"The Representative Problem in Reading Acquisition", Charles Perffeti, University of Pittsburgh. A chapter found in **Reading Acquisition** Philip Gough, Linnea Ehri and Rebecca Treiman (1992)

Highlights from the chapter by Charles Arthur

Some important questions for scientific study.
The most important question for reading acquisition is how a child moves from the initial learning state to more advanced stages of reading skill. What are the processes of becoming a skilled reader? What are the processes of word recognition? What are the processes by which the learning reader acquires higher levels of word recognition skill, moving from "novice" to "expert"?

The central theoretical questions for beginning reading in this view are these: How does the child mentally represent printed words at each point of reading development? How does the child access these representations during encounters with print? How do word representation and word access change with experience and instructions? That is, how does learning occur?

The Representation Question
The general form of the representation question is: How are words represented in the mind? …behind any process of pattern recognition is the form of knowledge that allows recognition. This is the representation question. Reading cannot be addressed without at least an implicit assumption regarding this question. The access question is how a printed word comes to cause a reader's mental representation of a word to be activated and accessed by a printed stimulus. Although the representation question and the access question are intertwined, in empirical terms almost hopelessly so, they can be conceptualized and described separately for some purposes.

Although several debates remain active, years of research have provided important empirical generalizations about access to printed words. Prominent among the important facts is that word recognition is holistic in appearance and nonholistic in reality. ….. It is now fairly clear that, whatever the appeal of the whole word hypothesis at the phenomenal level, word identification is mediated by letter perception. The individual constituent letters of the word are the units of its identification. Cues of word shape and word length appear to be of some significance, but they carry a very small share of the identification burden compared with letters.

Exactly how word recognition processes use the information of constituent letters is the central theoretical question in word identification. There are a number of models… I refer to (the) hybrid (model of) the Restricted-Interactive model of word recognition. (This model) demonstrates that phenomenologically compelling holistic word perception is mediated by perception of constituent letters while retaining in some sense the idea that not all the constituent letters need to be "seen". Some letters get a relatively high proportion of their activation from perceptual features and others get a relatively high proportion of their activation from the word.

Conclusion
I have argued that the central theoretical question for a theory of reading acquisition is the development of lexical representations.

The acquisition of a functional representation system entails an increase in the **number** of lexical entries and an increase in the **quality** of lexical entries. Quality is a matter of upgrading representations so that they are more fully specified and redundant. Access to this lexicon becomes increasingly word specific as the quality of specific word representations increases. The acquisition of

an autonomous lexicon builds on this same functional lexicon by changing the status of specific words to fully specified and redundant. This means that parts of the lexicon can become autonomous very early in reading.

Two important issues are indirectly handled by this account. In the case of phonemic knowledge, implicit phonemic knowledge is central to the quality of lexical representations.

Phonemic (speech codes) and Orthographic (letters) Information

I believe that in skilled reading lexical access involves phonemic information obligatory. Neither "direct access" nor "speech recoding" quite captures this idea of obligatory speech activation. Phonemic information is activated during lexical access as an intrinsic part of the process. This activation of speech codes occurs almost always because speech codes are part of the lexical representation. However, because letters and letter strings are also associated with phonemes, the opportunity for phonemic activation is doubled: activation of phonemes by letters and activation of phonemic word shapes by words.

When words are unfamiliar or when readers are unskilled, a rather high level of phonemic activation may build up before semantic codes are sufficiently activated. (the reader probably thinks a lot about the sounds before knowing the meaning of the word). In real reading, as opposed to lexical decision tasks, it is hard to imagine what "lexical access" can refer to except a point at which the reader is prepared to name (pronounce) the word or to make some judgment about its meaning. Whether the name of a word (pronunciation) is available before its meaning attributes is a meaningless question in general.

Automatic phonemic activation as part of access at least handles matters in a straightforward way. The name code (pronunciation) is always quickly accessed. Some meaning features may precede this name activation but certainly not all of them and, under some circumstances, probably not many of them.

Summary, a model for word recognition

The model I propose is a set of principles that embodies a class of models that I refer to as the Restrictive-Interactive Model. (it restricts what is interacted in the word id. process from outside sources). The principles are that in skilled reading there are restrictions on the use of nonlexical (outside of the word) knowledge in word identification. General knowledge and expectations have little or no influence on the initial access of a words.(it's id.) At the same time, the identification processes are interactive in the use of intralexical information. That it, links between letters and words, letters and phonemes, and phonemes and words permit reciprocal activation. …. Phonemic activation always occurs as a part of lexical access.

Acquiring Functional Lexical Representations

The major essential development in learning to read is the acquisition of individual word representation. (word identification) Here are the fundamental changes in the lexicon to be seen with increasing skill level: a) the number of lexical entries increases; and b) the quality of lexical representations improves.

Decoding rules of some sort are important in providing a backup process in reading never-encountered words. But as a word becomes represented in the lexicon, decoding becomes only indirectly important. That is, it has provided the links between letters and phonemes that can be

activated to assist recognition. However with increasing word familiarity, these links lose their ability to be of much assistance.

It appears that I am suggesting that acquisition of the lexicon is essentially a matter of what is often called "sight" vocabulary. … the notion of sight vocabulary is a bit imprecise, however, in terms of what the child comes to know; it implies, for example, holistic patterns. The present account emphasizes the acquisition of specific (but abstract) letter patterns, reinforced by sublexical links with phonemes. There is no possibility in this account for holistic patterns playing a major role in recognition.

Increasing the Quality of Representation

Increasing skill not only bring about more entries but also produces changes in the representation. There are two principles that characterize the development of lexical representation quality: precision and redundancy.

Precision. The precision principle is that fully specified representations are superior to partially specified ones. … In the case of word reading this means that a given letter string will be sufficient to activate a specific word and to quickly bring about the recognition of that word rather than some other word. It also means that there can be less reliance on context. In short, only in a system with fully specified representations, can the input features, the constituent letters in this case, easily control recognition. (there are many possible variations in imprecise representations in the minds of the reader.)

An important principle is that phonemic values play a large role in determining which letters get represented. The essence of the (variability) concept is the instability and changeability of the representation. …. Thus, the precision principle is that lexical representation evolve toward (stable) completeness and specification.

Redundancy. The main source of redundancy is between letters and phonemes and, more generally, between orthographic strings and phonemic strings. Two (important) development, the strengthening of context-dependent grapheme-phoneme connections and bonding of orthographic representations, are not independent. An analogy to chemical boding. This boding idea, I now recognize, is approximately the same concept as Ehri's "amalgamation" of information sources. Ehri especially emphasizes the combining of visual orthographic information with phonetic information in the child's acquisition of word recognition.

The string of letters i-r-o-n is sufficient to trigger a bonded representation (of the word iron) and so is a string of phonemes. The redundancy advantage (from two directions, letters to sounds and sounds to letters) is that redundancy over determines lexical access. The redundancy advantage is important in reading both for bootstrapping the identification of unfamiliar words and for the rapid automatic recognition of familiar words.

In short, the child comes to know more words and to know more about these words. The increase in quantity comes primarily through the acquisition of specific words. The increase in quality is a matter of gains in precision and redundancy of lexical representations. Fully specified orthographic and phoneme representations replace variable and unreliable ones.

Acquiring an Autonomous Lexicon

The functional lexicon represents words so that they can be visually accessed. Beyond this the representation system of the skilled reader acquires the property of autonomy. … The main characteristic of an autonomous lexicon is its impenetrability. How does it acquire impenetrability and what exactly is it that is impenetrable? (Accurate word identification requires this characteristic.)

I propose that the critical events for the acquisition of autonomy are the acquisition of fully specified and redundant lexical representations. Autonomy follows naturally from the acquisition of such representations. … Because the graphic representation has no "holes" in it, it can be triggered by graphic input in a totally deterministic way. The practice that is sufficient to establish the high quality representation is (possibly) sufficient to make it autonomous. A given word moves from the developing functional lexicon to the autonomous lexicon just when it becomes fully specified and redundant.

My proposal then is that the reader's lexicon can acquire impenetrability as a result of the quality of its representation, which in turn is the result of knowledge (orthographic and phonemic) and practice (at lexical access).

Phonological knowledge

Phonological knowledge is clearly critical in skilled reading. The heart of lexical access is the activation of a phonological referenced name code. The issue simply put is whether explicit reflective phonemic knowledge is necessary to learn to read an alphabetic orthography. (Although some phonological knowledge facilitates beginning reading, phonemic awareness is no longer a prerequisite that has to be met (and cannot be met by most children) but an achievement of learning that then facilitates further learning. **The glue for the redundant lexical representation and, perhaps more important, the basis for a fully specified lexical representation comes from phonemic knowledge along with alphabetic knowledge.**

For words, there are both printed segments (letters) and spoken segments (phonemes). Knowledge about the two kind of segments can develop in tandem and probably does in many cases. … Phonemic awareness training does not merely give them access to phonemic knowledge, but it also makes the structure of words clearer.

Conclusion

I have argued that the central theoretical question for a theory of reading acquisition is the development of lexical representations. … The acquisition of a functional representation system entails an increase in the number of lexical entries and an increase in the quality of lexical entries. Quality is a matter of upgrading representations so that they are more fully specified and redundant. Access to this lexicon becomes increasingly word specific as the quality of specific word representations increases. The acquisition of an autonomous lexicon builds on this same functional lexicon by changing the status of specific words to fully specified and redundant. This means that parts of the lexicon can become autonomous very early in reading.

Phonemic knowledge is central to the quality of lexical representations.