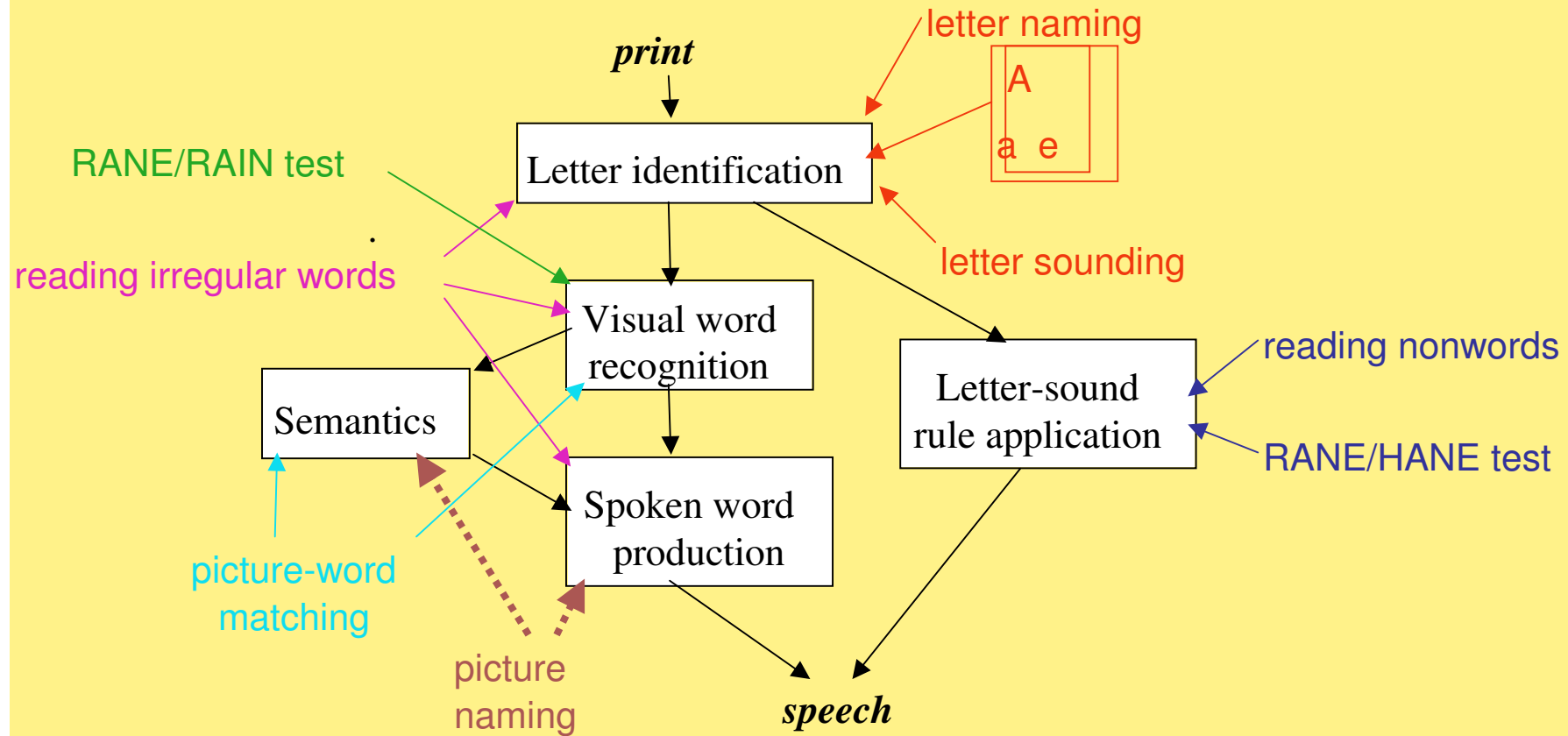
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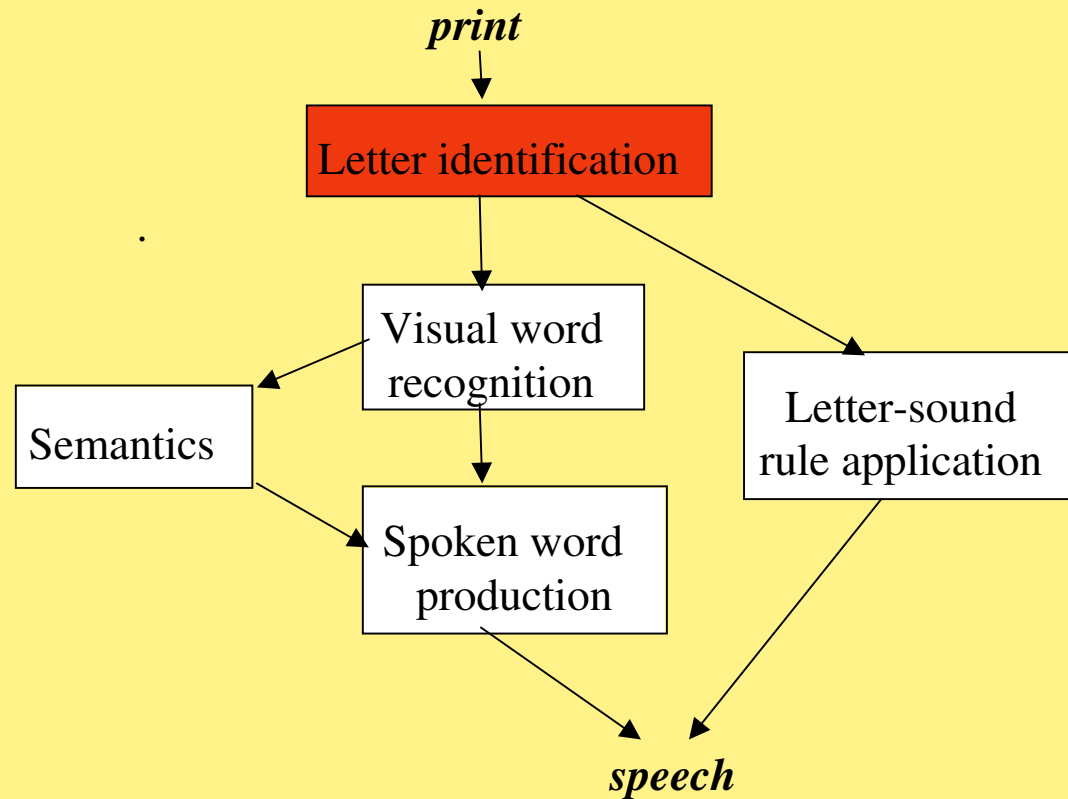
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- Assessment of basic reading difficulties

The reading system: overview of assessment



The reading system: assessment

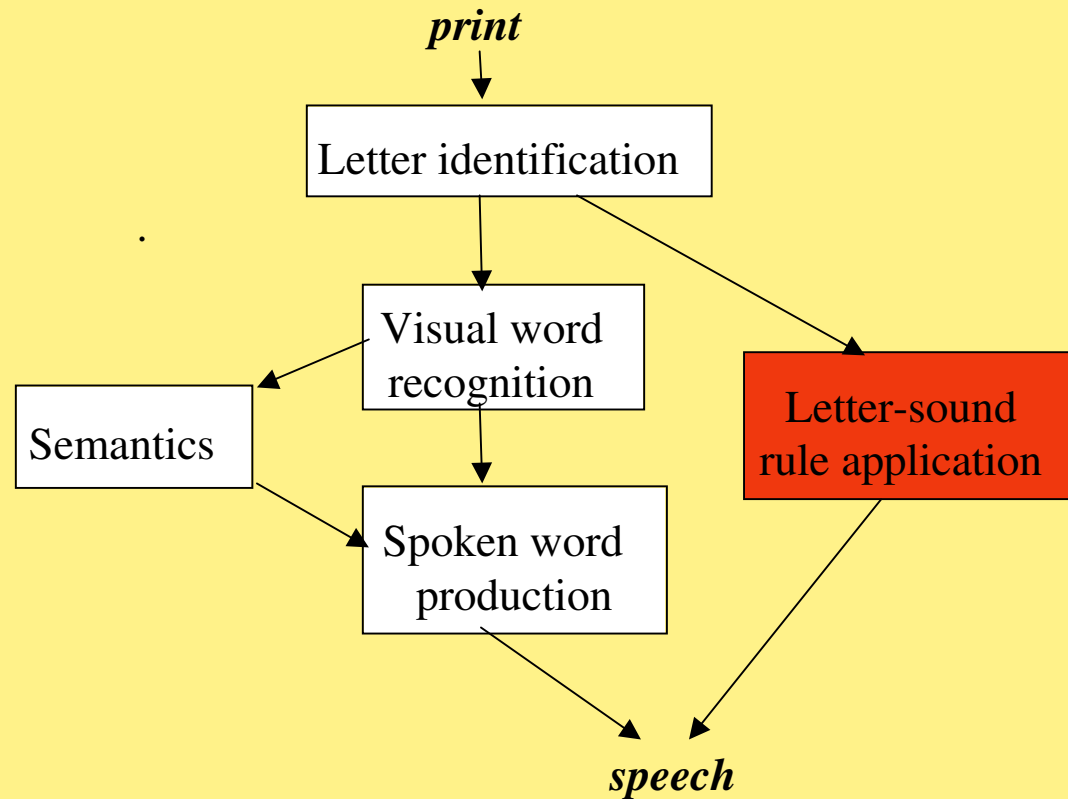


Three ways of testing letter identification:

- Letter naming
- Letter sounding
- Cross-case matching

A
a e

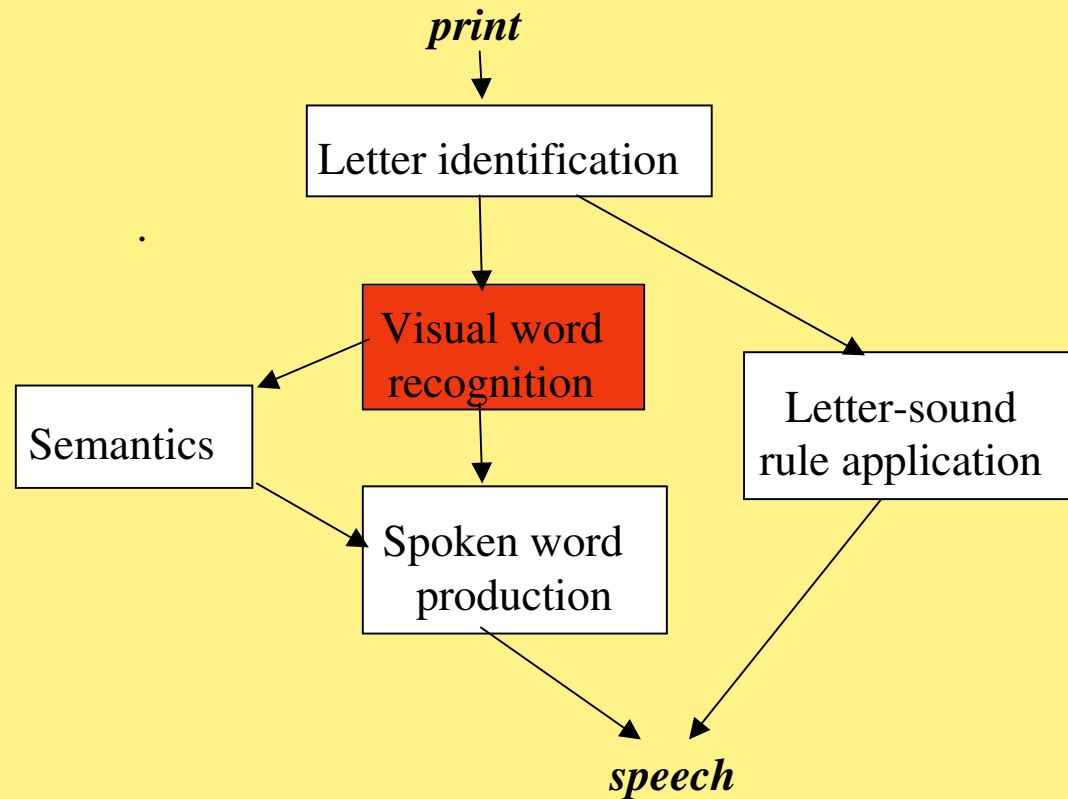
The reading system: assessment



Two ways of testing letter-sound rule application:

- Reading nonwords aloud
- RANE HANE: which sounds like a word?

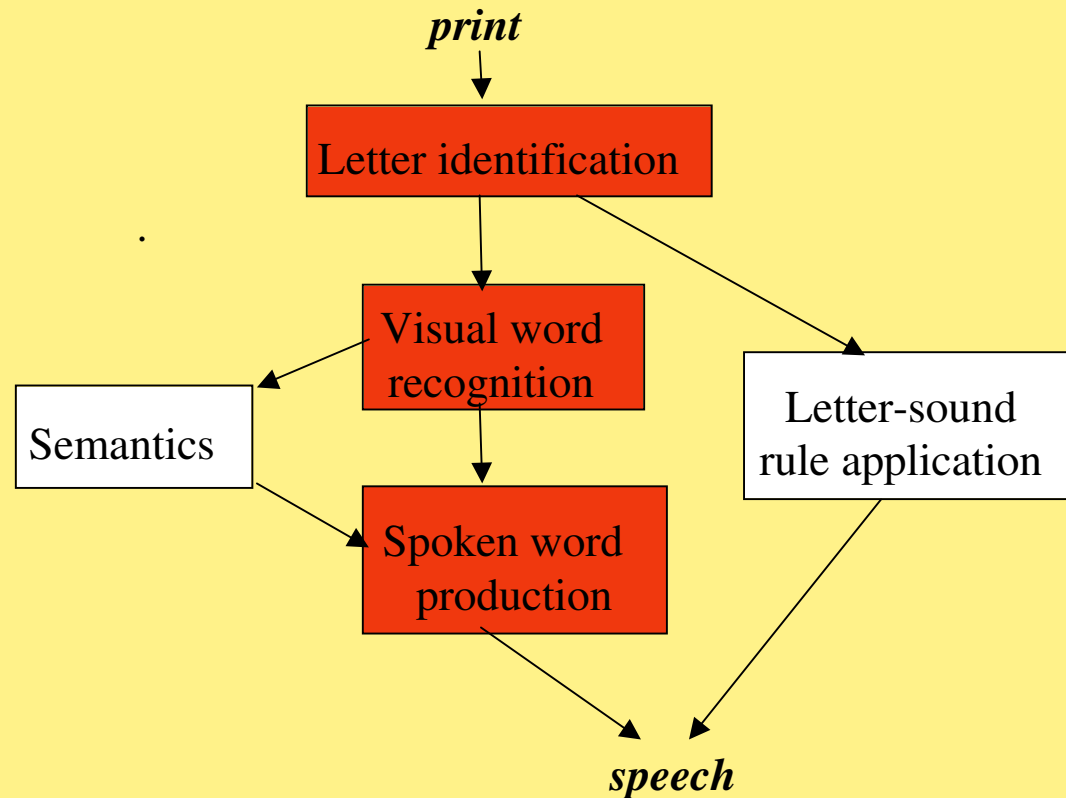
The reading system: assessment



One way of testing visual word recognition:

- RANE RAIN: which is the real word?

The reading system: assessment



- Reading irregular words aloud needs **ALL THREE** of these subskills
- So a child who is normal on this task is normal on all three of these subskills

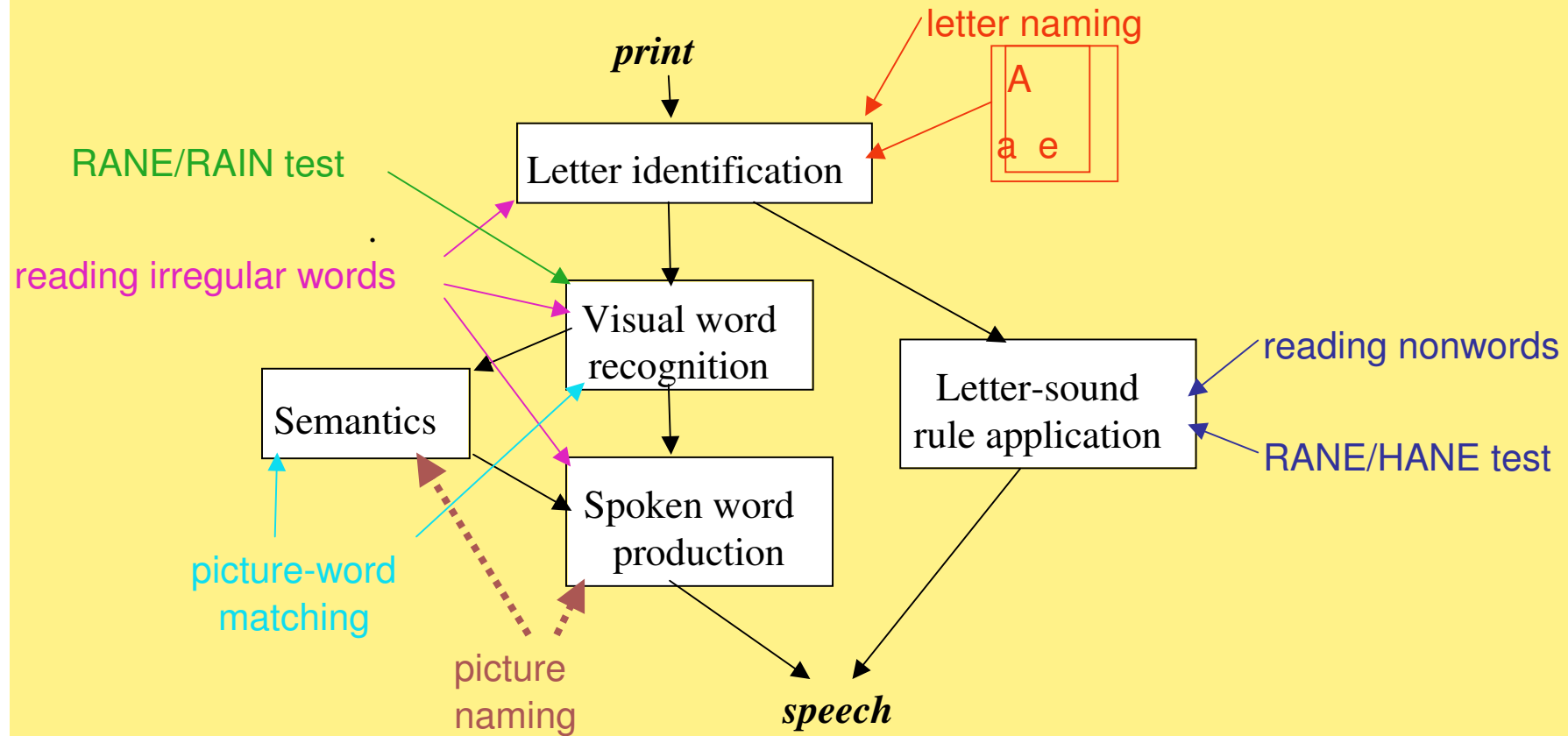
REGULAR WORDS IRREGULAR WORDS NONWORDS

bed	good	norf
free	friend	rint
hand	give	delk
luck	eye	aspy
chicken	head	baft
take	wolf	spatch
need	work	drick
long	pretty	hest
drop	shoe	brinth
market	come	framp
mist	blood	gop
tail	island	bick
life	break	peef
middle	bowl	grenty
plant	sure	stendle
pump	iron	tapple
cord	soul	farl
navy	ceiling	pite
wedding	lose	seldent
brandy	choir	borp
chance	cough	brennet
marsh	yacht	gurve
check	routine	crat
flannel	brooch	boril
stench	tomb	bleaner
context	bouquet	ganten
nerve	gauge	trope
curb	meringue	pofe
weasel	colonel	doash
peril	rint	nono

Australian norms available

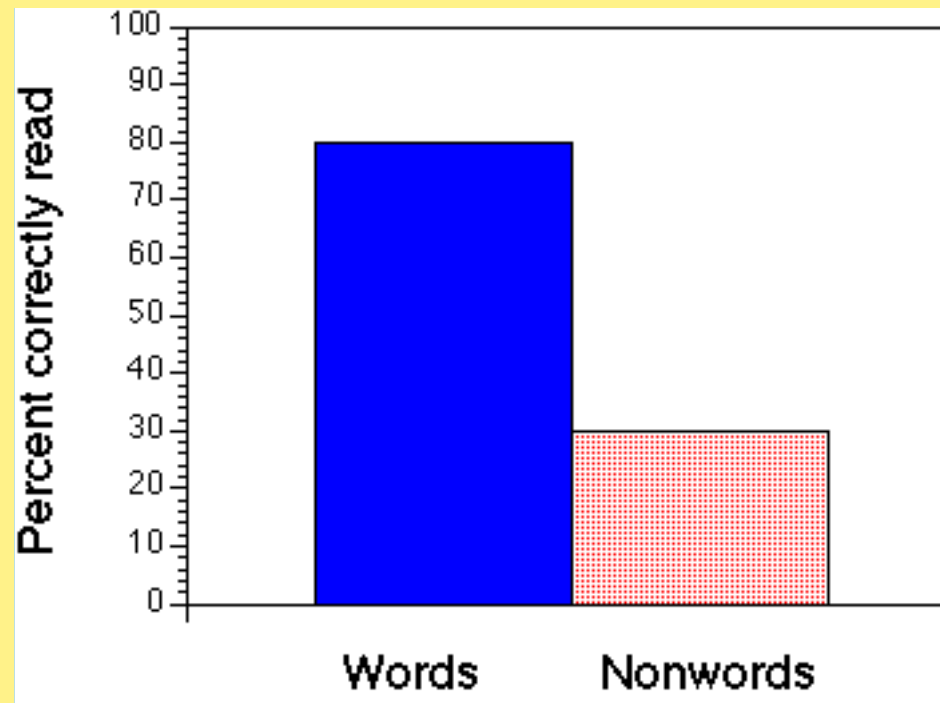
- Coltheart & Leahy, Australian Journal of Psychology, 1996
- Edwards & Hogben, Australian Journal of Psychology, 1998

The reading system: overview of assessment

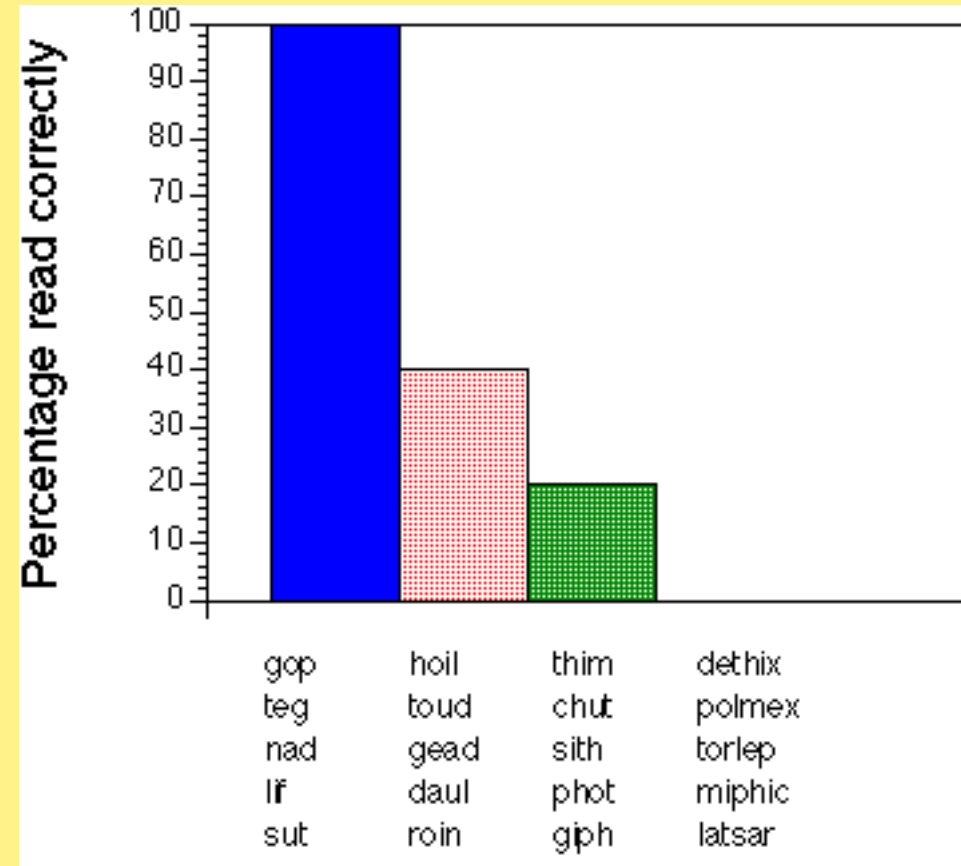


Case studies of two types of
difficulty in learning to read.

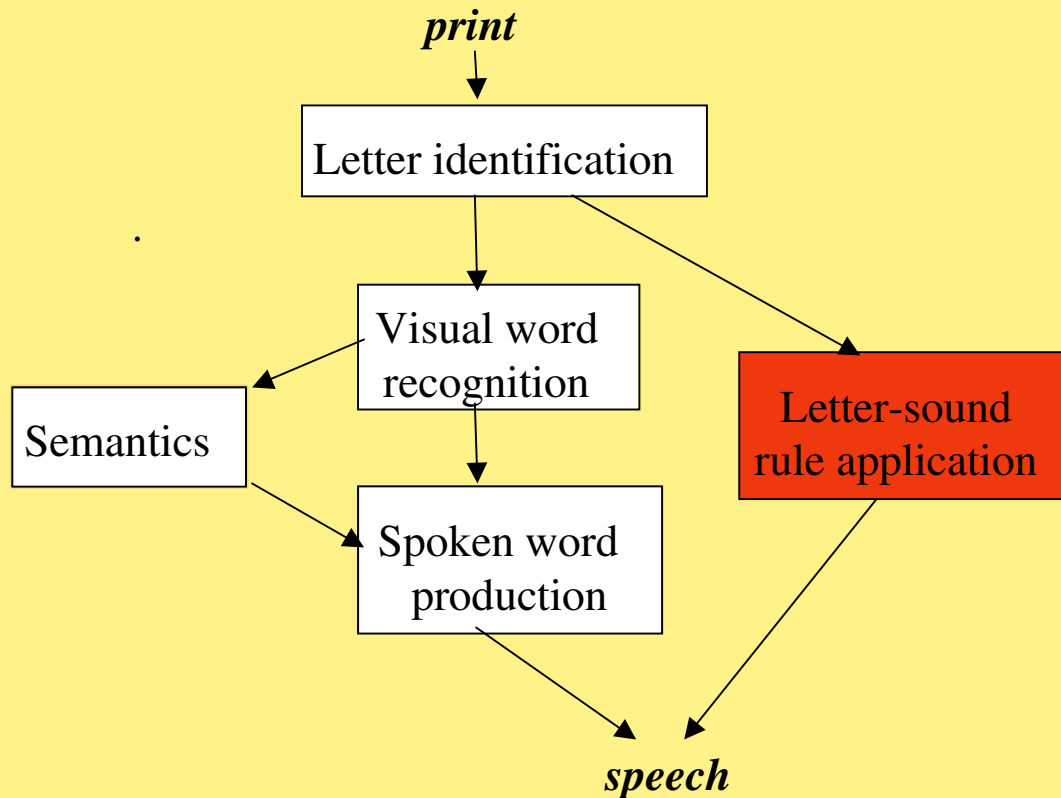
Case JF



Case JF



JF: developmental phonological dyslexia



Specific difficulty in acquiring the letter-sound reading route

Was successfully treated with a systematic phonics approach ("From Alpha to Omega")

Case MI

- Aged 9
- IQ 141 (Verbal 130, Performance 142) (That is in the top 1% of people).
- His reading was only in the 38th percentile
- His spelling was only in the 12th percentile.
- Both parents professionals, and highly literate.
- His two siblings were good readers
- Every other child in his class had learned to read well
- M.I.'s spoken language was good and there was no history of neurological disorder

MI reading aloud

- Regular words 26/30 correct
- Nonwords 26/30 correct
- Irregular words 8/30 correct
- Note how good he is at reading nonwords (above average for 9 year olds, which is 24/30) and how bad he is at reading irregular words (9 year olds average 22/30 correct).
- Most of his misreadings of irregular words were the pronunciations that the rules prescribe.

MI reading aloud irregular words: some examples

island → “iz-land”

break → “breek”

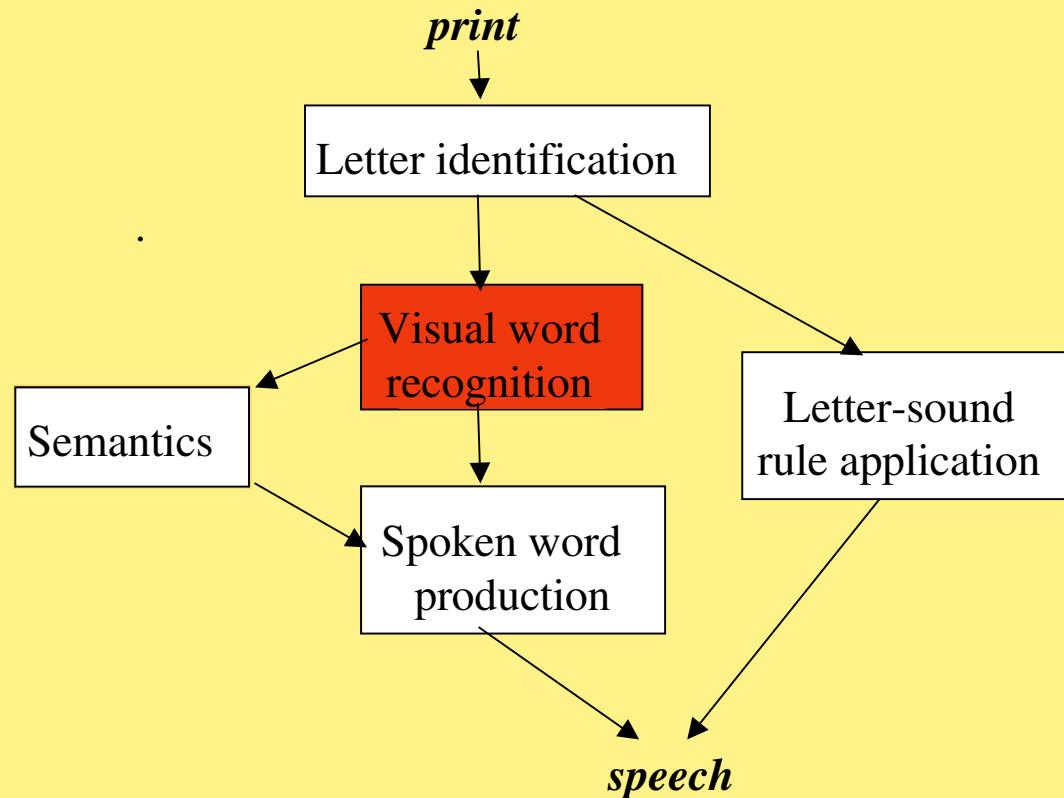
quay → “kway”

yacht → “yatched”

show → “show”

All of these are examples of using letter-sound rules to read aloud, rather than whole-word recognition.

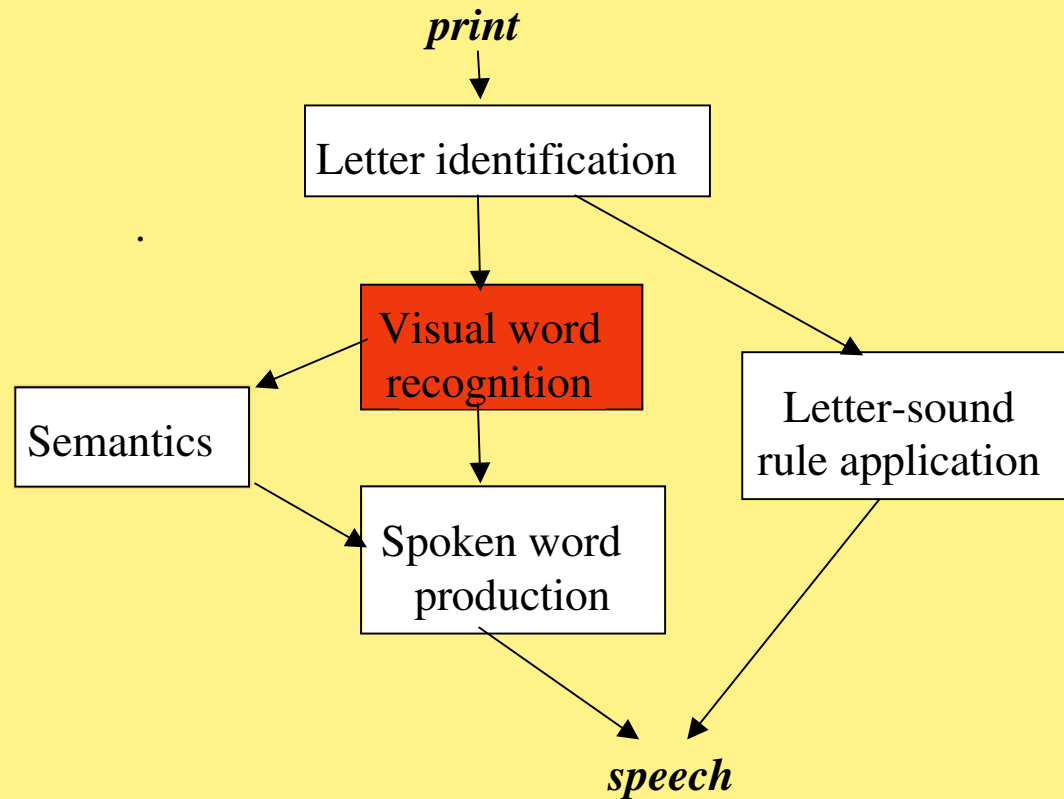
MI: Developmental surface dyslexia



Specific difficulty with visual word recognition, i.e., abnormally small sight vocabulary

Thus many words that should be recognised are not; so MI can only read these via letter-sound rules.

MI: Developmental surface dyslexia



Why has MI been unable to develop an adequate sight vocabulary?

MI: Developmental surface dyslexia

Why has MI been unable to develop an adequate sight vocabulary?

Phonology?

- MI normal at judging whether words rhyme
- MI normal at phoneme deletion (“polmex”->“olmex”)

MI: Developmental surface dyslexia

Why has MI been unable to develop an adequate sight vocabulary?

Phonology? No

Visual memory impairment?

- Visual recognition memory test
- Benton visual retention test
- Visual sequential memory test

MI: Visual recognition memory

Visual recognition memory for words:

MI sees 50 words, then sees word pairs and has to say which member in each pair he was shown before.

- 47/50 correct (normal for adults)

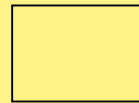
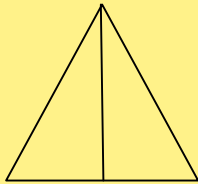
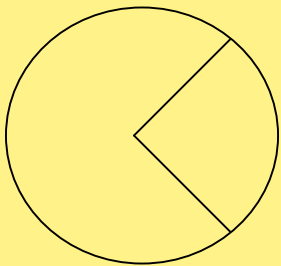
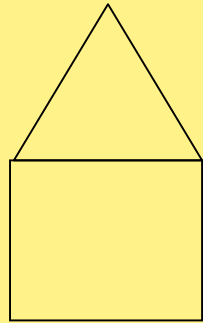
Visual recognition memory for faces:

MI sees 50 unfamiliar faces, then sees face pairs and has to say which member in each pair he was shown before.

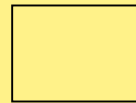
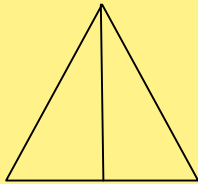
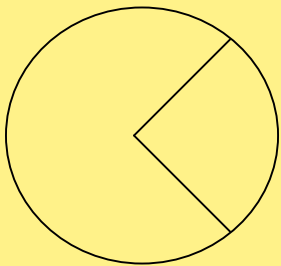
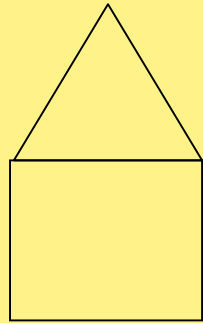
- 45/50 correct (normal for adults)

So no problem there.

MI: Benton visual retention test



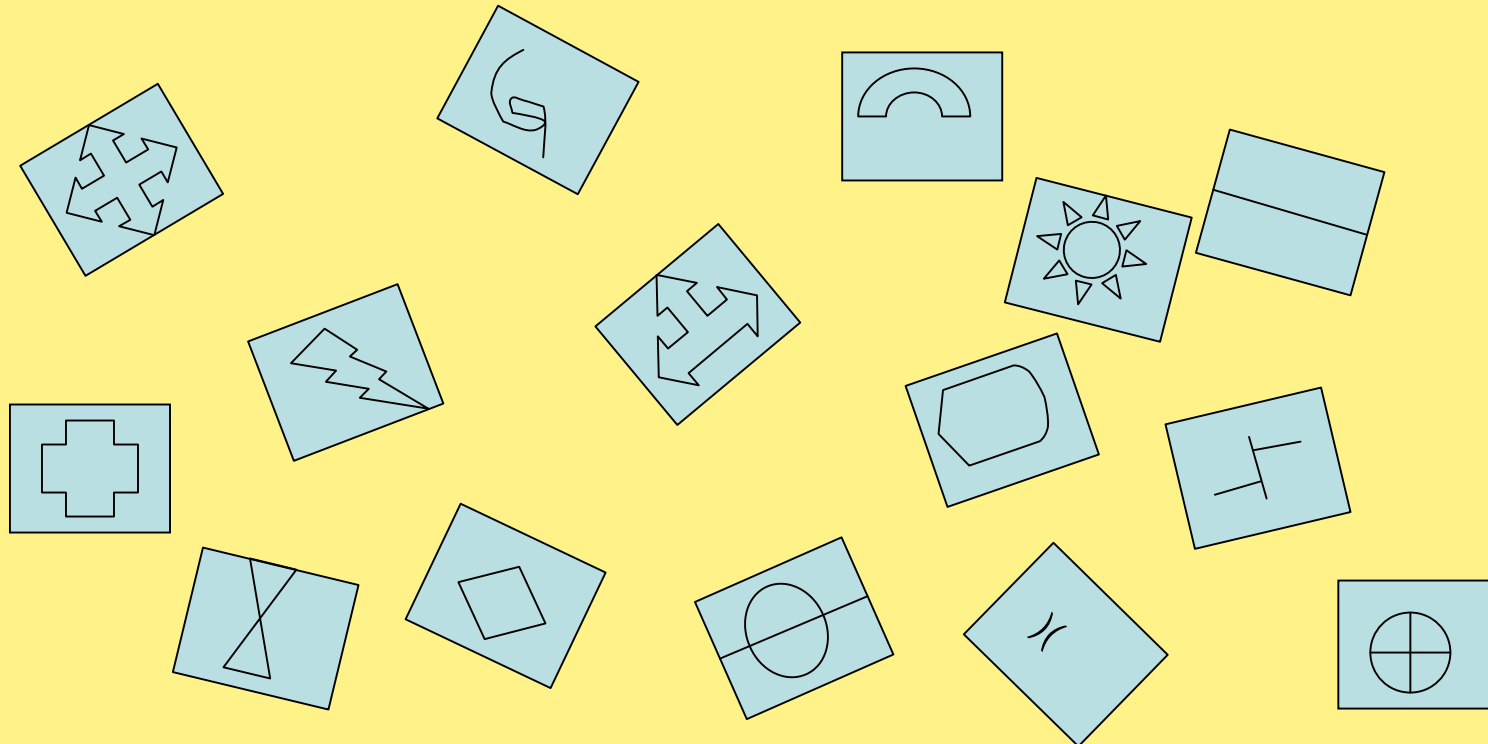
MI: Benton visual retention test



MI: 10/10 correct (in superior range of adult scores)

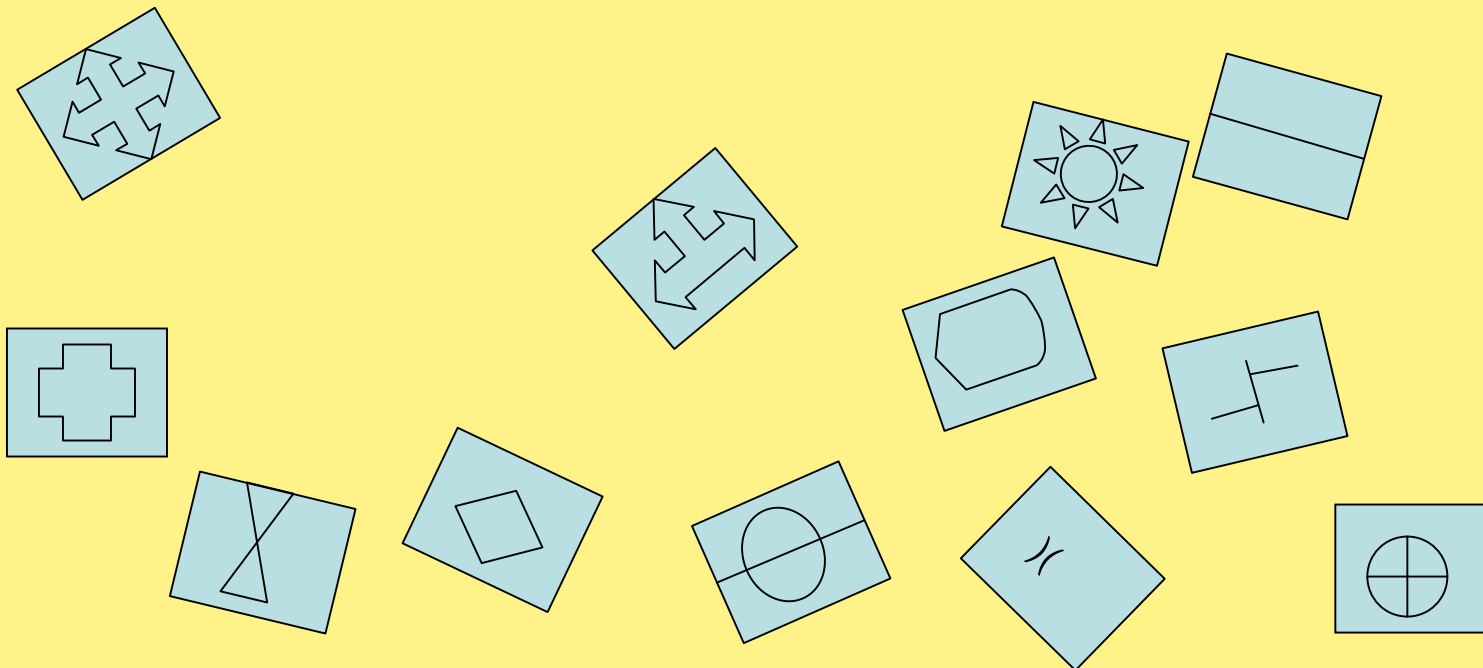
Visual sequential memory test

“See these?”



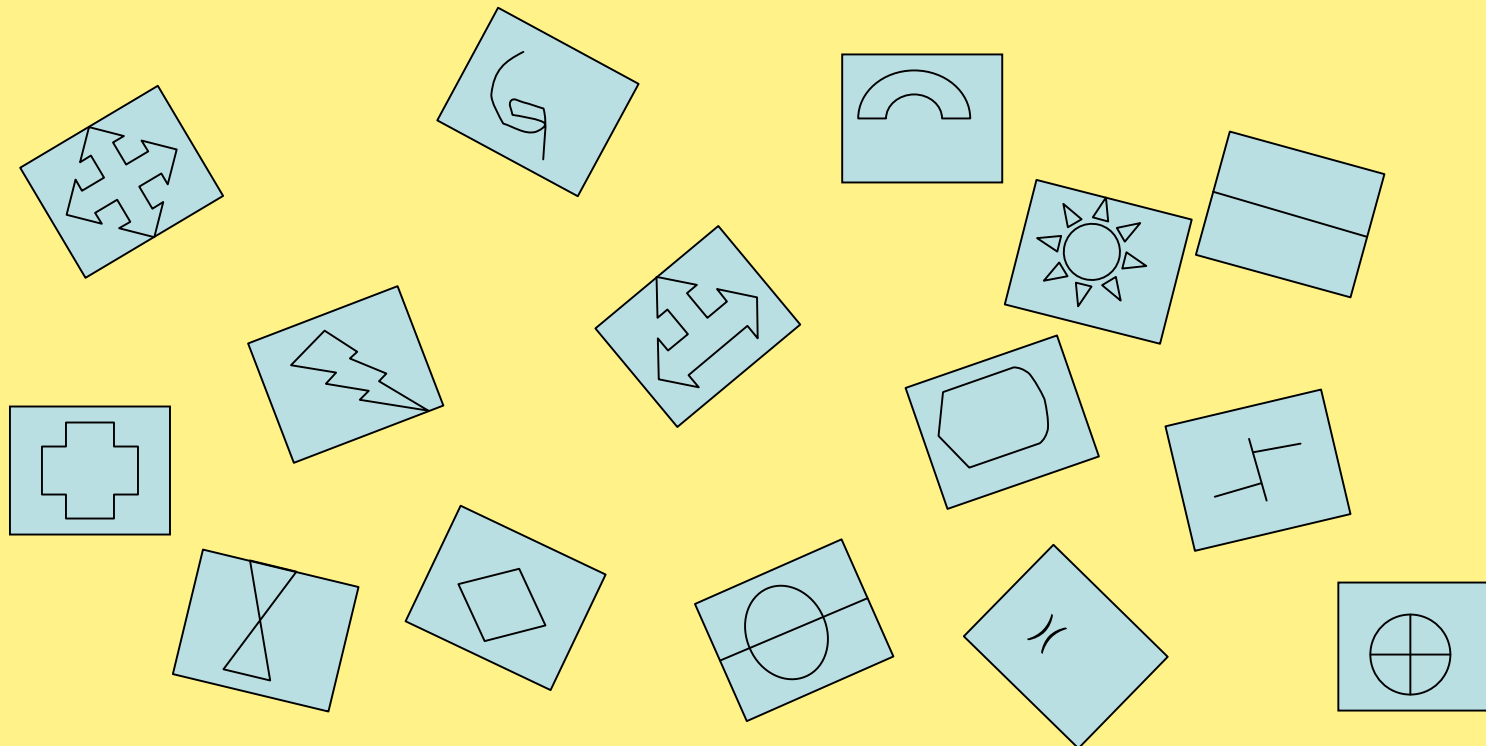
Visual sequential memory test

“See what I’ve made?”



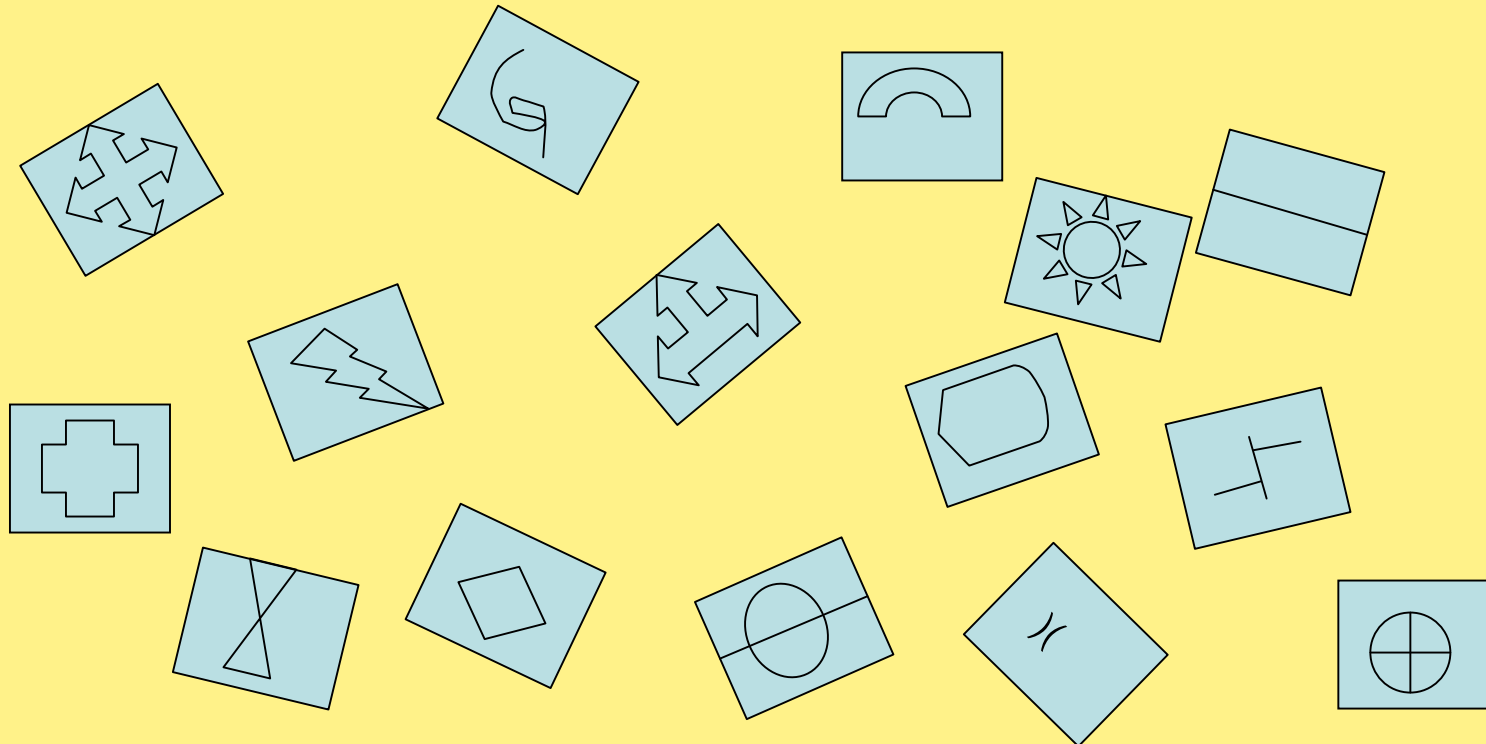
Visual sequential memory test

“Now you do it”



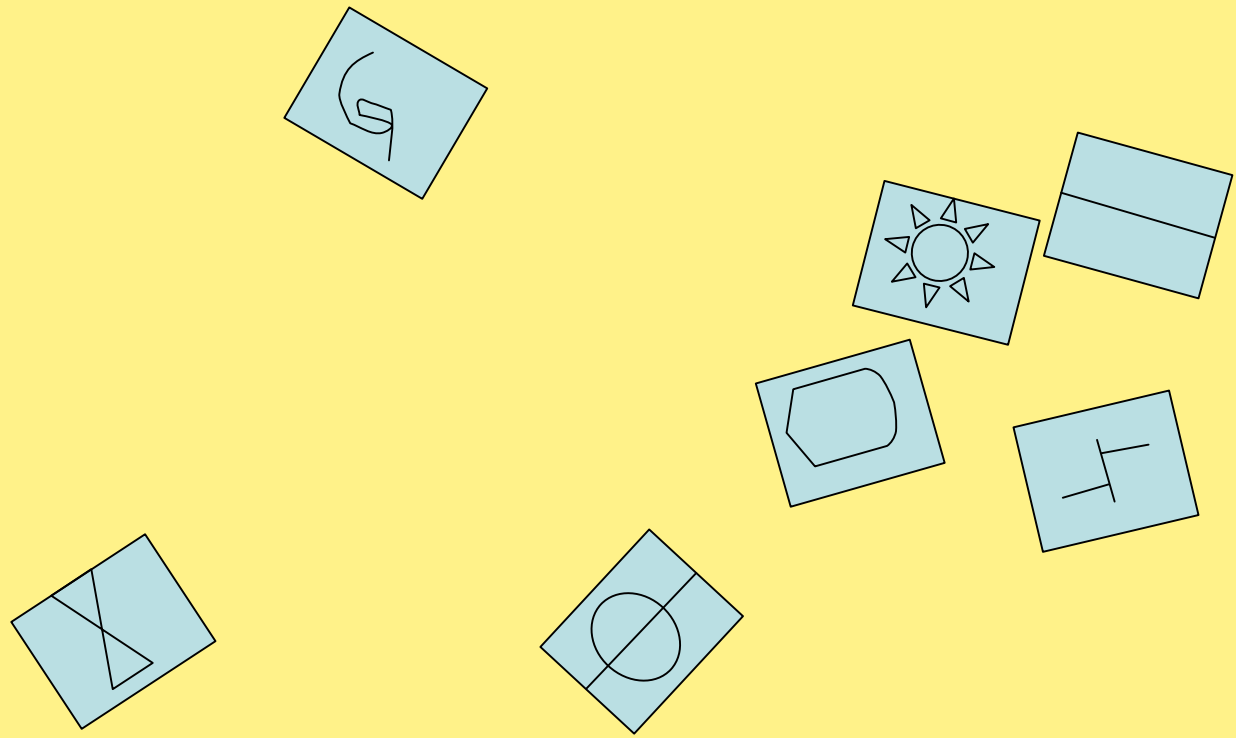
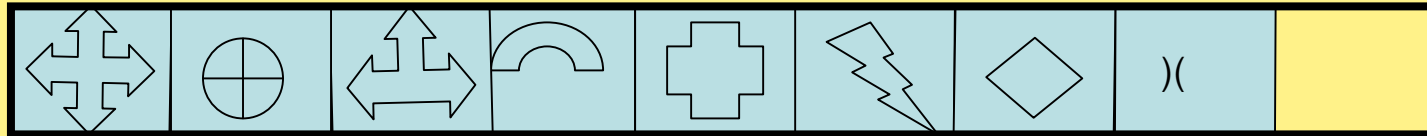
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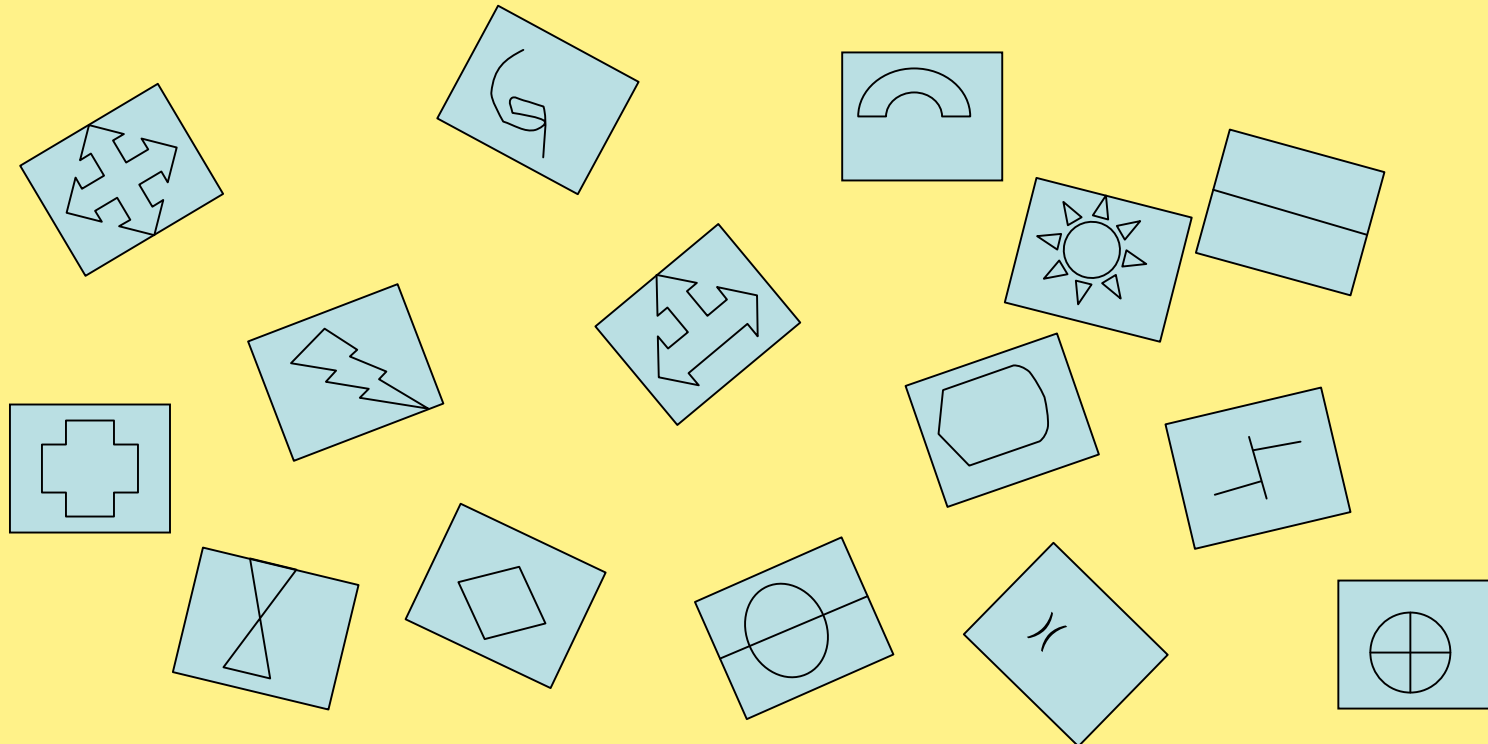
MI: Visual sequential memory test

“See what I’ve made?”



MI: Visual sequential memory test

“Now you do it”



MI: Visual sequential memory test

Score: 99th percentile

(i.e. a higher score than 99% of adults)

MI: Developmental surface dyslexia

Why has MI been unable to develop an adequate sight vocabulary?

Phonology? No

Visual memory impairment? No

Answer:

We haven't the faintest idea

Causes and treatments for these two types of difficulty in learning to read.

Causes and treatments for children's reading difficulties

Poor phonics (nonword reading) ability - that is, developmental phonological dyslexia.

- This is well understood now.
- Associated with phonological (speech processing) problems before reading, so identifiable before reading begins i.e. in kindergarten.
- Genetic influence - link to chromosome 6
- Treatable in kindergarten by phonemic (sound) training e.g. "I Spy" games, and later by systematic phonics programs, e.g. the SWELL program from Macquarie, or THRASS, or Jolly Phonics, or the Spalding program.

Causes and treatments for children's reading difficulties

Poor sight vocabulary - that is, developmental surface dyslexia.

- Not well understood.
- Cause(s) not known (remember MI?).
- Genetic influence - possibly chromosome 15?
- Various effective ways of treating it e.g. by whole-word recognition training using visual mnemonics.

Treatment of a case of developmental
spelling difficulty (developmental
dysgraphia)

(Ruth Brunsdon, PhD in progress)

Case MC

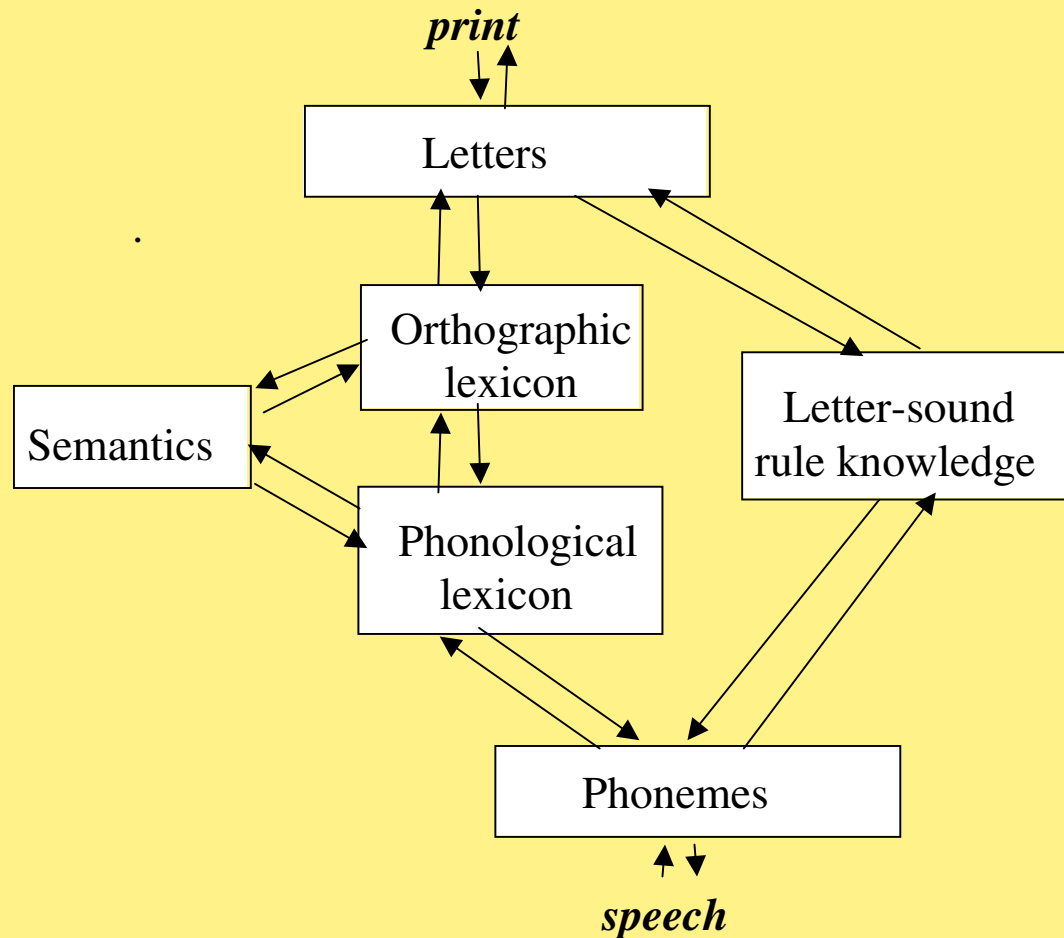
12 years old

FSIQ 112

Poor reading and poor spelling

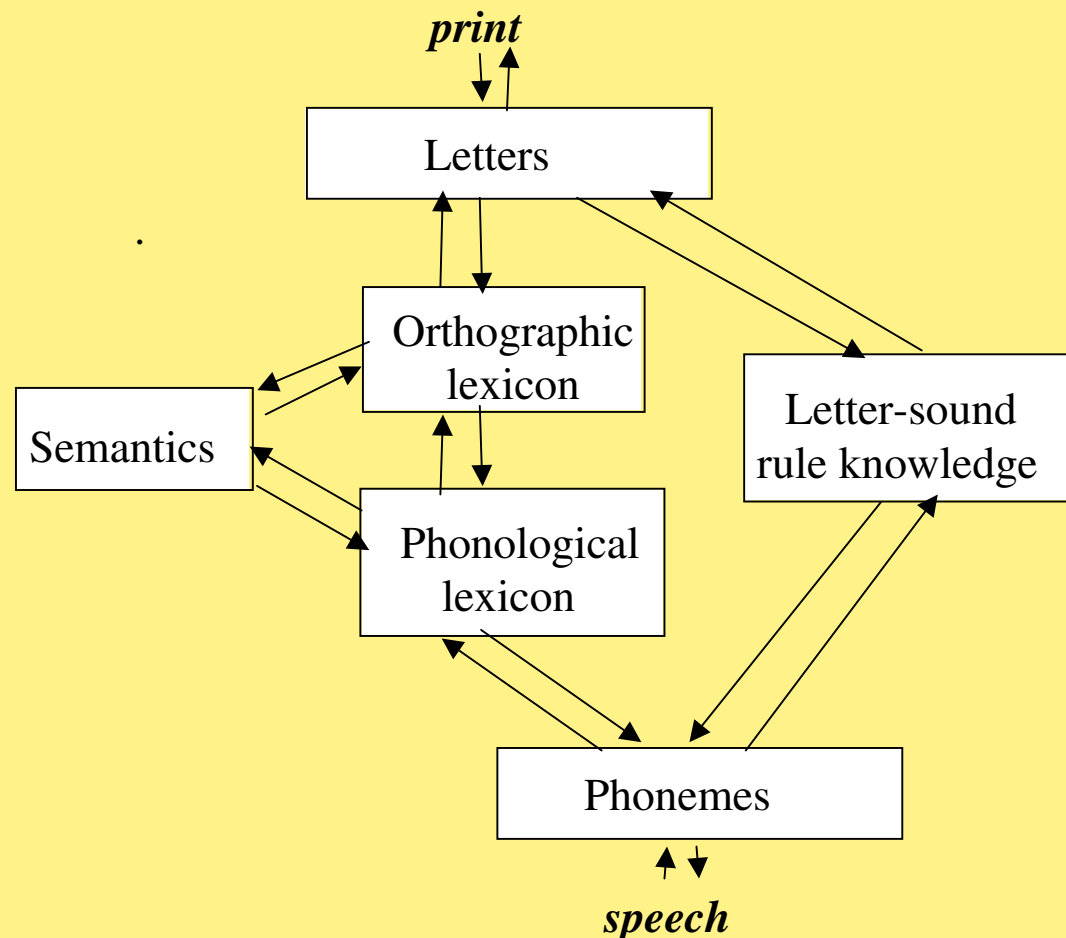
First we need a model that applies to spelling as well as to reading

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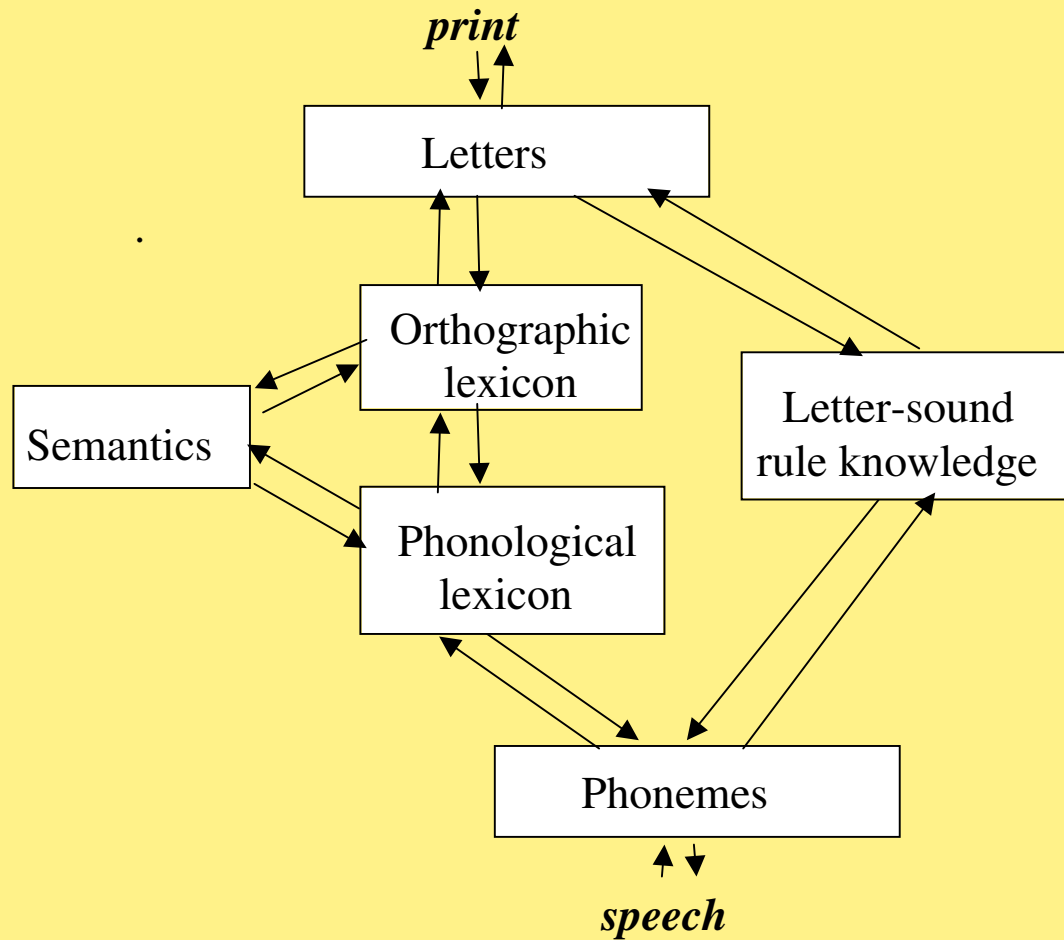


First we need a model that applies to spelling as well as to reading.

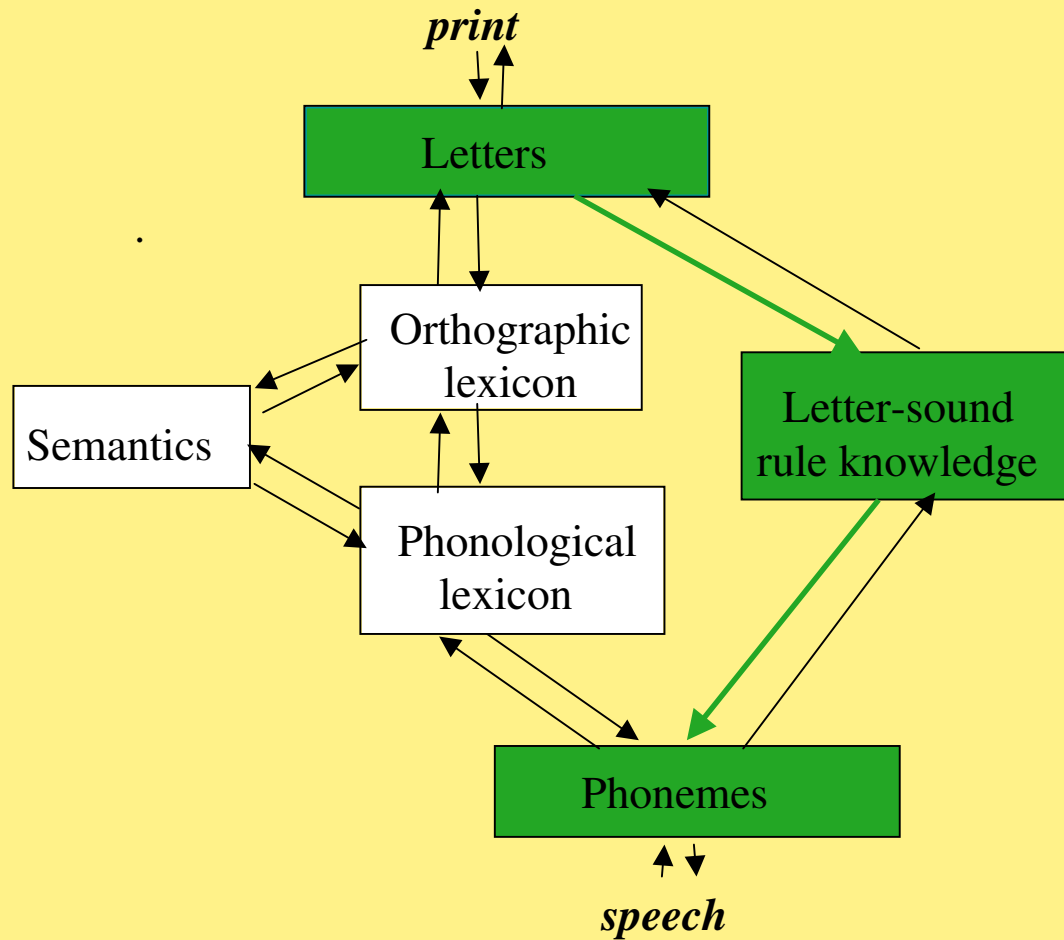
The assessment is based on this model.



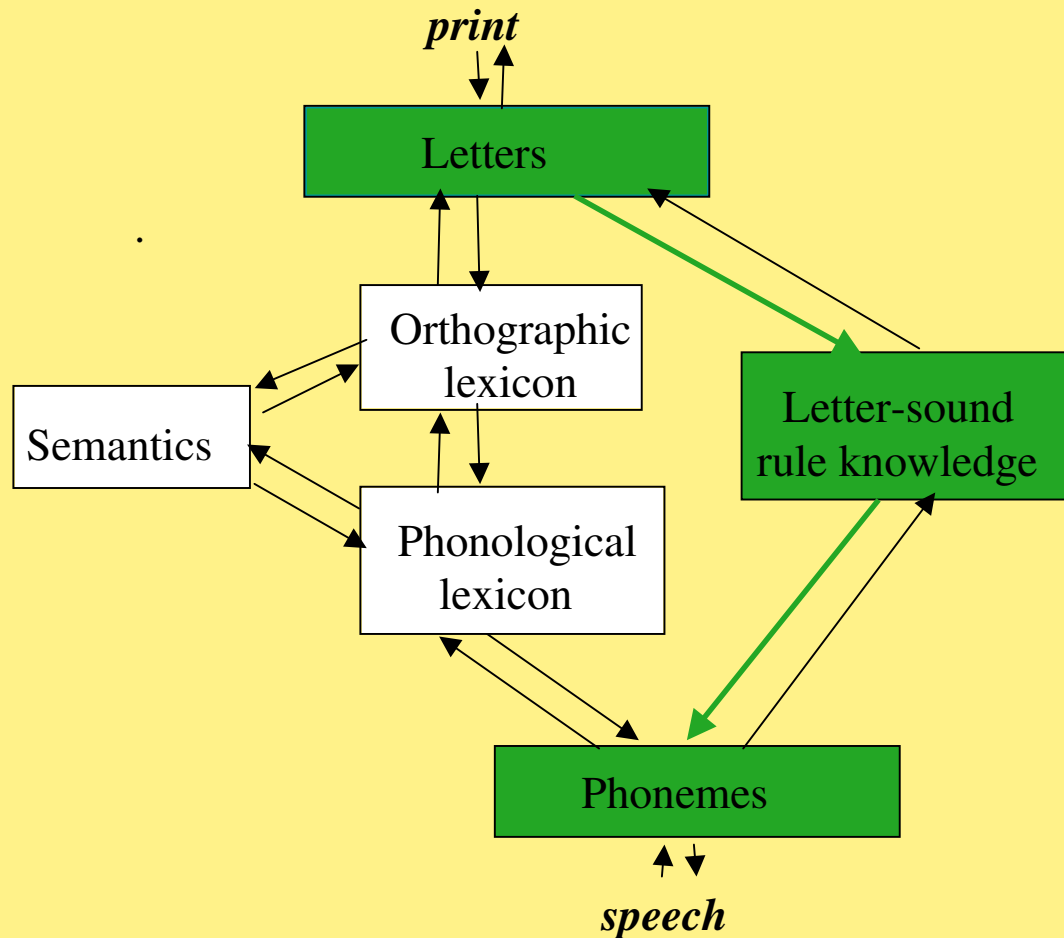
Nonwords read aloud well, so



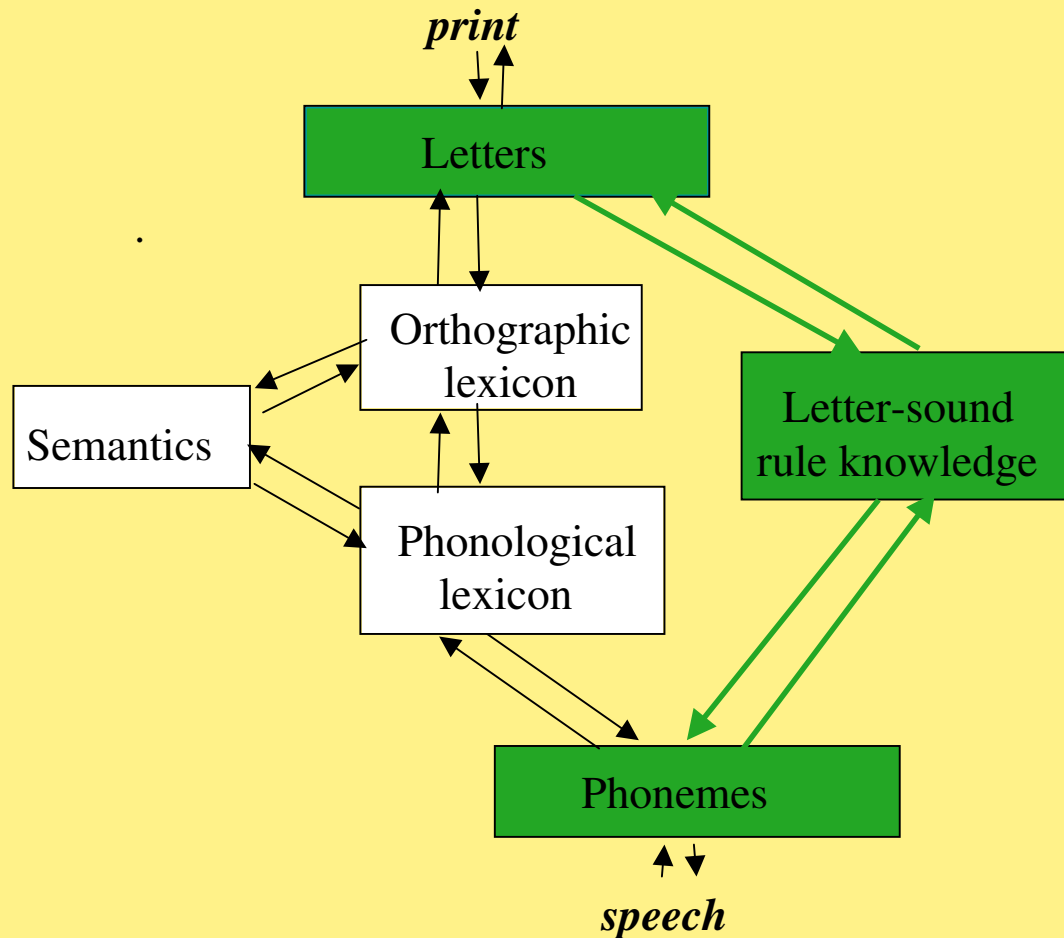
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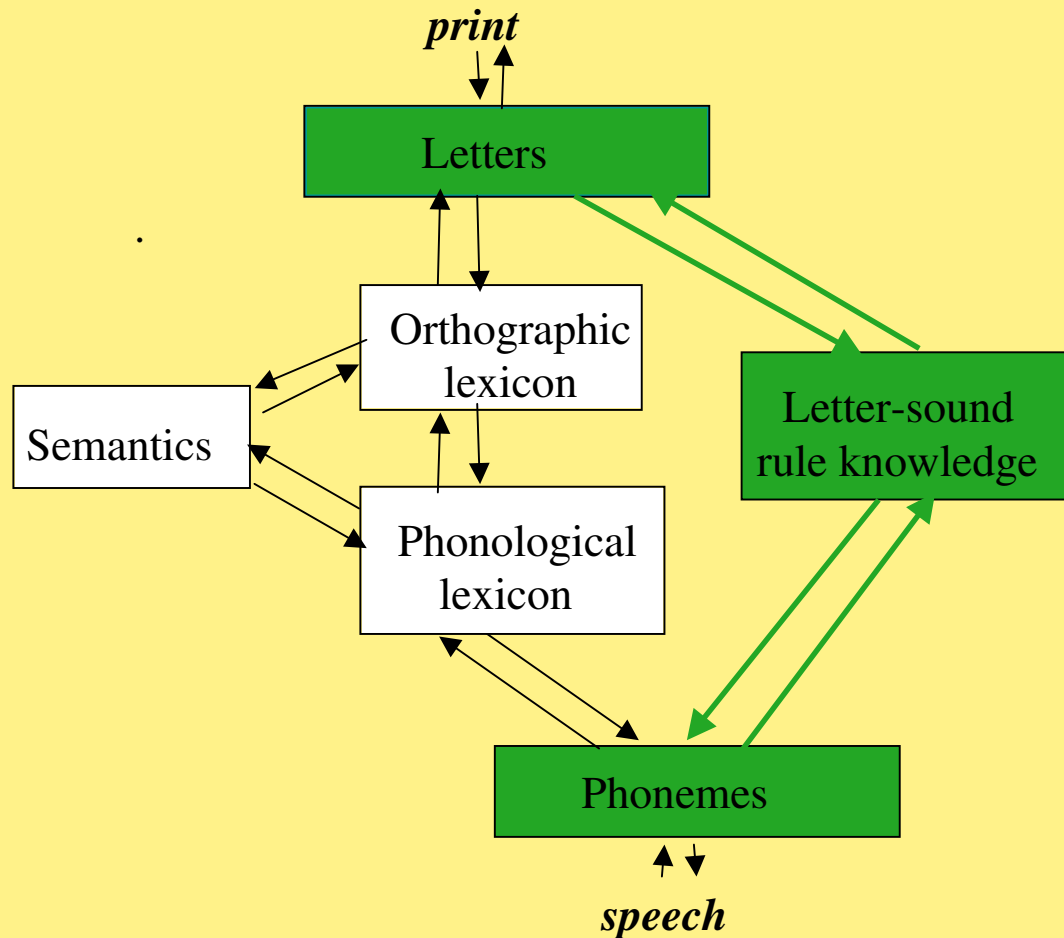
Nonwords spelled to dictation well, so



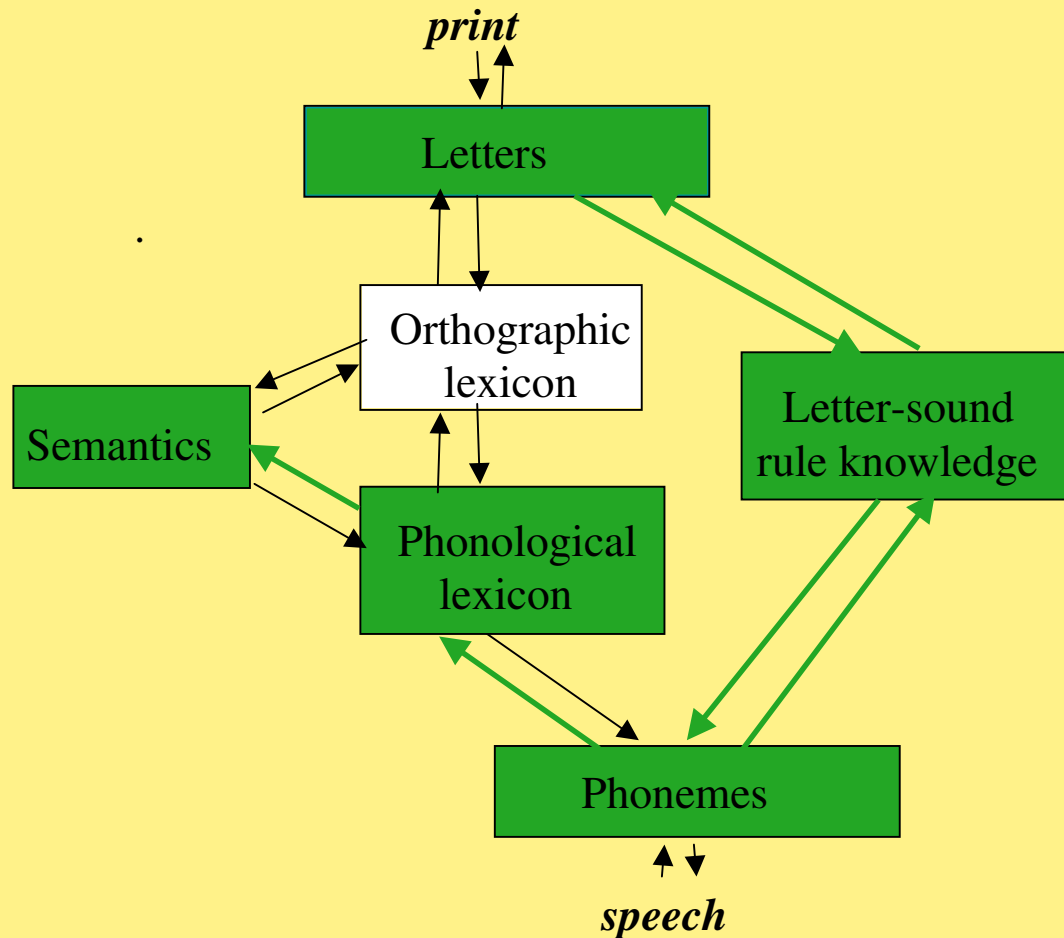
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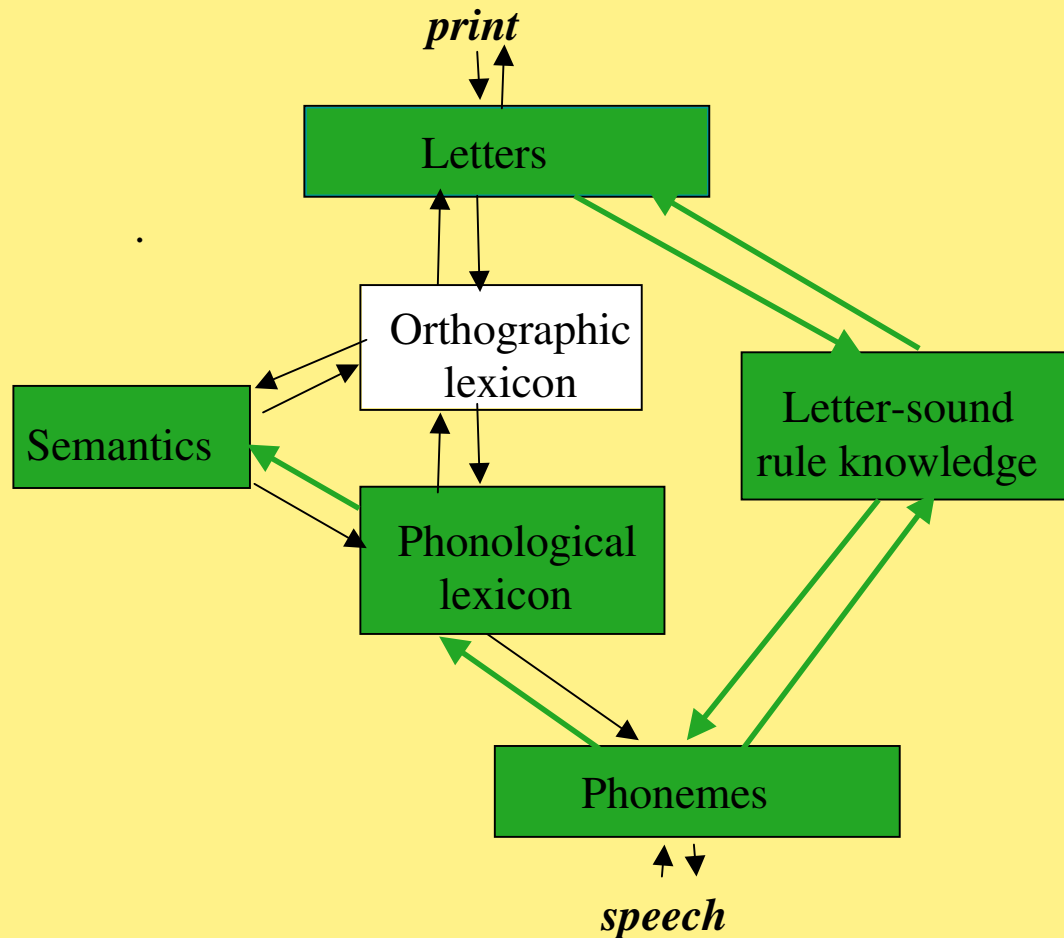
Intact comprehension of spoken language, so



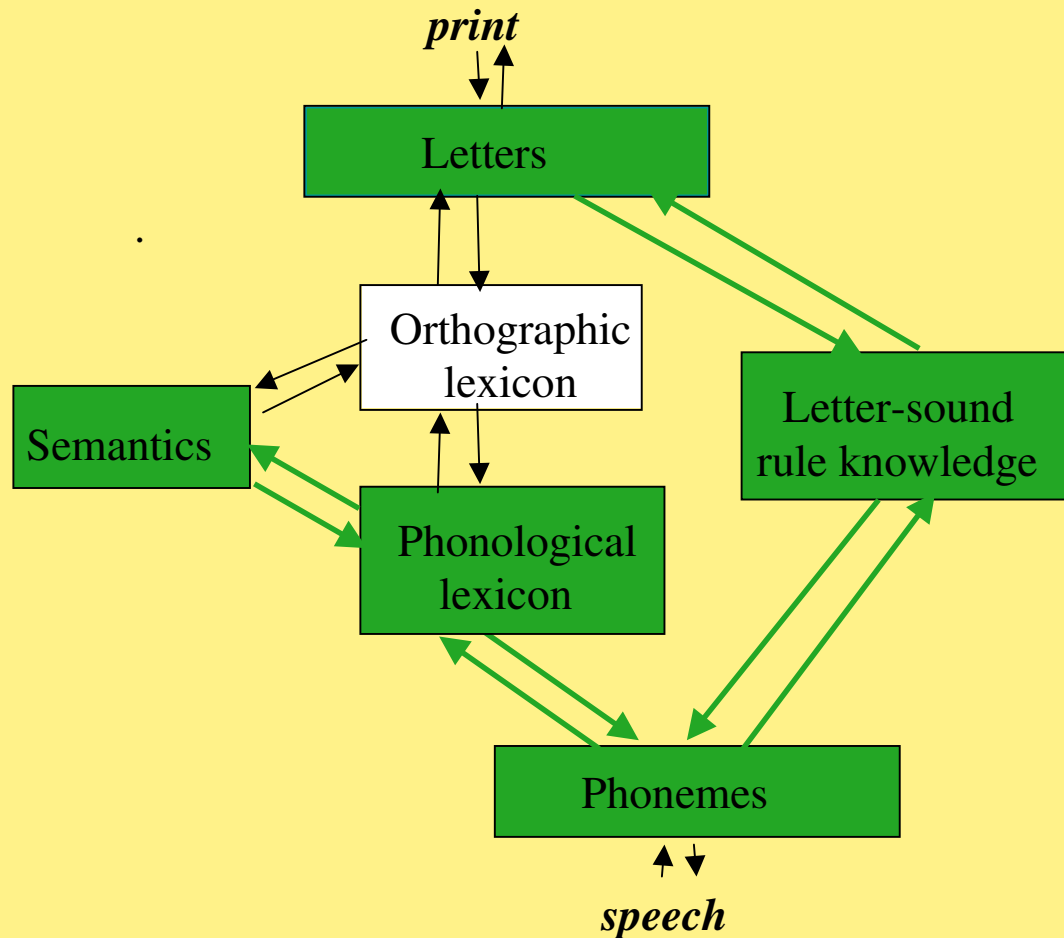
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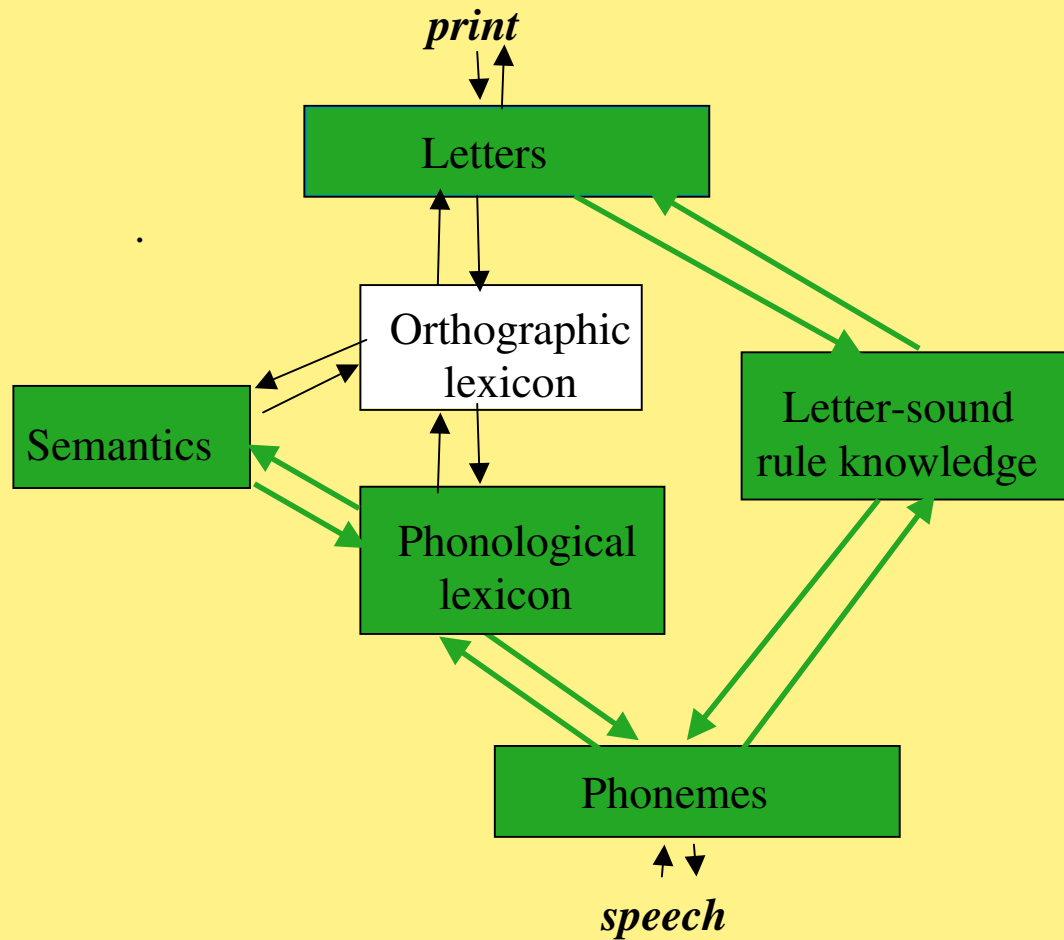
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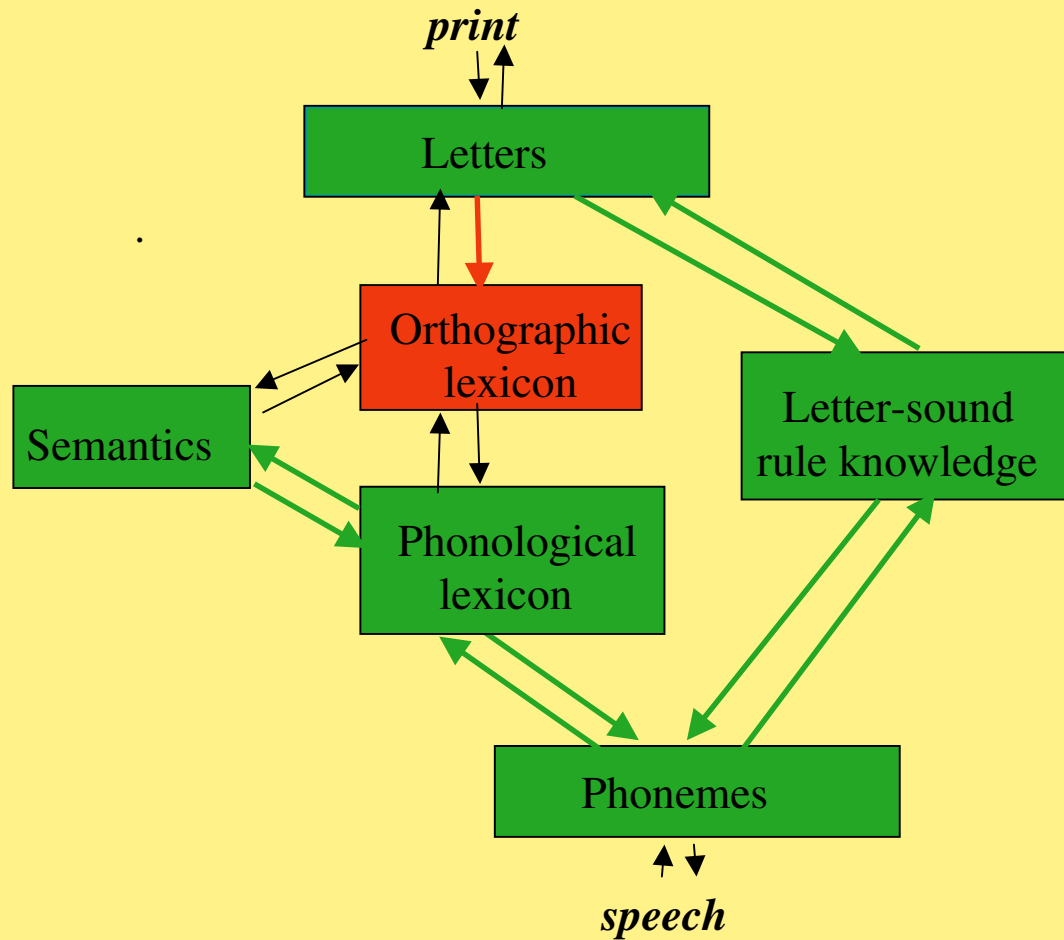
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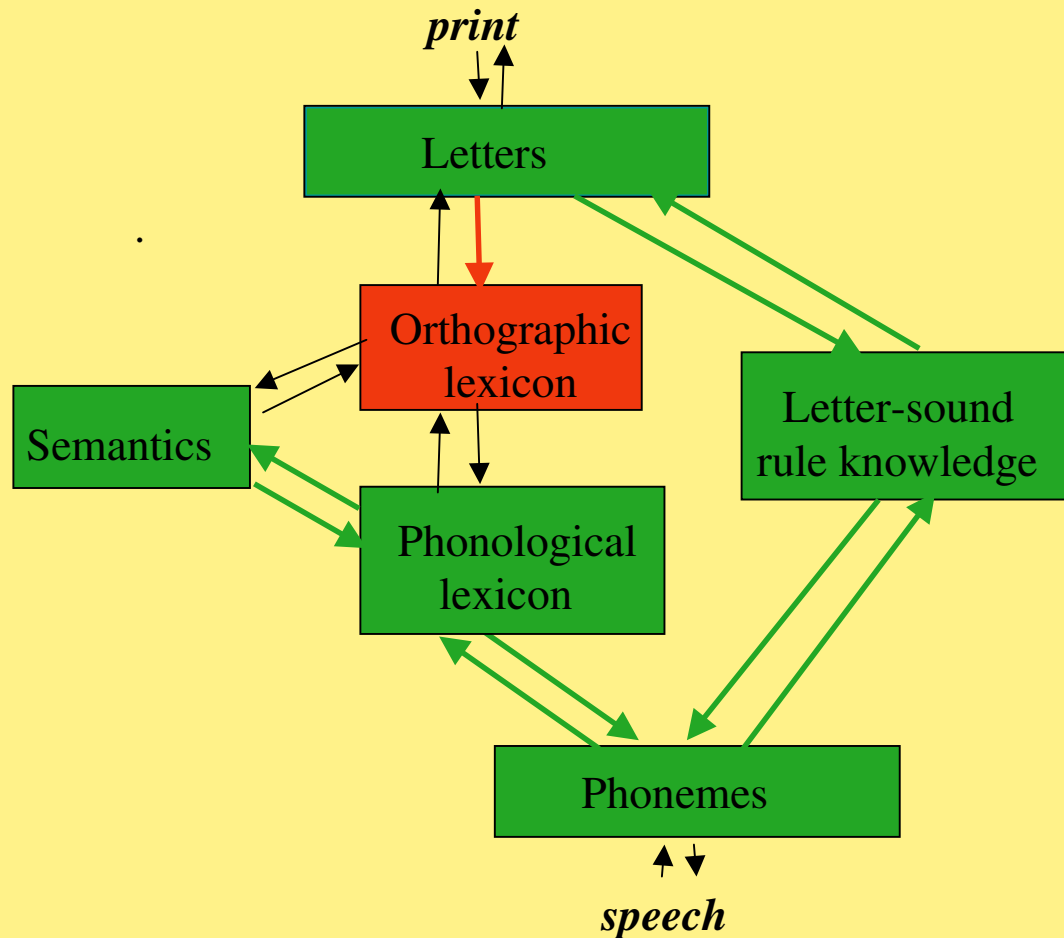
Poor visual lexical decision, so



Poor visual lexical decision, so

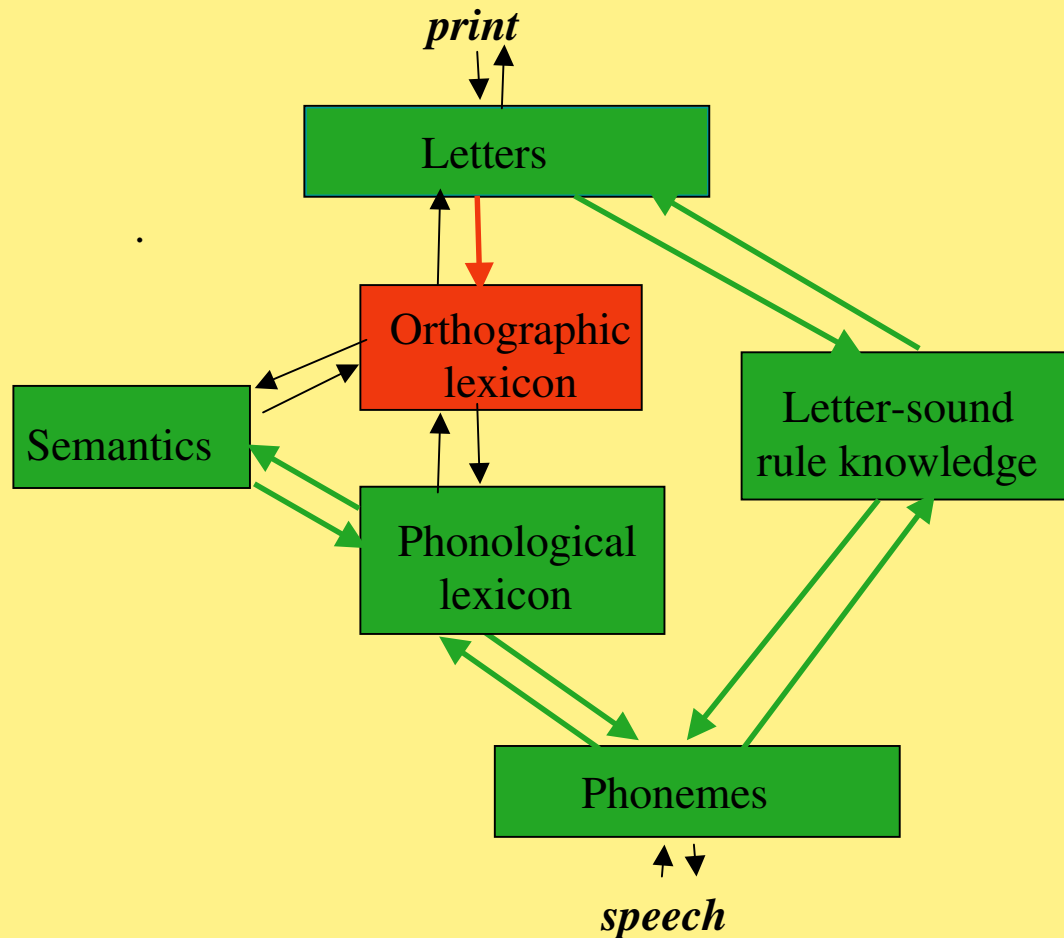


Is it the arrow or the box? If the box, spelling of irregular words like YACHT will be normal.



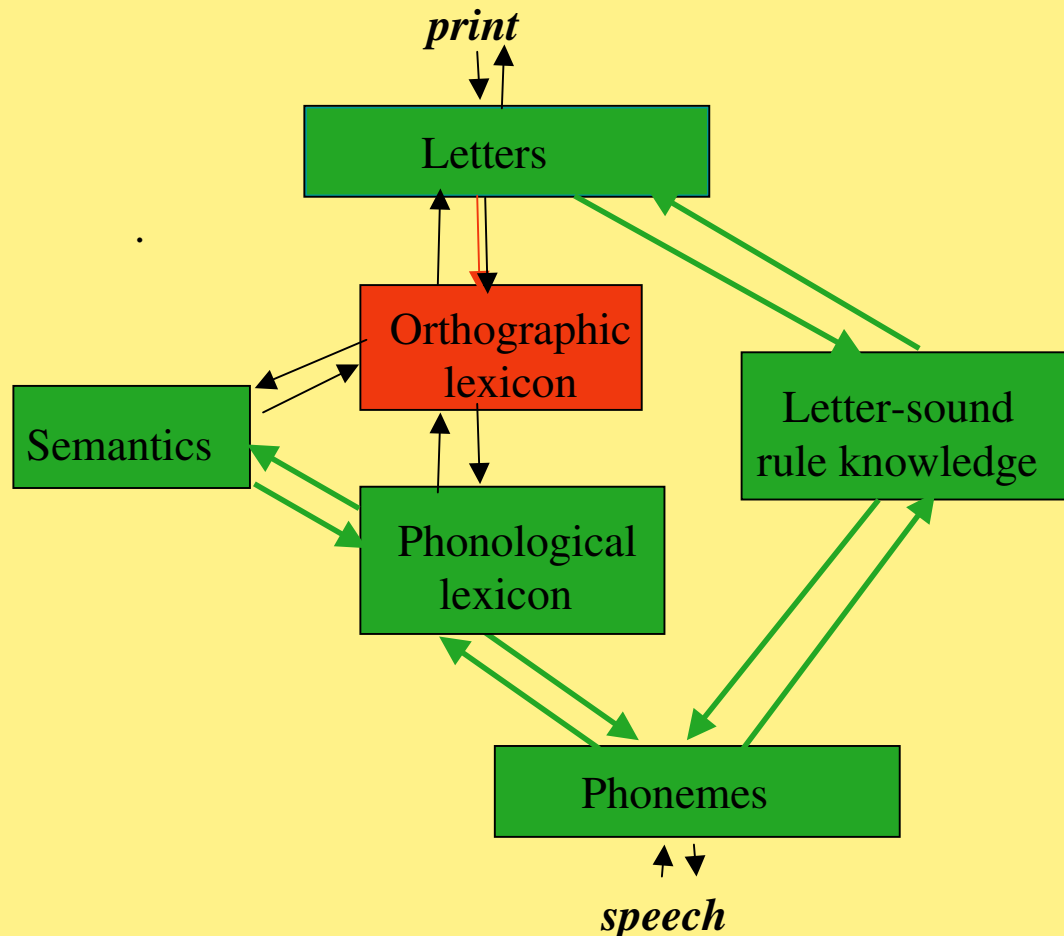
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This was impaired, so



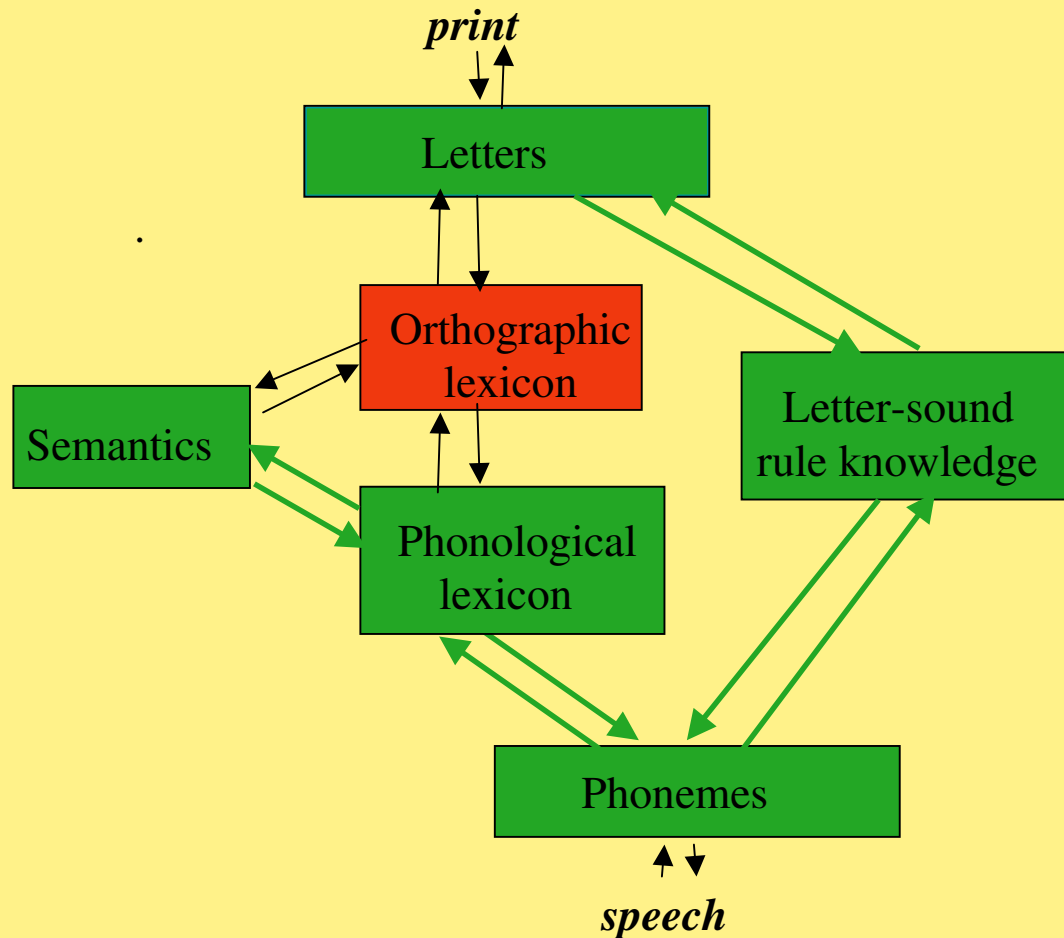
Is it the arrow or the box? If the box, spelling of irregular words like YACHT will be normal.

This was impaired, so it's the box



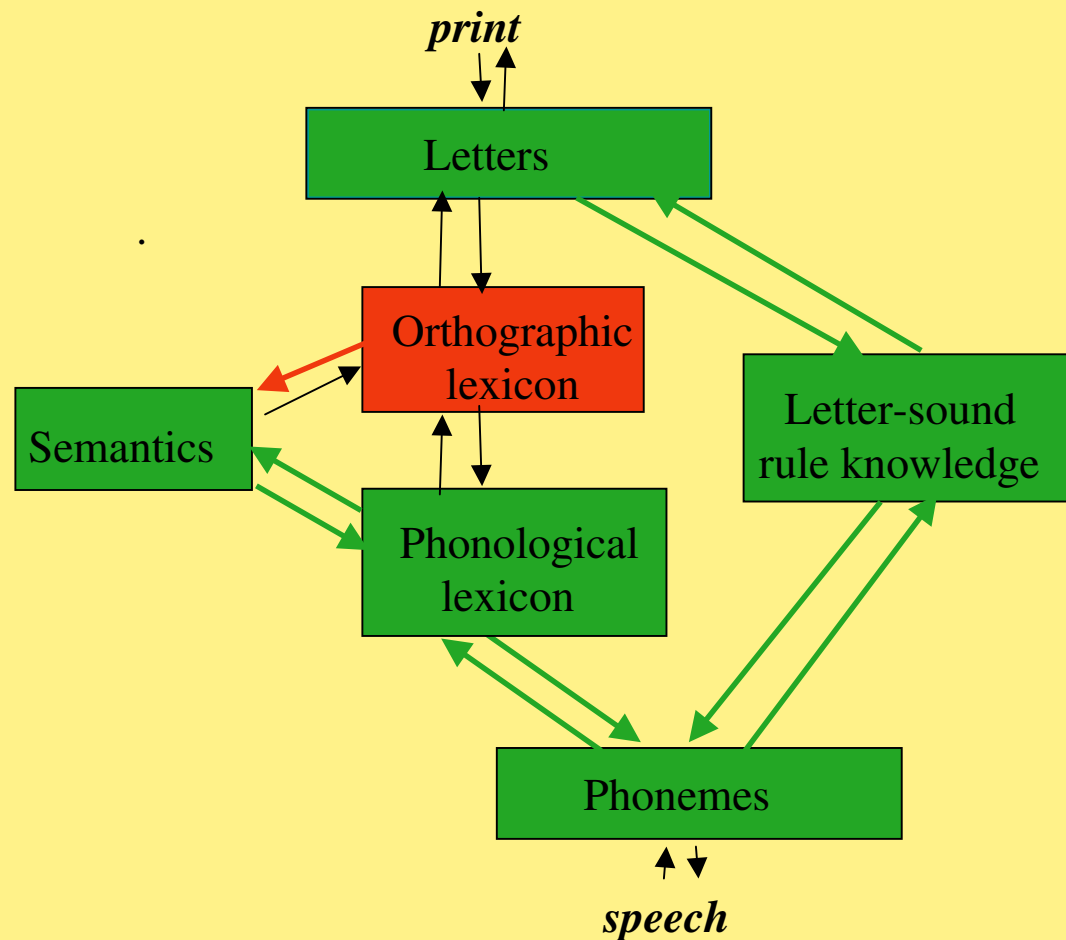
Defining printed irregular homophones

queue -> “the actor needed a cue”, so . . .

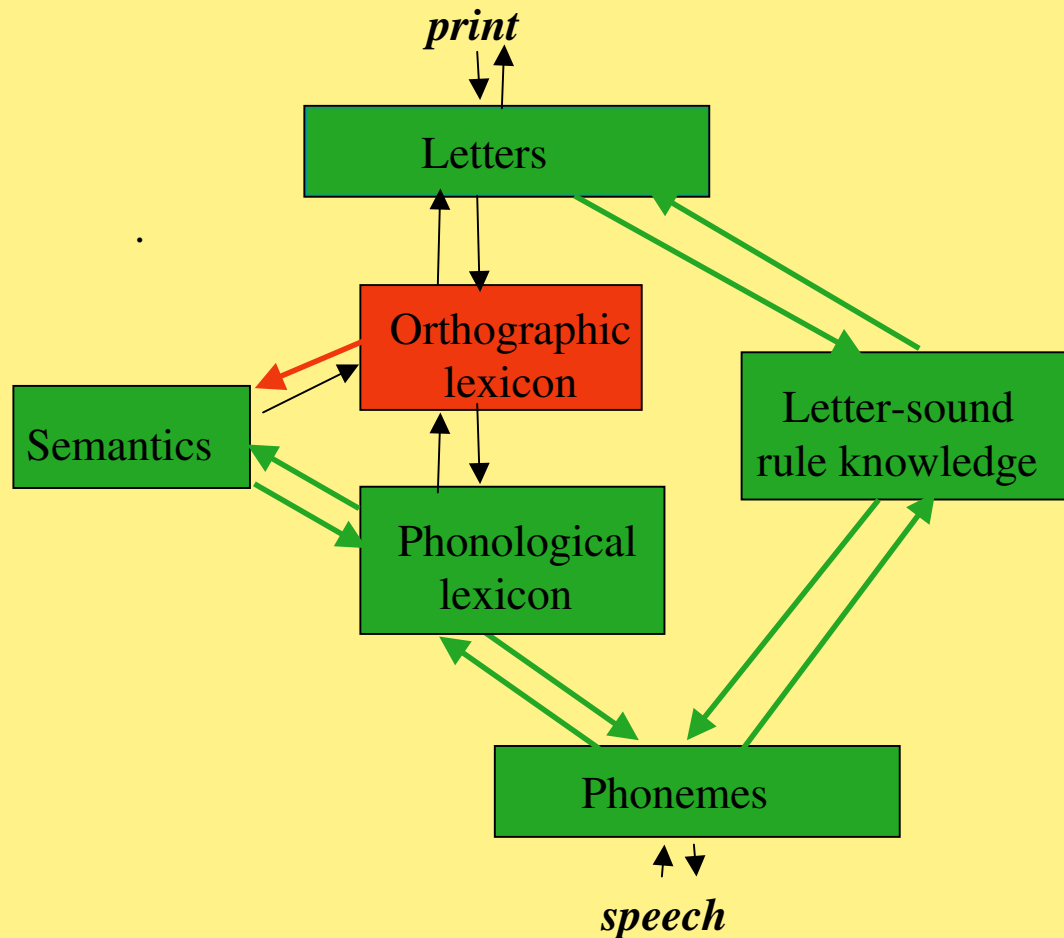


Defining printed irregular homophones

queue -> “the actor needed a cue”, so . . .

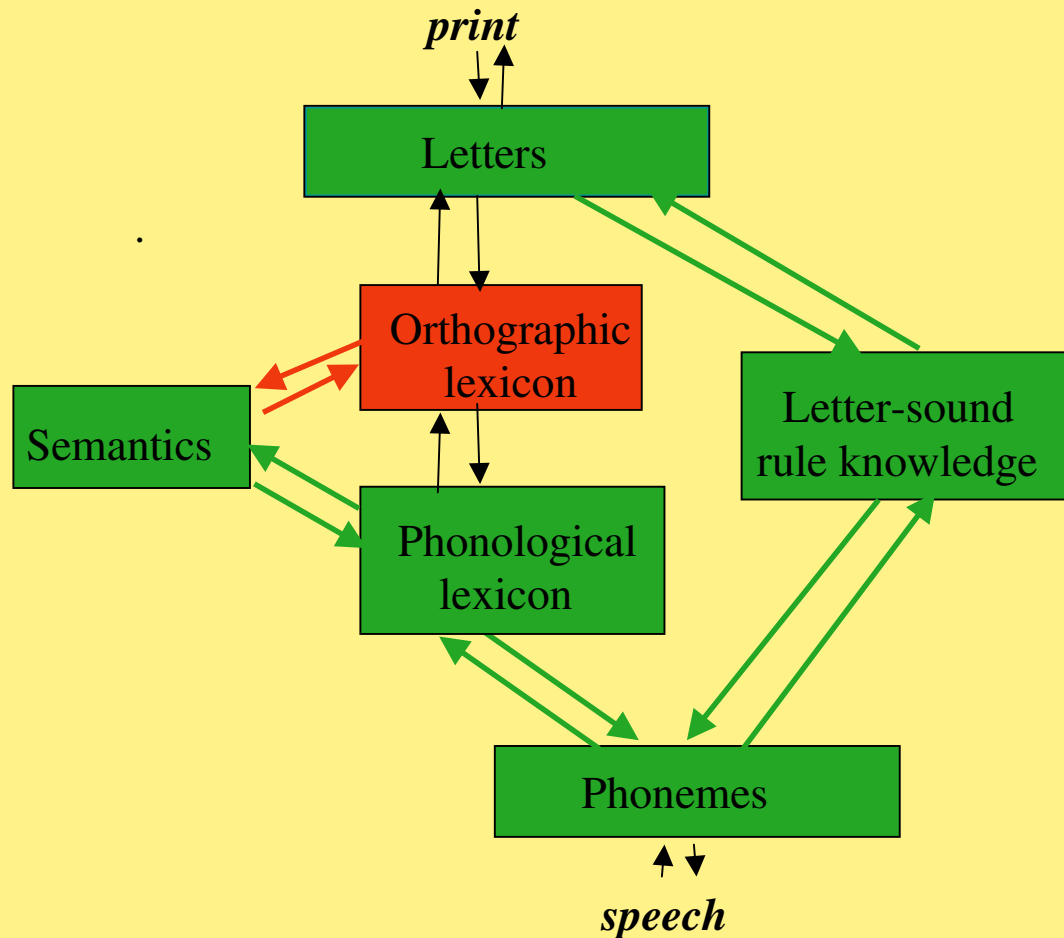


“Bare . . . The desert landscape was bare” -> bear.

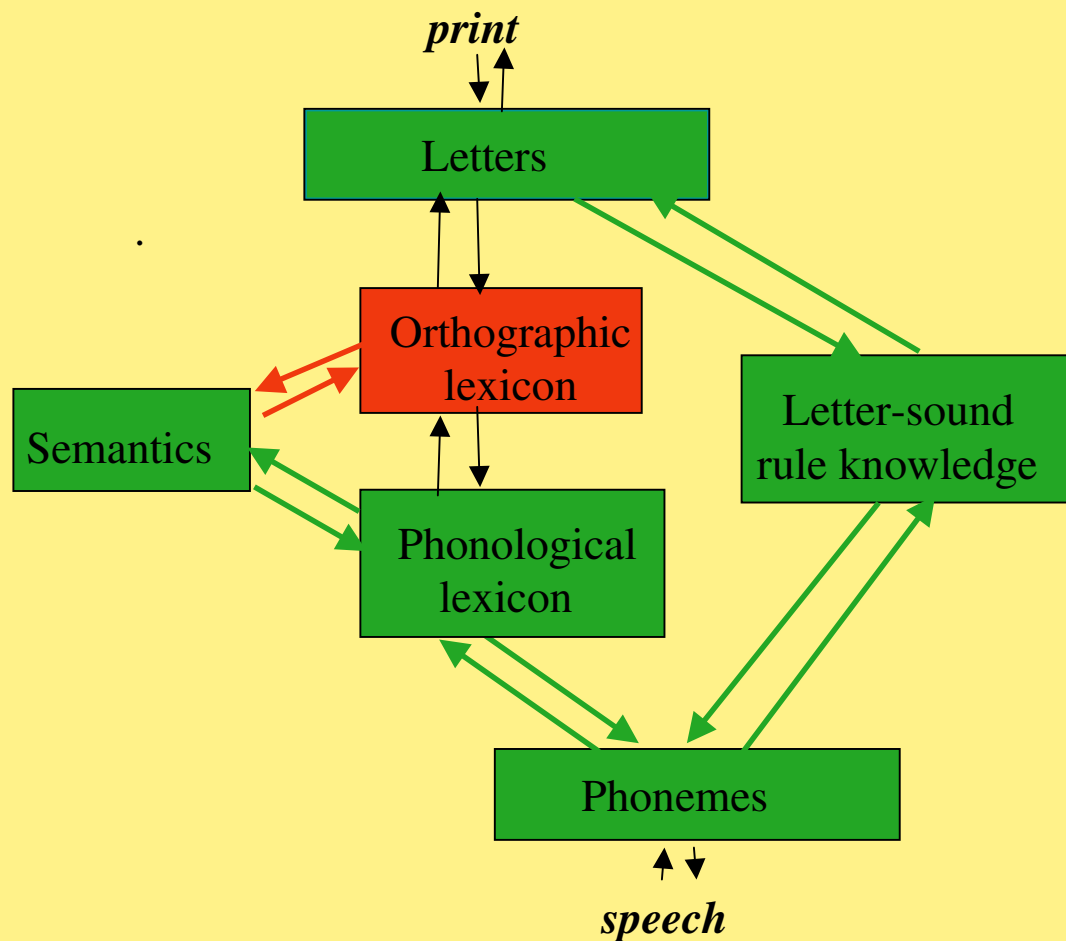


“Bare . . . The desert landscape was bare” -> bear.

So



The complete assessment: three orthographic impairments



Now for the treatment . . .

And we design the treatment regime so that we can determine whether or not the treatment actually works

222 irregular words chosen and divided into 3 equal sets

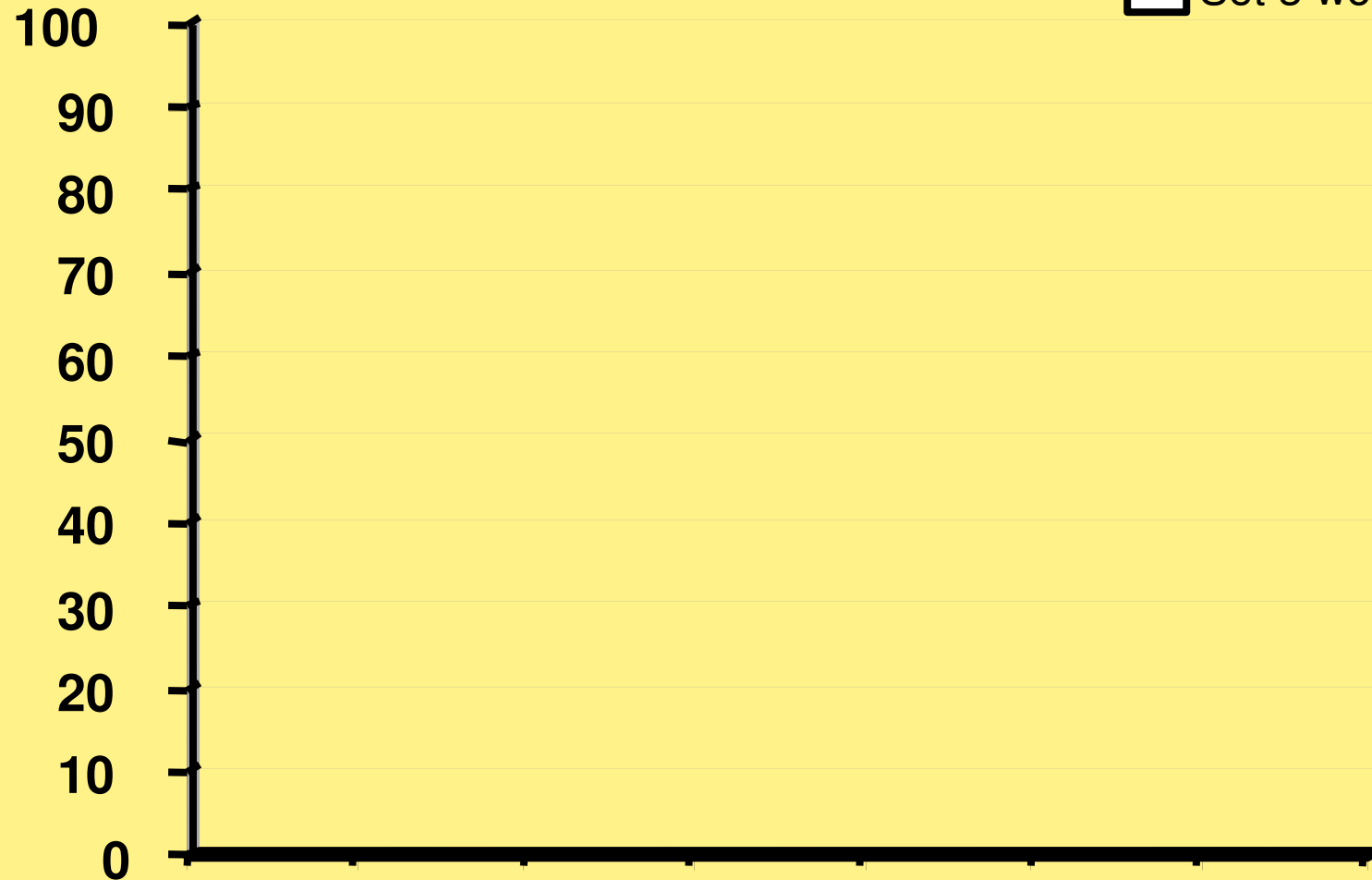
For set 1:

1. MC shown a flash card with an irregular word on it.
2. He copied the word.
3. The word was taken away and he wrote it 10 seconds later
4. Then he wrote it to dictation
5. His parents gave him practice at home in writing the words to dictation

Set 2 and set 3 words acted initially as controls

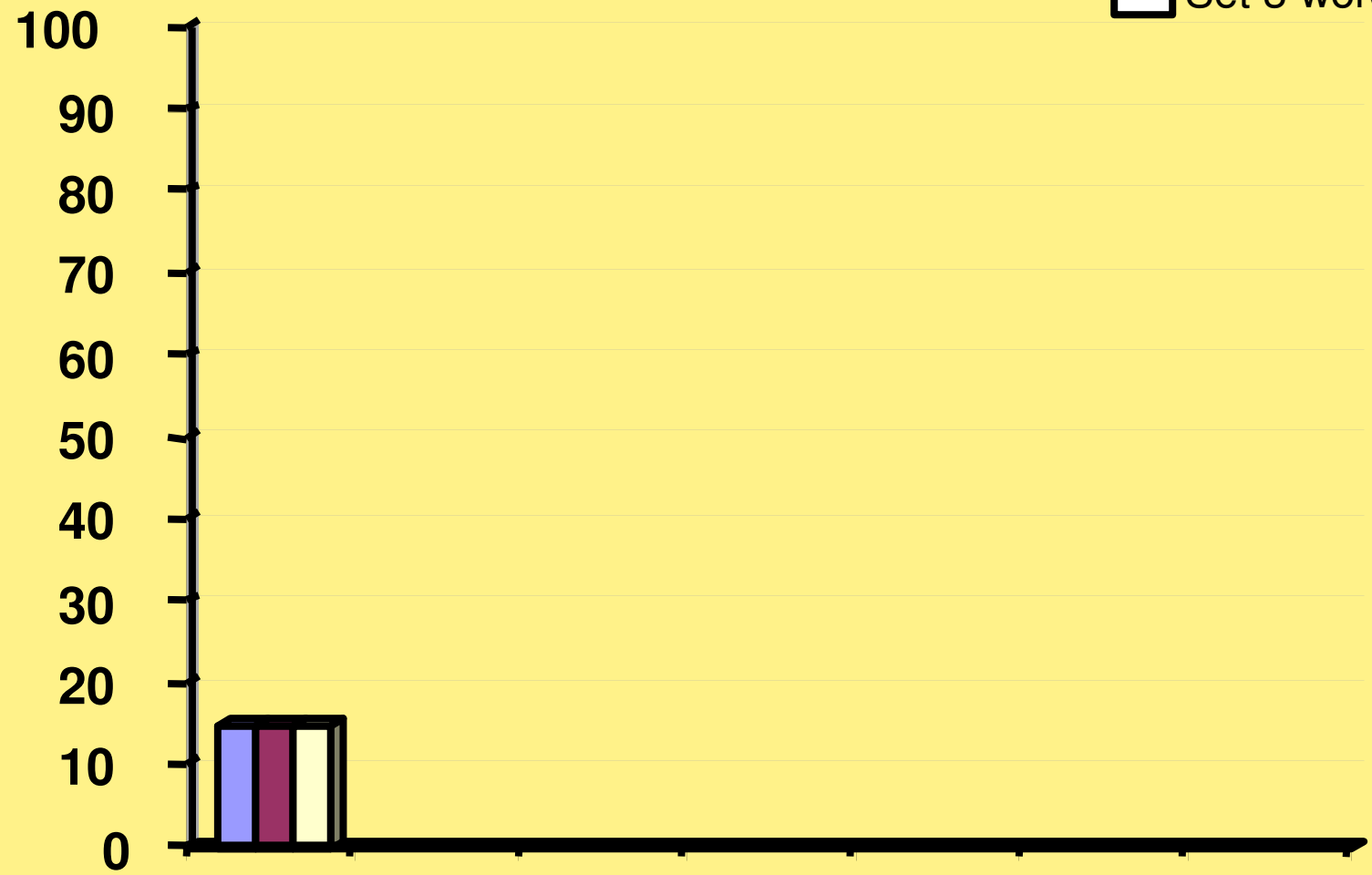
Firstly, pretest spelling of all words

- Set 1 words
- Set 2 words
- Set 3 words



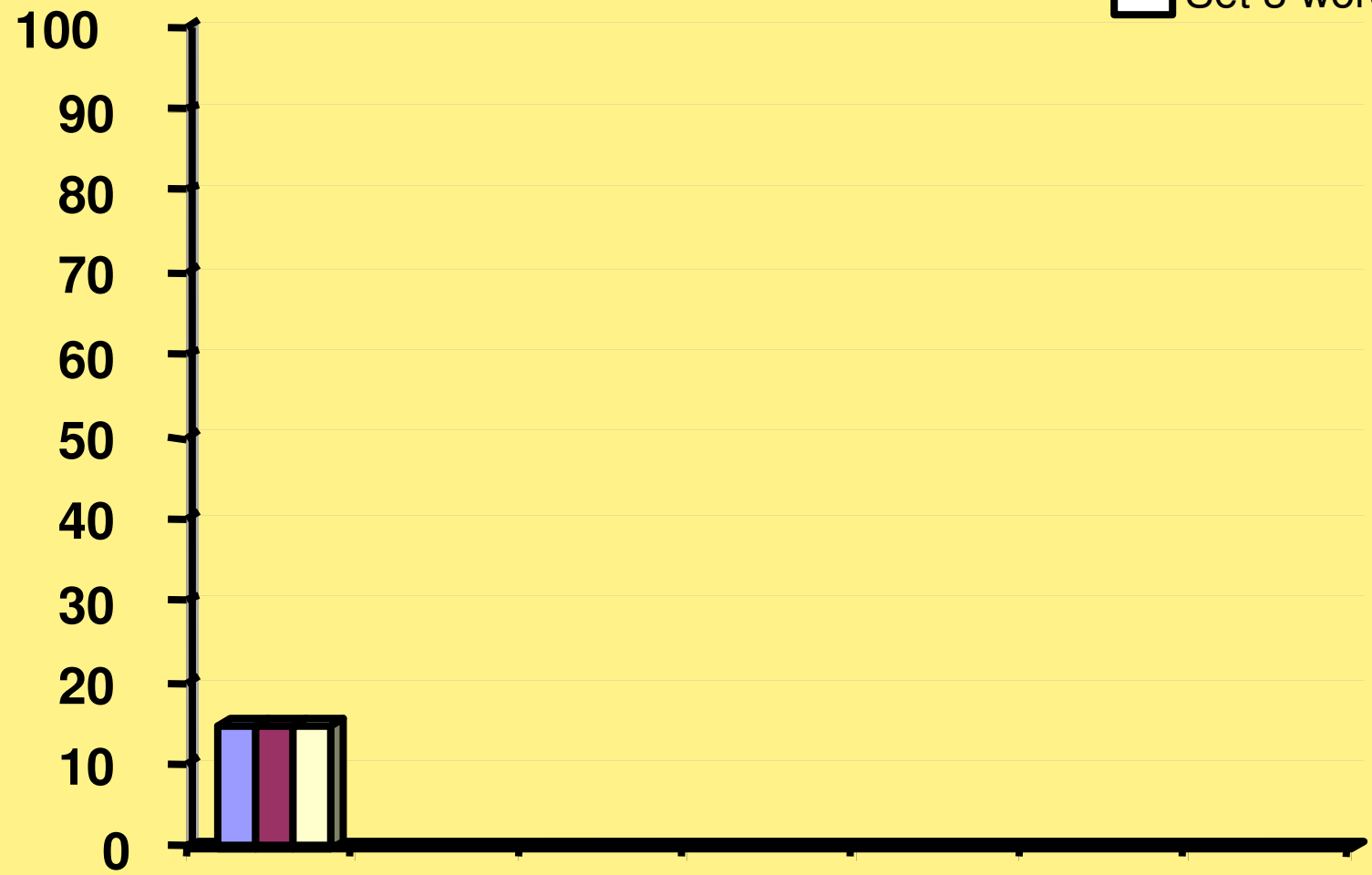
The three sets are equally difficult

- Set 1 words
- Set 2 words
- Set 3 words



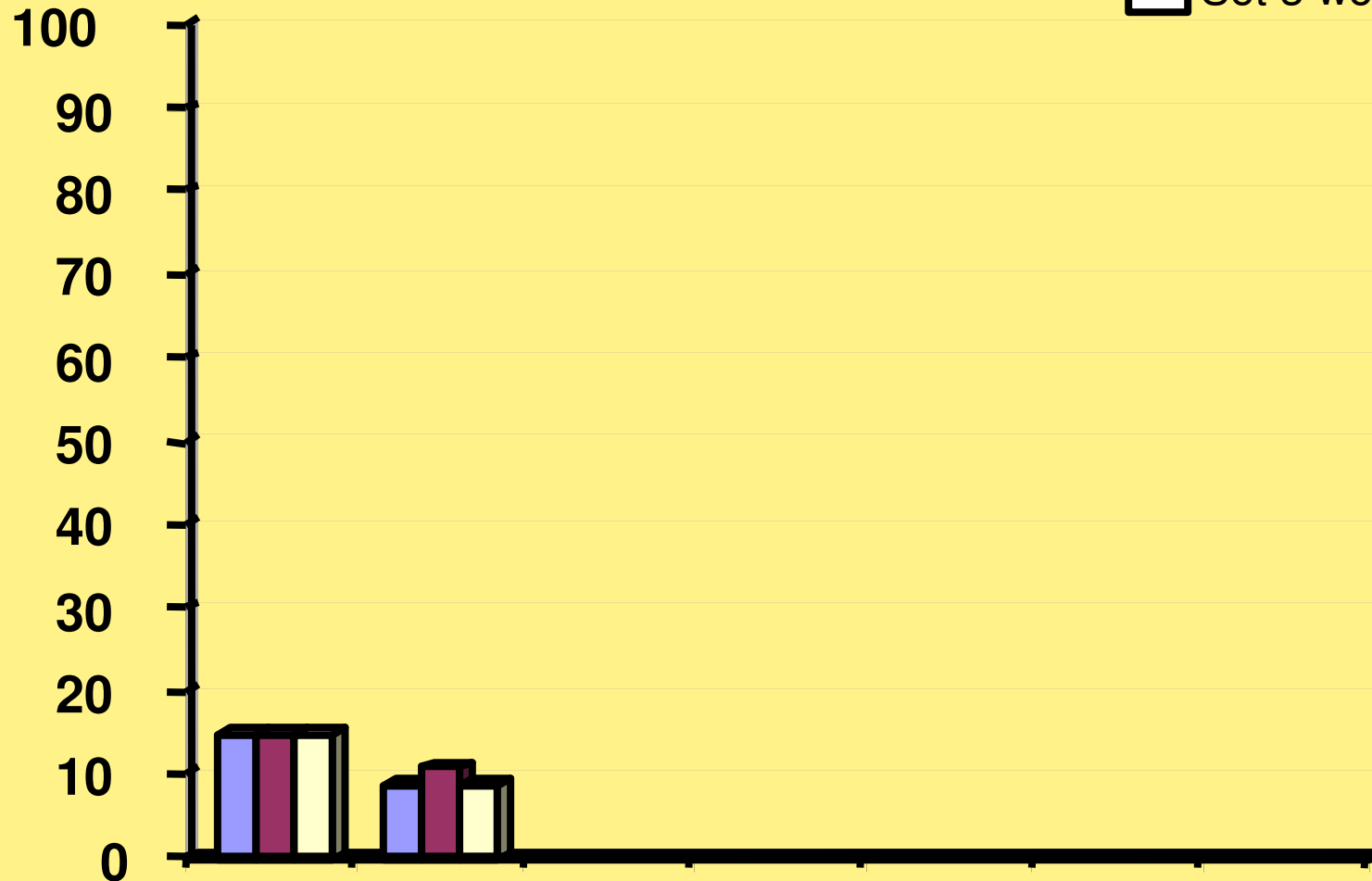
The three sets are equally difficult

- Set 1 words
- Set 2 words
- Set 3 words



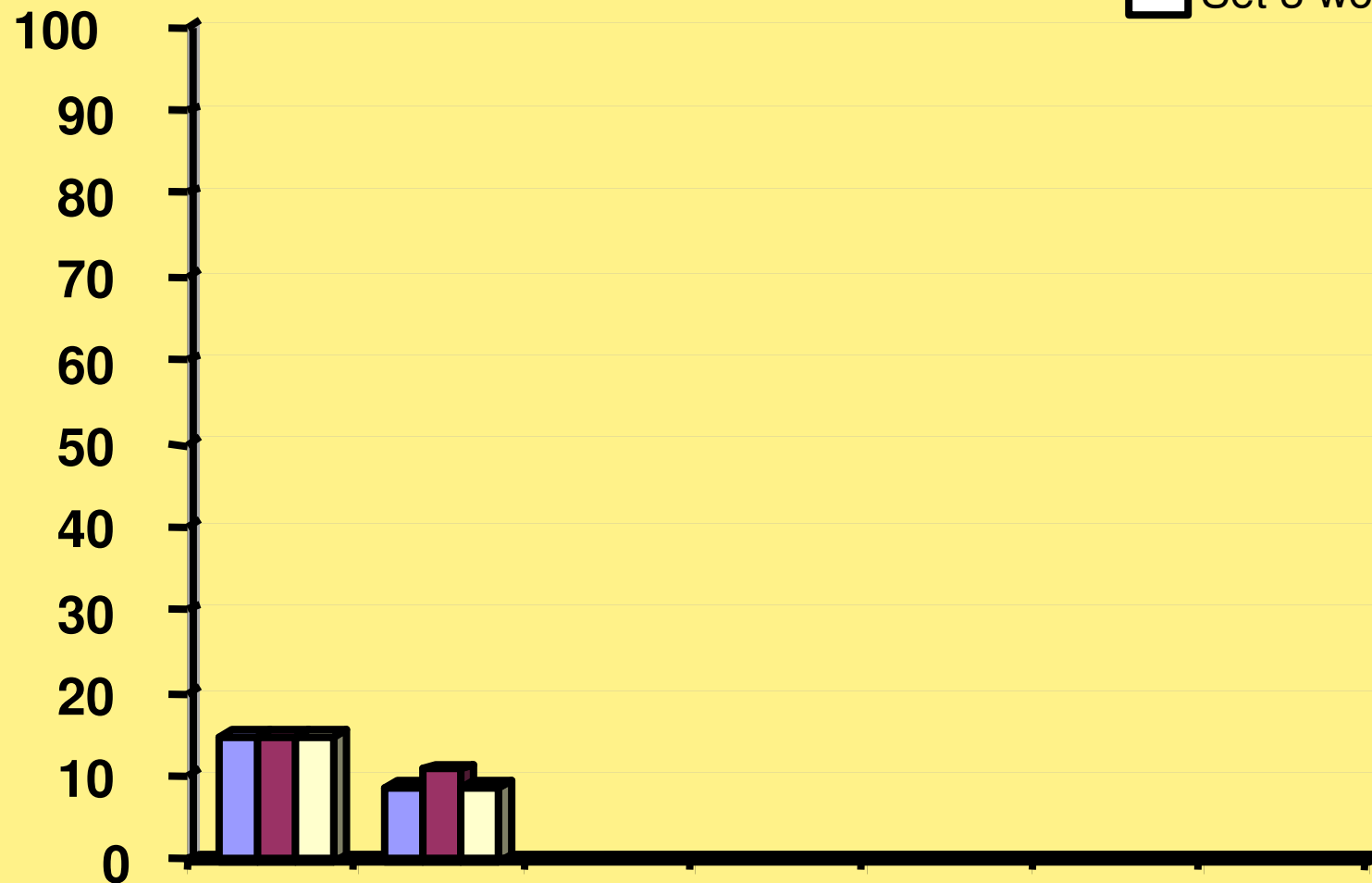
Is there improvement over time without treatment? No.

- Set 1 words
- Set 2 words
- Set 3 words

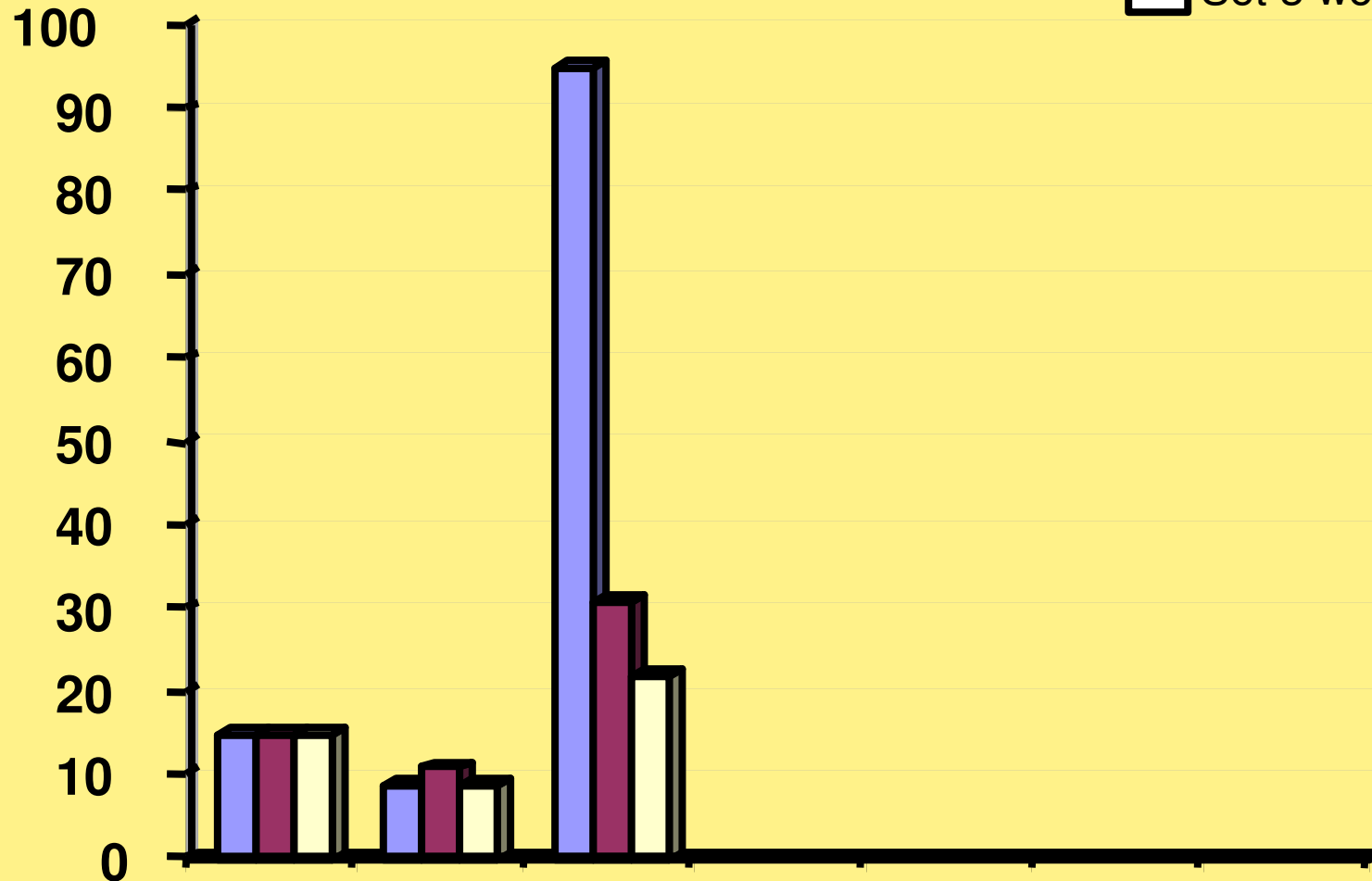
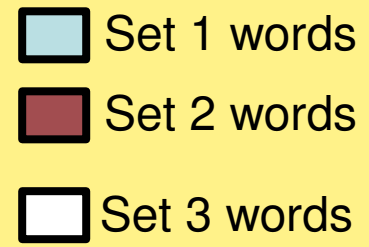


OK. Begin treatment - JUST SET 1 ITEMS

- Set 1 words
- Set 2 words
- Set 3 words

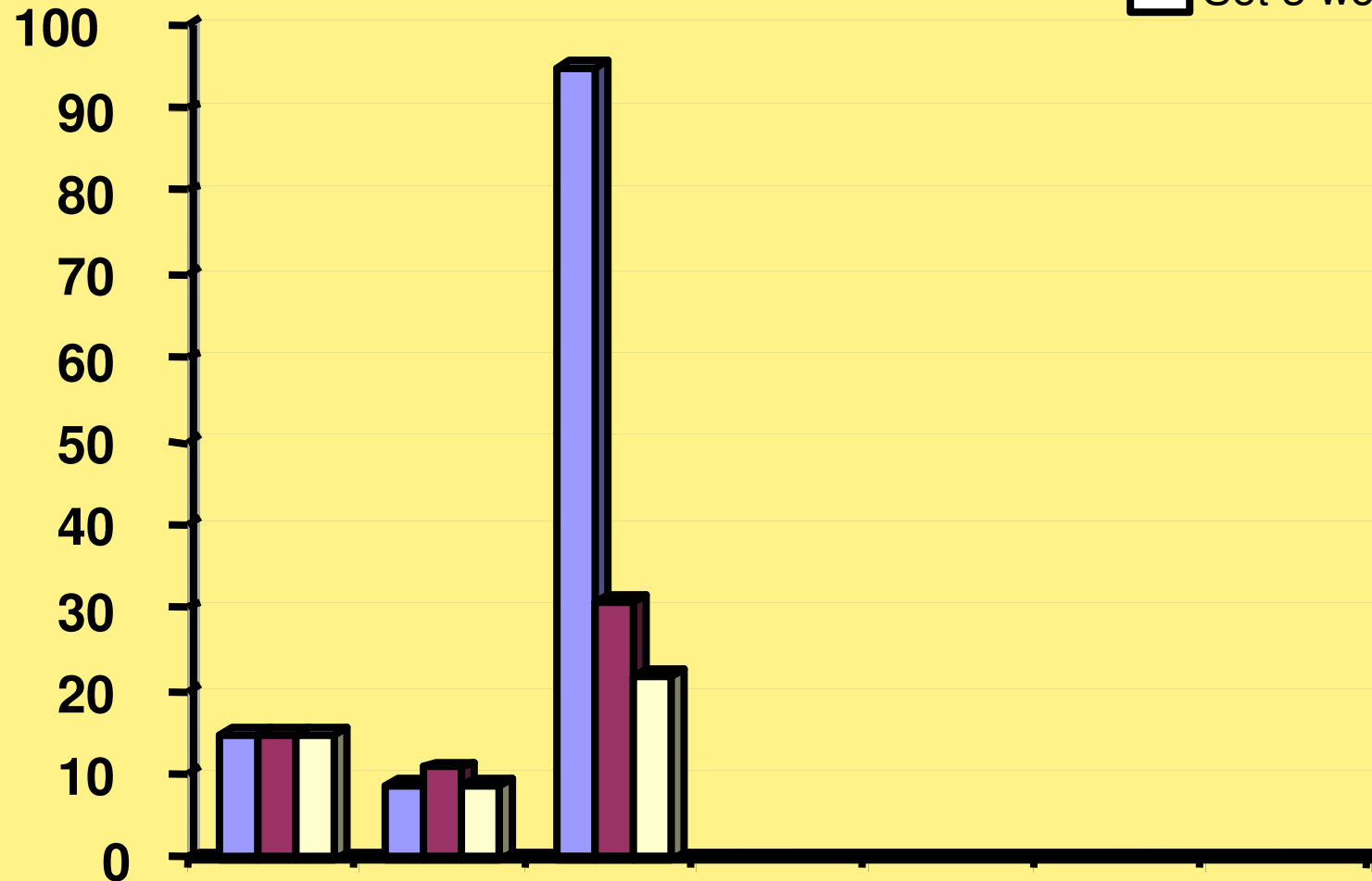
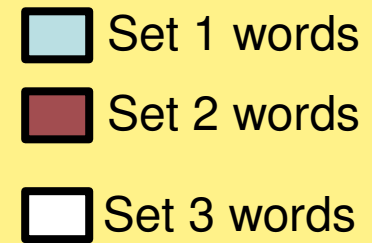


Set 1 (treated) items improve greatly.

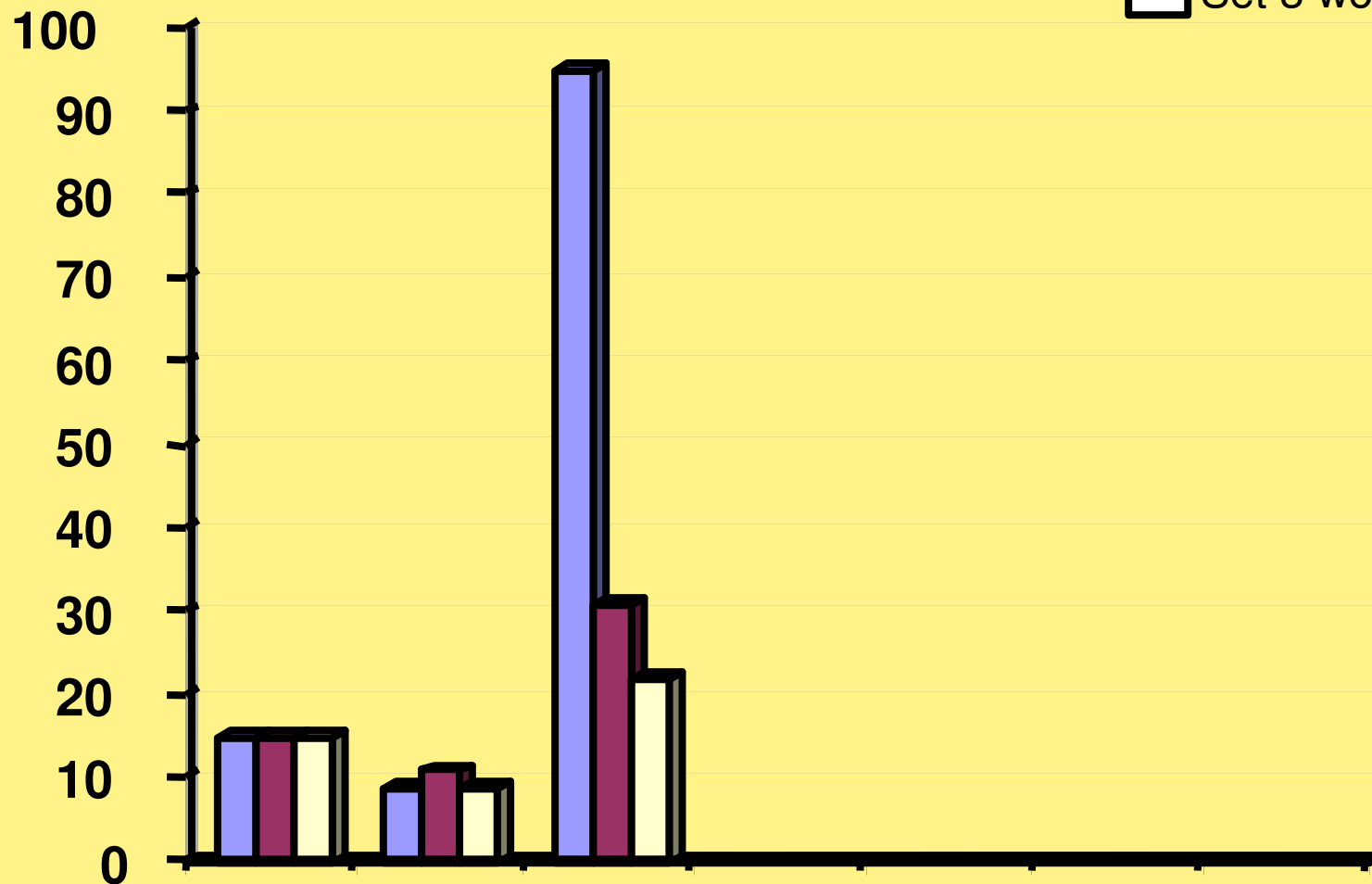
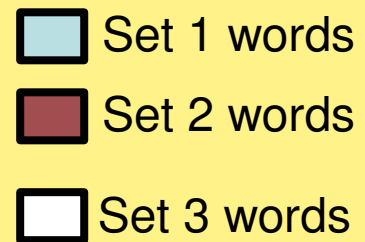


Set 1 (treated) items improve greatly.

SIGNIFICANT IMPROVEMENT IN SETS 2 & 3

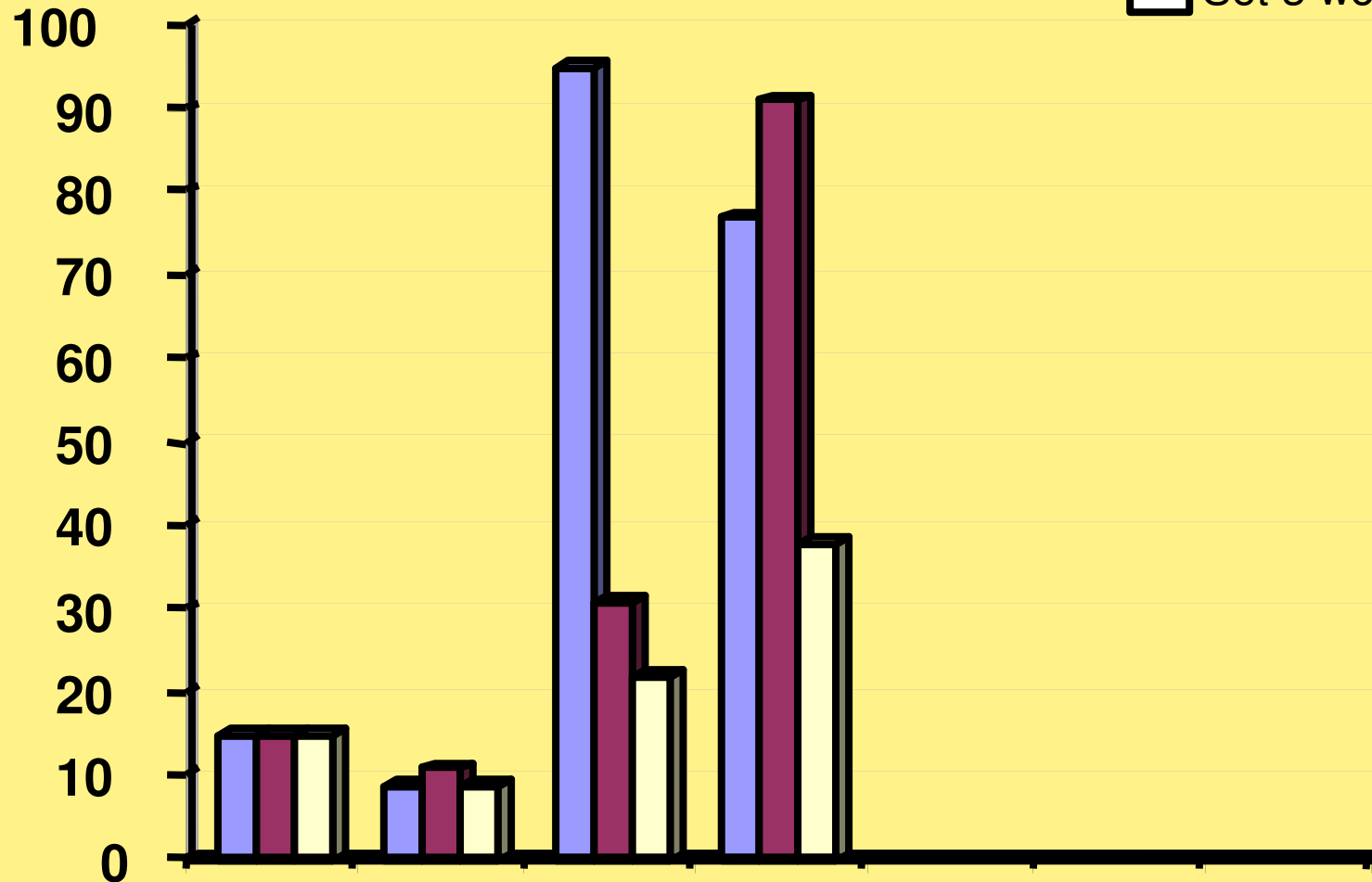
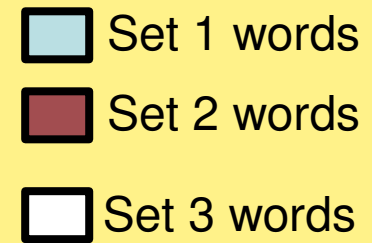


Stop treating set 1 items. Treat Set 2 items.

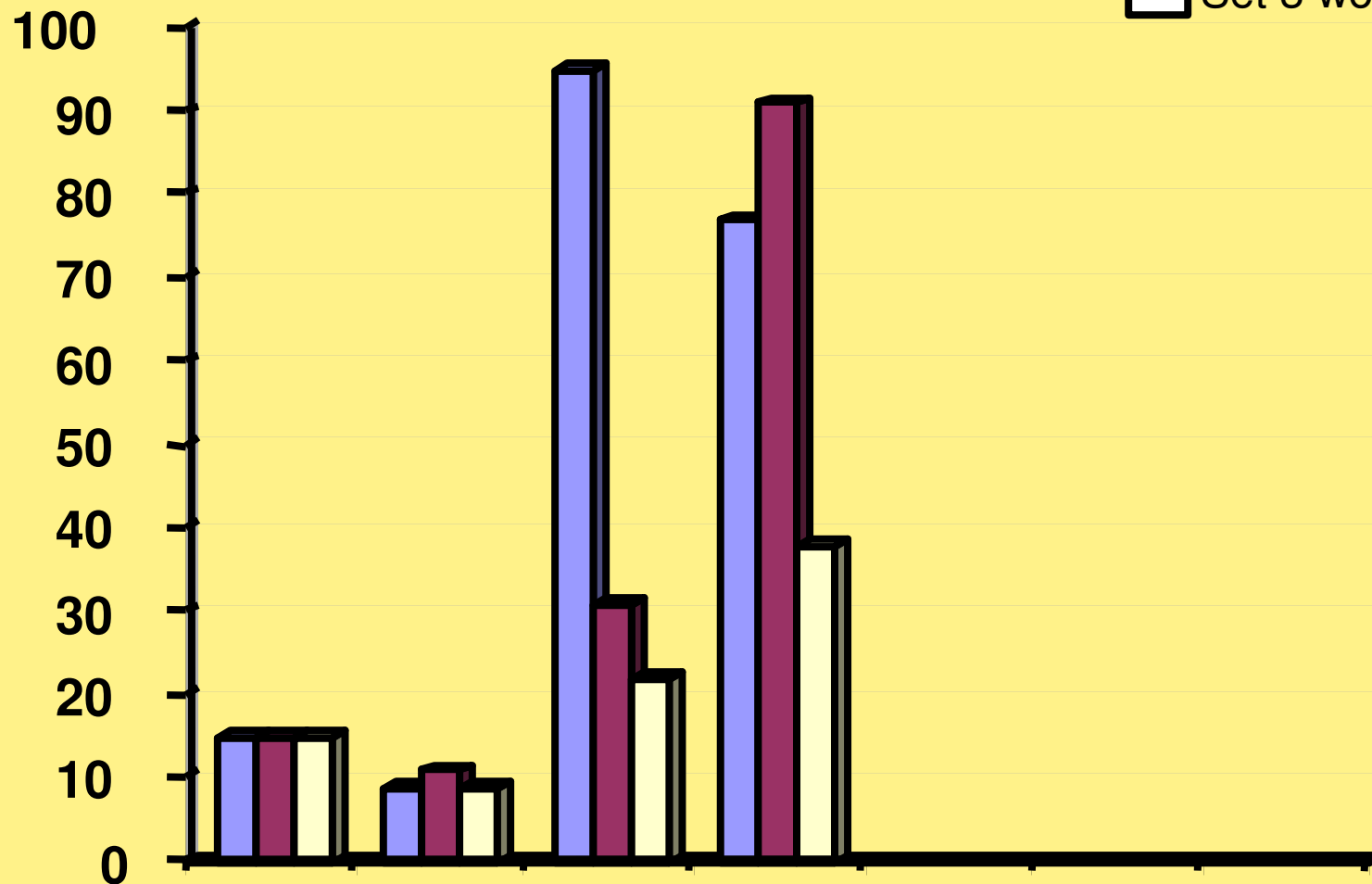
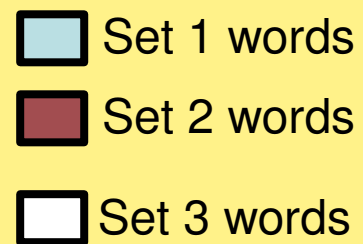


Set 2 (treated) items improve greatly.

Set 3 (untreated) items improve further

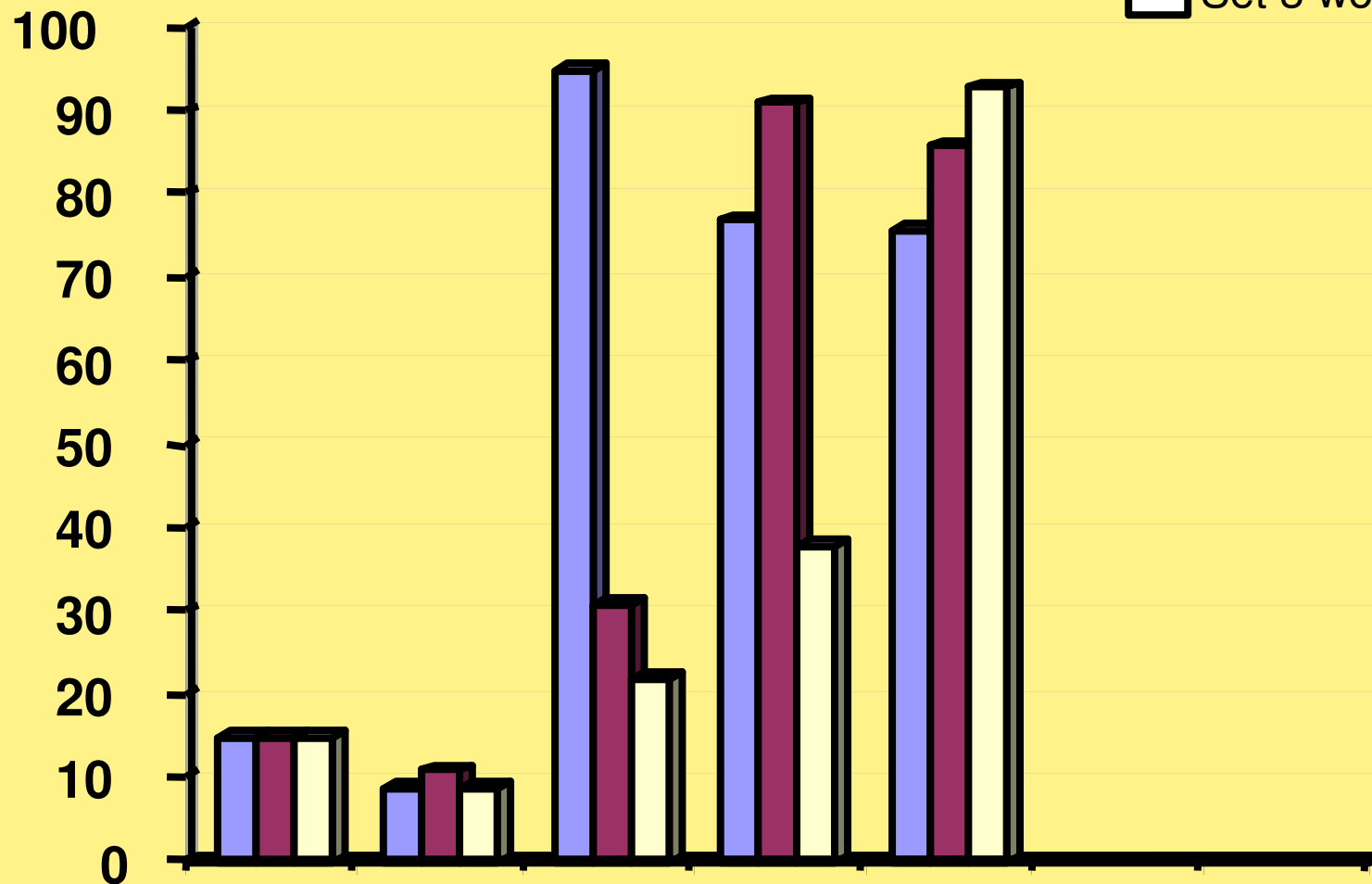


Now treat Set 3 items

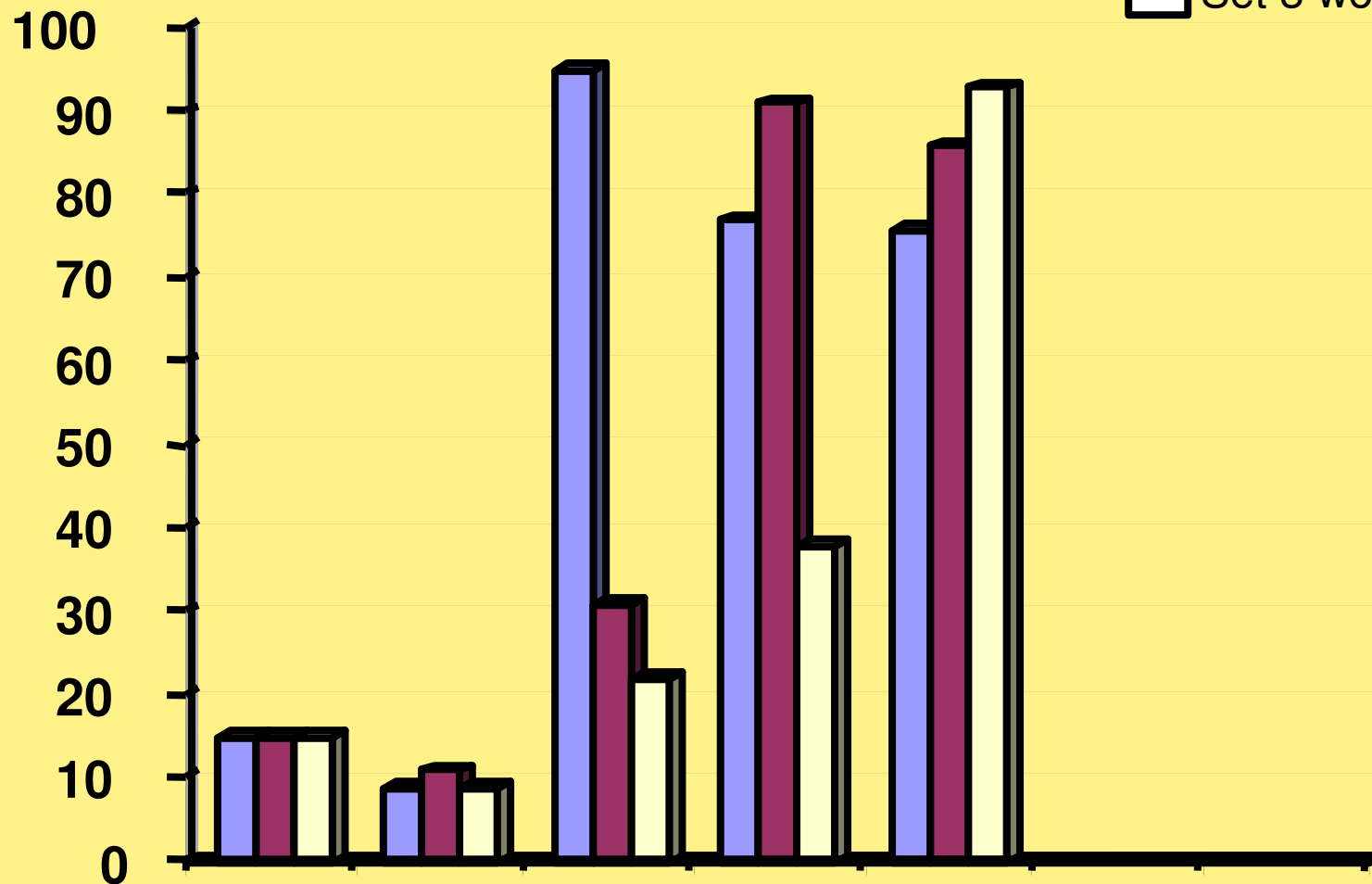
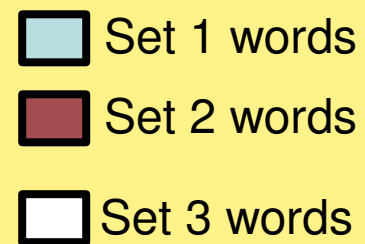


Set 3 items improve greatly

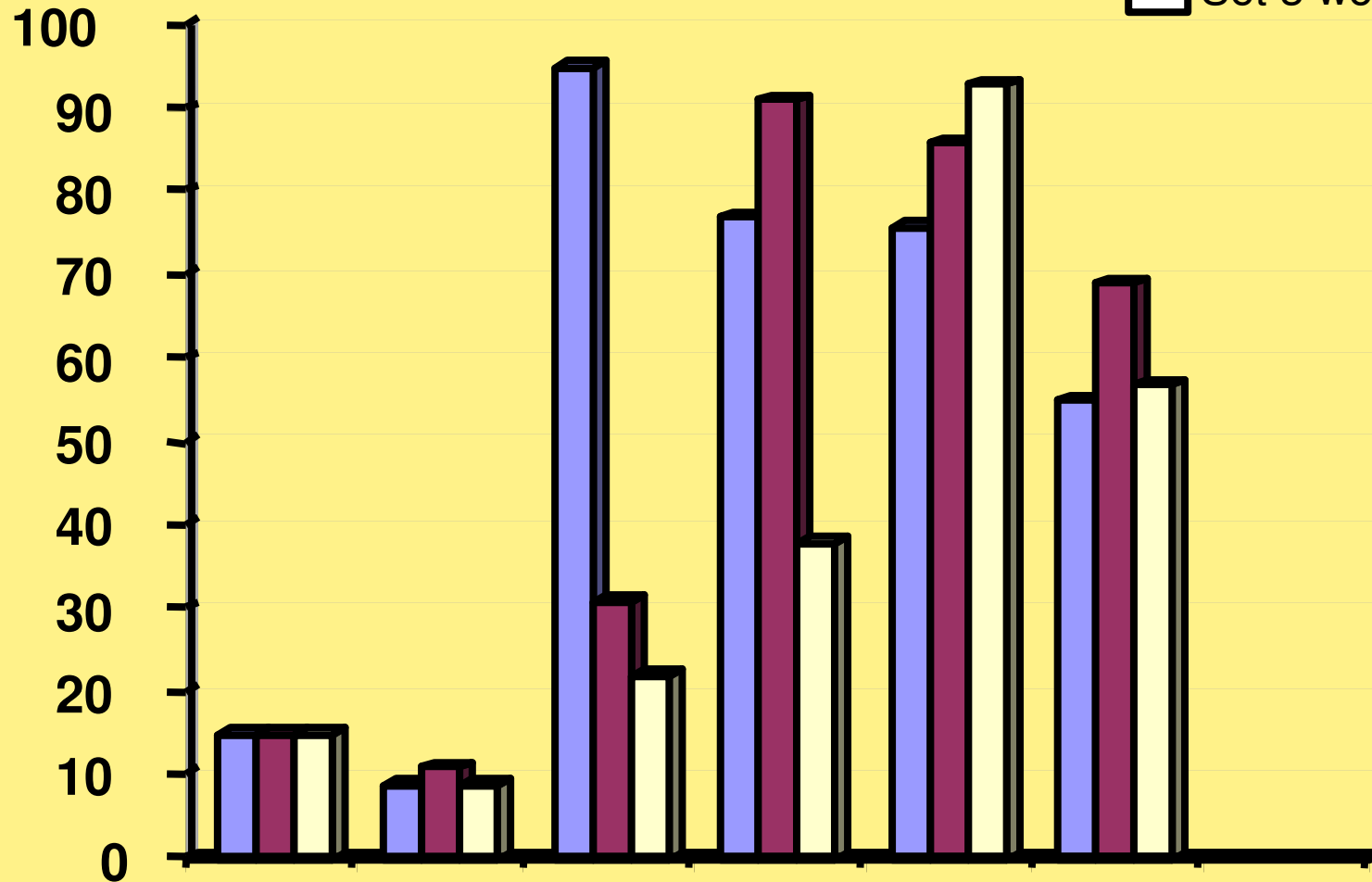
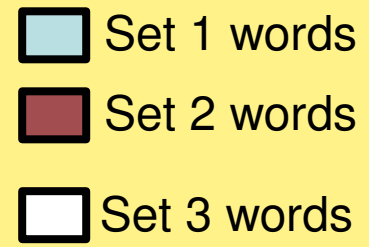
- Set 1 words
- Set 2 words
- Set 3 words



How long-lasting are these improvements?
Stop all treatment.

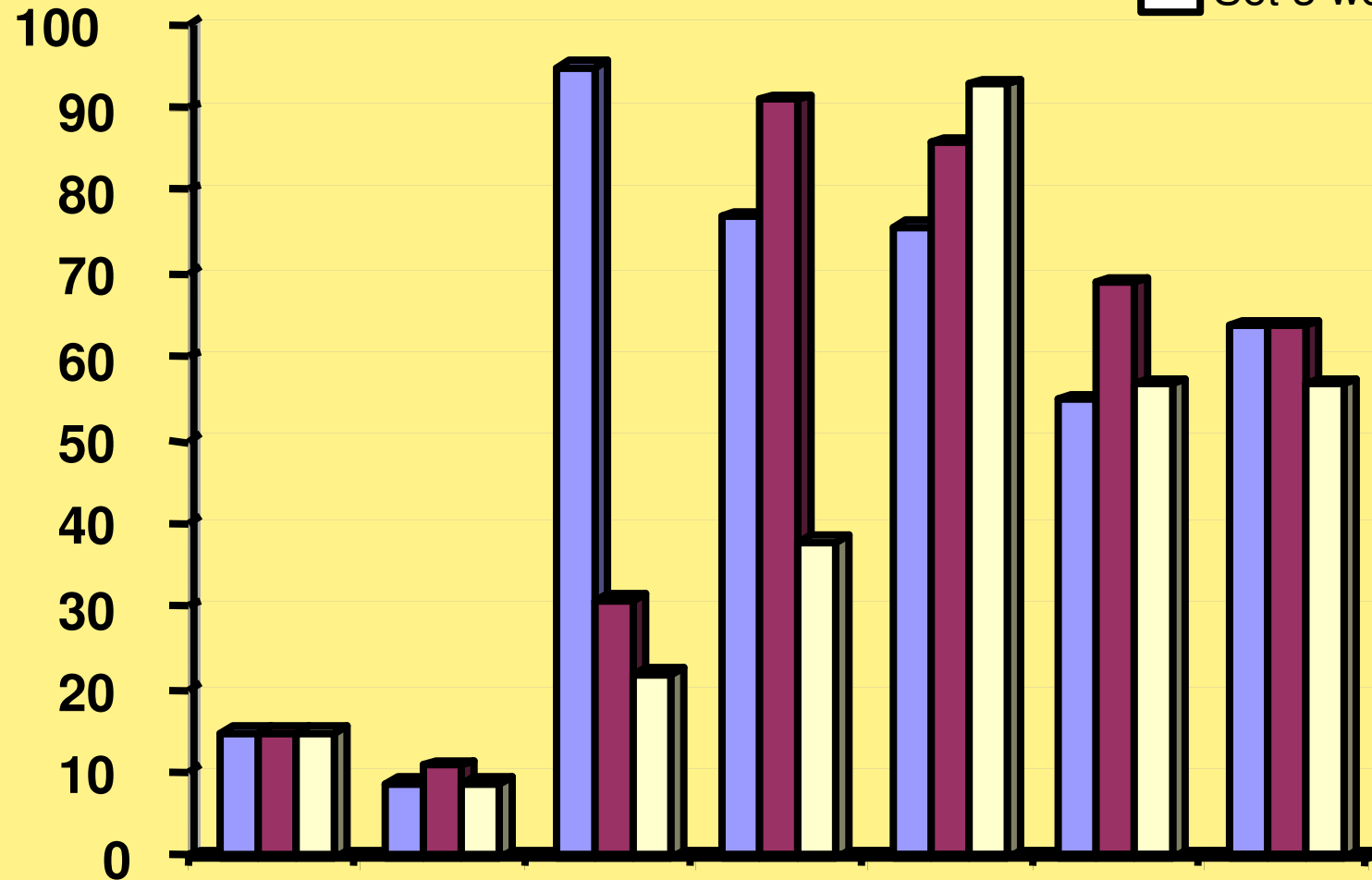


Two months later



Four months later

- Set 1 words
- Set 2 words
- Set 3 words



Overview

- The basic approach
- The Reading System of skilled readers: What is it like?
- The reading system: some of its developmental difficulties
 - The normal course of learning to read
- Assessment of basic reading difficulties
- Case studies of two types of difficulty in learning to read.
- Causes and treatments for these two types of difficulty in learning to read.