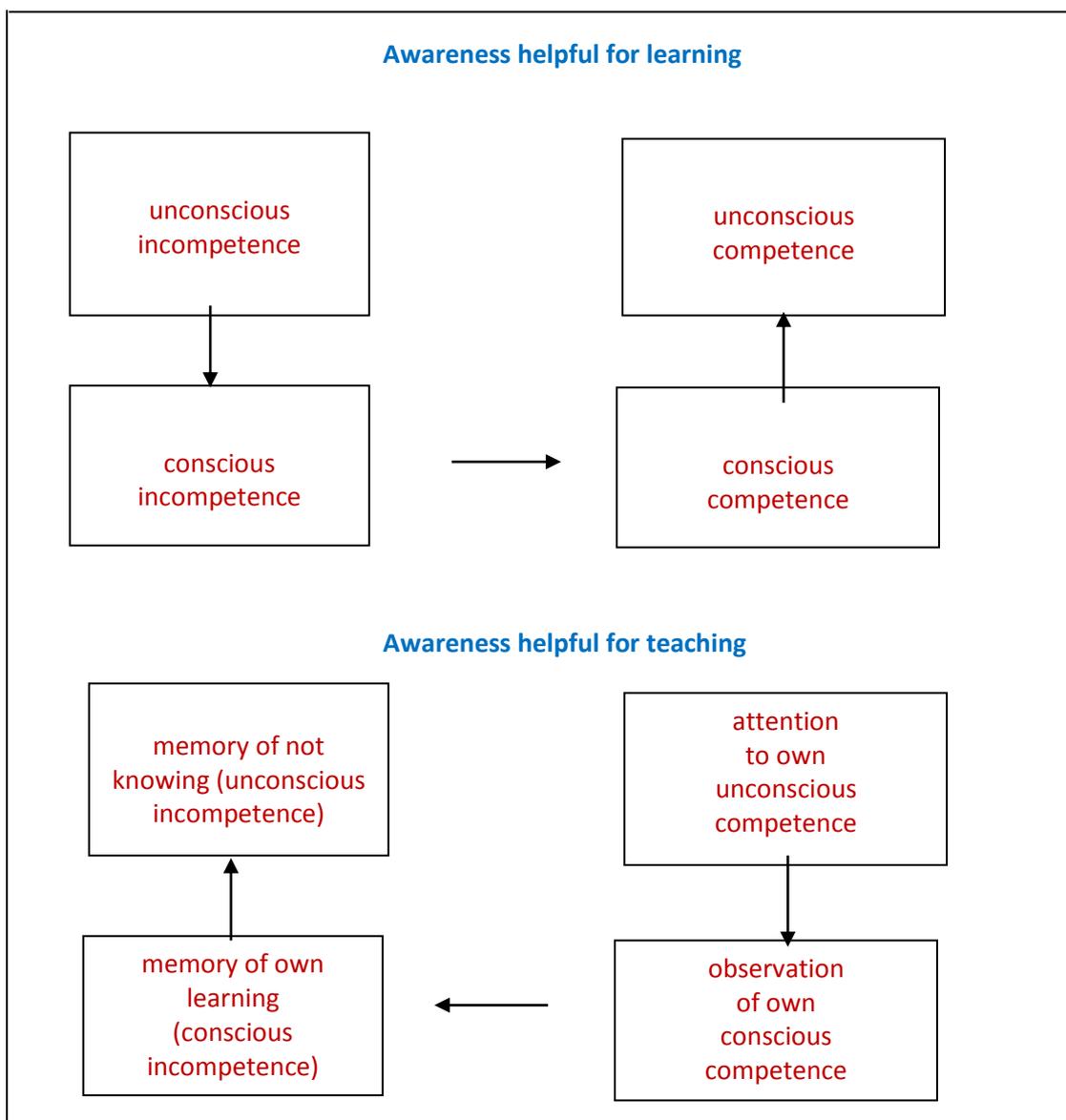


# What skilled readers are doing – the psychology of reading

Mary Gordon<sup>1</sup>

Skilful reading, of the kind that is done by literate people everyday, is an extraordinary act of mental prowess. Like driving a car, once you can do it well you pretty much do it automatically and are largely unaware of the precise processes and abilities that you are using. But becoming more conscious of what you are doing when you read can help you become a more effective teacher of reading (moving back from unconscious competence to conscious competence).



<sup>1</sup> Much of the information in this paper is taken from Adams, M. J. (1990). *Beginning to Read: Thinking and Learning about Print*. Cambridge, MA: The MIT Press

Word recognition abilities are highly developed in skilful readers and operate at extraordinary speeds. Our rate of reading typically exceeds five words per second. We can perceive whole words as quickly and accurately as single letters and we can recognise whole phrases as quickly and easily as strings of three or four unrelated letters. Not only are we quick but we do most of the work automatically and subconsciously. This means that our active attention is not on the mechanics we are using but on the meaning of what we are reading. Nor are we usually attending to word meanings as entities in themselves but rather have as our focus the comprehension of texts, whether sentences or longer passages.

How do we do this? It would appear that skilful reading is not a unitary skill but the complex integration of all the information we obtain when we fluently process the orthographic, phonological and semantic features of words in context.

The orthography of a word is its *appearance* based on the sequence of letters that make it up (its spelling). Orthographic processing involves visual analysis of letter strings and depends on the reader having a good knowledge of the letters of the alphabet. If you can spell a word it means you can remember its orthographic features. Orthography applies to *written* language only.

Phonology, on the other hand, applies to *spoken* (or oral) language. The phonology of a word is its *pronunciation*, which is composed of a sequence of speech units or phonemes. The number of phonemes varies greatly, from short words (*a, in, dog*) to long ones (*hippopotamus, irregularity, incomprehensibility*). When the word is written down these phonemes are represented by letters. In a perfect alphabetic system sounding the letters in sequence should lead to the correct pronunciation of the word. English spellings are frequently irregular however and this makes learning to read English more difficult than it would otherwise be.

#### Hints on Pronunciation for Foreigners

I take it you already know  
Of tough and bough and cough and dough?  
Others may stumble but not you,  
On hiccough, thorough, laugh and through.  
Well done! And now you wish, perhaps,  
To learn of less familiar traps?

Beware of heard, a dreadful word  
That looks like beard and sounds like bird,  
And dead: it's said like bed, not bead -  
For goodness sake don't call it "deed"!  
Watch out for meat and great and threat  
(They rhyme with suite and straight and debt.)

A moth is not a moth in mother  
Nor both in bother, broth in brother,  
And here is not a match for there  
Nor dear and fear for bear and pear,  
And then there's dose and rose and lose -  
Just look them up - and goose and choose,

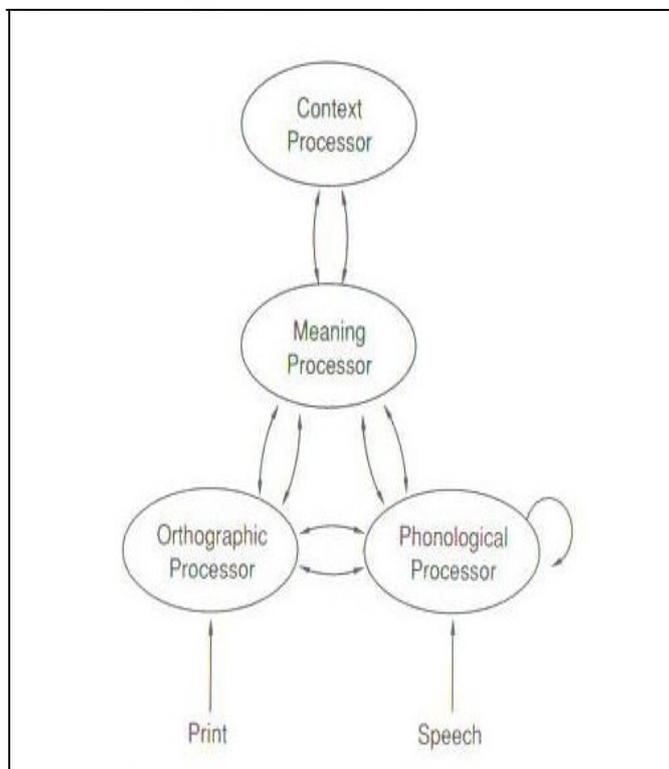
And cork and work and card and ward,  
And font and front and word and sword,  
And do and go and thwart and cart -  
Come, come, I've hardly made a start!  
A dreadful language? Man alive.  
I'd mastered it when I was five.

By T.S.W., published in the London Sunday Times, January 3, 1965.

Meaning is conceptual. The meaning that a word has for us is made up of all the concepts, usually inter-associated with each other, which we have constructed when we have met this word in the past. Our concept of the word's meaning might be relatively clear (e.g. *table, sun, walk, very*), somewhat vague (e.g. *monarch, from, sidle, onomatopoeia*) or ambiguous, as when two words that look (and, perhaps, even sound) the same can mean entirely different things (e.g. *rose, lead, can, fine*).

In ordinary life – and whether we are talking about spoken or written language – we nearly always meet words in the context of phrases, sentences or longer passages. Speech is most often heard in the form of conversations and the written word appears most often in the form of written texts (newspapers, books, leaflets, notices, subtitles). It is rare enough to encounter a word in isolation (“No!”, “Sorry”, “Stop”, “Yield”). So when we hear or read a particular word a large part of its meaning is contributed by the *context* it is in

Below is a model (Adams, 1990) representing the key elements which are involved in skilful reading and their relationship to each other.



## Orthographic processing

The orthographic processor is the only one that receives information directly from the printed page (unless the text is being read aloud at the same time). Because skilled readers read so quickly it looks like we could not possibly be looking at every single letter, and must be taking short cuts. For example, perhaps we are recognising words holistically by their letter shapes?

### Reading by letter shape

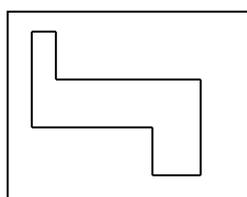
Words are read in capital letters (which lack distinctive features and are all of similar size) nearly as quickly as in lower case form:

IN AND DOGS HOLIDAY REMEMBER IRREGULARITY

Varying the font and size of letters changes the normal shape of words but makes very little difference to how quickly they are read:

baCK sUcE gTsi

Word shapes on their own are not unique enough to be recognised as particular words and cannot compare to the distinctiveness of a sequence of letters in all the detail of their features:



What is this word? By its shape alone it could equally be *log*, *hay*, *bug*, *boy*, etc.

Perhaps we have got very good at guessing what is coming next and only give a cursory look at the words?

### Cursory examination

Memory is extraordinary. Although I was only there as a small baby I can still remember the smell of the flowers that grew around my grandmother's house.

We notice that *remember* in the sentence above is spelled incorrectly, even though *m* and *n* are similar looking letters and we were primed for the word by the previous sentence.

Perhaps our comprehension is based on hypothesis-testing and we are anticipating what is to come and skimming over letters only as far as is necessary to confirm or correct expectations?

### Skilled guessing from the meaning

Experiments that have studied the tiny eye movements we make when we read indicate that we are fixating almost every word and processing its component letters quite thoroughly. If we do skip over a word it is usually only one word at a time and the skipped word tends to be a function word (such as *of, in, to, and* and *the*).

remember

but

Paris in the  
the spring

In addition, we do not only recognise contextually relevant meanings, as you would expect if we were simply guessing on the basis of the overall passage we are reading. When we encounter words that have more than one meaning (e.g. *ball, rose, lead*) we register all the meanings before selecting the one that makes sense in the context. This is frequently done so quickly that we are not aware of doing it but our ability to recognise puns and double entendres indicates that we are in fact accessing all possible meanings.

They all rose.

The bird feeder attracted finches, robins and tits.

He patted her ass and stroked its ears.

No, apparently we are doing none of these things – what research has shown is that skilful readers are actually processing every single letter in the words we are reading. Only we are doing it very, very rapidly.

### Speed of processing

How can we process individual letters so quickly? When we can read fluently we look at the letters and see letter patterns. This is because associated links between letters that frequently occur together in words have been built up in our minds over time. If we see a three-letter word beginning with *t* and ending with *e* we will be expecting *the, toe* or *tie*. We won't be expecting *tqe* because we probably have never seen that combination of letters before.

the

In normal English spelling, *t* can only be followed by *a, e, i, o, u, y, h, r,* or *w*. If it is followed by *h* (the most common letter to come next) the next letter must be *a, e, i, o, u, y* or *r* and if it is a three letter word – as we can see that it is straight away – it is more likely to be an *e* than a *y, a' or o'* (*the* being a much more frequently encountered word than *thy, tha' or tho*). Through our past experience of letters associating together into

words or syllables we are expecting particular combinations and positively not expecting others. Letters that frequently come together activate each other. It takes very little time for us to see what we are expecting because through this letter activation process we are being primed. On the other hand, to see an unusual combination of letters requires us to inhibit our expectations, and this takes time and thus delays the perception of the word.

*tqe*

To register *tqe* (an unpronounceable pseudoword) we have to overcome our expectation of *t* inhibiting *q* and *q* activating *u* and inhibiting *e*.

Words that do not follow usual English letter patterns can be learnt, however.

### Sight vocabulary

#### Sight vocabulary

Unusually spelt words are read very rapidly once they have become familiar enough to enter our sight vocabulary.

*guide aisle knight sapphire*

They are accessed as whole words rather than as a combination of familiar letter strings. Changing the initial letter of a word will frequently leave the reader with little difficulty with pronunciation even if the result is a pseudoword (e.g. location / pocation, second / mecond) but unusually spelt words are stored as whole units and do not as easily facilitate phonological analysis by analogy (e.g. guide / fuide, sapphire / tapphire).

As long as they have been encountered and read often enough they can become part of our *sight vocabulary*. A sight vocabulary is the list of words whose letter sequences are so familiar to the reader that they can be read with great rapidity and their meaning accessed.

Orthographic processing requires careful attention to the *order* as well as to the nature of the letters in a word.

#### Accurate processing of letter order

Depending on their order, the same six letters (*t, i, s, r, p* and *e*) can make four different words:

*stripe ripest sprite priest*

## Processing meaning

Specific meanings may be located in words but for the most part meaning is located in longer speech or written passages.

### The context processor

During reading the context processor is responsible for constructing a coherent, ongoing interpretation of the text. Its connections to the meaning processor facilitate the perception of contextually appropriate interpretations for words whose meanings are ambiguous or diffuse.

Particular word meanings are primed by the context in which they appear. This is true of visually ambiguous words such as homographs (i.e. words that have the same orthographic form but more than one meaning such as ball, rose and lead).

The debs' *ball* took place in the local hotel.  
They played *ball* in the garden.

It also leads to the priming of particular meanings out of all other possible ones.

According to the Irish Tourist Board, *South Kerry* is a beautiful place to visit.  
The election results for *South Kerry* will be announced shortly.

Contextual cues become particularly important when the orthographic information is impaired or unclear, as when print is faded or handwriting is difficult to read. For example, interpreting handwriting is often facilitated by contextual cues:

Pole vaulting was the third event of the meet.  
After dinner, John went home.

Here, both *event* and *went* are written in an identical fashion but we see them as different because of the influence of the sentence contexts in which they are located. Note that the context processor also needs to take syntax (the rules and principles governing sentence structure) into account as word order has a large bearing on meaning. In the example above, the ambiguous word is clearly a noun in the first sentence as it follows the word "third", while it can only be a verb in the second.

## The meaning processor

The semantics or meaning that a word has for a person is made up from all the experiences that they have had of meeting that word in the past. If the word is a common one, frequently used by people in their speech (e.g. *dog, eat, and, but*), it will contain a rich wealth of associated meanings. For example the word *dog* might represent a vast range of widely different looking animals (e.g. St Bernards, Jack Russells, mongrels); dogs in different contexts (e.g. as pets, as racing / fighting / working animals); and experiences with dogs (e.g. as a source of threat or of play); distinctions about dogs (e.g. that they are *not cats*); and the idiomatic or metaphorical meanings attaching to dogs in phrases like *going to the dogs, being a bitch, dogs of war*. Whether a person likes dogs or not will be in the meaning the word has for them, along with their history of particular dogs.

Likewise, a word like *and*, which tends not to engender an immediate image in the same way that *dog* might, will be understood to mean *as well as* or *in addition*; to indicate that the next word is the final one in the list (e.g. "I got a doll, a bike, a tea set *and* a ball from Santa"); and to give emphasis at the beginning of a sentence (as in "And, if you think you can ..."). Function words (like *and, but, only, for, that*) tend to be harder for young children to learn than nouns (like *cat, elephant, tyrannosaurus rex*) or verbs (*run, do, remember, fight, laugh*) because they don't carry such a strong and isolatable semantic meaning.

Reading is the principal way in which we develop word knowledge and build vocabulary as we encounter a much greater number and range of words when reading than we typically encounter in spoken language.

## Phonological processing

The phonological processor accesses *speech* directly from the outside but a person can only access *print* by means of the orthographic processor. The brain responds to the pronounceability of the letter strings it receives from the orthographic processor, while the information it receives from the meaning processor also stimulates it to sound words. Skilful readers do not depend on phonological translation or recoding (i.e. pronouncing vocally or subvocally when reading) for recognising familiar words and accessing their meanings, but it seems that we tend to do it anyway. However, in the case of the 10% or so low frequency words that we encounter, the ability of the phonological processor to activate itself by vocalising the letters and letter strings it has received helps in the word being *heard* and in this way recognised.

It is important to note that a great many words in English are not spelt in an orthographically regular fashion and so we cannot rely on phonological processing to access them.

of is to are you said any have give good who does love  
again move mountain friend through shoe women yacht

Skilful readers are often unaware that these common words are not written as they sound. It appears that once the word is in your sight vocabulary you no longer notice how strangely it is spelt.

## Integration and fluency

Fluency – the speed, accuracy and ease with which we process the orthographic, phonological and semantic information we receive – is critical for optimal reading performance. The interactive nature of the model compensates for weaknesses in the different processors and encourages fluency.

Each of the processors makes its own contribution. The orthographic processor can compensate for poor letter resolution.

TAE CAT

Although the exact same symbol is used to represent different letters in *the* and *cat*, it is perceived as a *h* in the first and an *a* in the latter because of how the adjoining letters excite these interpretations and inhibit the others.

The phonological processor can break down visually daunting long words into pronounceable syllables.

diatessaron gerentomorphosis trypsinogen anfractuosity thigmotaxis

Even though we may never have seen these words before we can read (if not understand) them because they are composed of commonly occurring letter strings and are pronounceable.

fet sust bome agatom honfosed taitationally

Only the meaning processor can decide if words like these are real English words or pseudowords. The orthographic and phonological processors would both be happy to accept these pseudowords as these are composed of regular letter strings.

bylg wloc nudich shihk etzcotlyz bgoszczydlods

These pseudowords, however, are rejected by the orthographic and phonological processors as well as by the meaning processor because they are composed of unpronounceable and unfamiliar letter strings.

## Processor limitations

Each of the processors also has its own weaknesses. For example, the orthographic and phonological processors cannot resolve homophones:

They all rows.  
Tie the not.  
We swim in the see.  
The sky was blew.

Neither phonological nor orthographic processor can detect anything wrong with these sentences. We rely on the meaning and context processors to resolve homophones.

The meaning processor however cannot resolve homographs.

lead?          rose?  
  
He will lead the horse into the field.  
She wrote with a lead pencil.  
  
They all rose.  
The rose smelled lovely.

The meaning processor cannot interpret homographs until they have been contextualised.

But, equally the context processor may lead in the wrong direction if it too casual or does not take syntax into account:

Though smelly and ugly to look at, the  
sewer makes beautiful clothes.  
John said, "Does are in the park, aren't  
they?"  
The conductor stood before the audience  
left the concert hall.  
The old train the young.

The preceding context can lead to the wrong meaning being assumed, which the succeeding context then has to correct. Note the context processor has to pay heed to syntax (sentence structure) as well as to semantics when interpreting words in context.

## Some implications for teaching reading

Written English is oral language written down. Readers need to understand that this is what print is and to become aware of the features of the oral language that they use effectively and confidently, often without being aware of them. These features include such things as the way the language they speak is composed of words and that words have meanings, references and associations and are linked to thinking; that some words serve particular functions (e.g. *is* versus *is not*; *a* versus *the*, *every* versus *only* or *some*); that some word parts also contain transferable meanings (e.g. *-er*, *-est*, *-ed*, *-ing*, *un-*, *re-*, etc.); that a word is made up of a sequence of sounds (e.g. *d-o-g*), that the sounds are arbitrary (there is no reason why the word for a dog should be *dog*, and it isn't in other languages) but constant (what *dog* refers to doesn't keep changing); that the sounds within words can be distinguished and separated; and that there is a limited number of sounds available and that words share features of their sounds with other words (for example they can rhyme – *cat*, *bat*, *sat*, *fat*, *mat*, *pat* – or start with the same sound – *cat*, *candle*, *cup*, *Christmas*, *kettle*, *king*).

Full awareness of the features of oral language does not have to precede learning to read. Fortunately, awareness develops in a reciprocal fashion with learning to read. This is because written language draws our attention to what it is we are doing when we speak or when we comprehend what someone is saying to us. The more we read the more aware we become of the semantic, syntactic and grammatical structures operating in oral language. It can be very helpful to a learner though if the teacher draws their attention in an explicit way to these structures.

Written English follows a code. There is a match between the letters that make up a word and how it is pronounced. Readers must be able to distinguish clearly between the letters – in both capital and lower case form – and to do this they need to know their names. They also need to know what sounds are associated with each letter and to be able to isolate and play around with these sounds, to separate and to blend them and to identify the letters that are used to represent them. Explicit teaching of the alphabet and of the phonological features of words is necessary if the learner is to learn the code.

The code for written English, however, is an imperfect one with many words having a somewhat irregular spelling and there being more than one way to represent the same sound.

### Spelling the *ān* sound in English:

*ain*: gain, lain, main, pain, rain, vain, chain, brain, train, stain, sprain, strain

*ane*: bane, cane, Jane, lane, mane, pane, sane, vane, crane, Shane

*ein*: rein, vein

*eign*: deign, feign, reign

*ayne*: Wayne

This means that learners need to become very familiar with common irregular words and to have their attention drawn to the exact sequence of letters that make them up because they won't be able to spell them correctly by sounding them alone. They also need to have the meanings of phonologically ambiguous words or homophones explained (e.g. *pain* / *pane*, *vain* / *vein*, *rain* / *reign*, *Dane* / *deign*).

Familiarity with the letter strings frequently found in words, and in parts of words or syllables, leads to them being processed quickly and effectively. Compilation of word families based on orthographic features can be very helpful (e.g. separating *-ain* words from *-ane, -ein and -eign* words). It is not recommended that learners group words according to exclusively phonological features (e.g. *cat, candle, cup, Christmas, kettle, king*), but care also needs to be taken to avoid compiling word families where the words look the same but are pronounced differently (e.g. *dove, wove, move*).

Fluency needs to be developed so that the sense of the words encountered in reading and the overall meaning of the text can be apprehended immediately and without distraction. Fluency is achieved by the paying of careful attention to the detail of the letter sequence making up the word and by the repeated experience of meeting this word in the course of reading meaningful text. Sufficient attention and exposure to a word leads in time to its meaning(s) being accessed quickly, accurately and with ease. So the main way that a person learns to read is by reading. It follows then that the single most useful thing that a teacher can do is to encourage their learners to read and reread texts that are of interest to them.

The elements of literacy that need to be addressed when teaching (and measuring or testing) literacy skills, then, include the following:

- comprehension, vocabulary and some awareness of syntax and grammar in oral language
- sounds and sound patterns within words
- letter names, sounds and common letter strings
- sight vocabulary
- fluency
- comprehension
- uses of reading: for information, enjoyment, empowerment
- interest and motivation