

ORTHOGRAPHIES AND READING

Perspectives from Cognitive Psychology,
Neuropsychology, and Linguistics

Edited by
Leslie Henderson

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Introduction

The last two decades have seen a remarkable rebirth of psychological interest in the process of reading. While attention has increasingly been directed to aspects of fluent reading, such as eyemovement control or contextual effects within the sentence (e.g., Rayner, 1983), to a great extent progress has depended on refinement of the experimental analysis of factors that govern the processing of isolated words. This apparently narrow concern with word recognition has turned out to raise a rich collection of questions about the reader's access to phonology and meaning. In this volume these questions are pursued across the range of orthographic systems which written languages exhibit.

Looking back over recent work on word recognition, it seems that two general concepts have served as the focus of inquiry. The first is the notion of a *mental lexicon*, a knowledge base that allows translation between the domains of writing, speech, and meaning. The second is the concept of *orthography*, the graphemic patterns of a written language and their mapping onto phonology, morphology, and meaning.

In the early 1960s, experimental work on the mental lexicon was largely concerned with its role in the visual identification of words. At the empirical level, the word frequency effect attracted particular attention. When Treisman and Morton advanced the idea of word detectors that were tuned by successive encounters with a word so that sensitivity to common words increased, it became possible to envisage an entire system of word detectors whose accessibility was organized according to word frequency. Toward the end of the 1960s the general question of how we gain access to the mental lexicon came to the fore. "How is this stock or store organized,

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arranged, and indexed?” Oldfield (1966) inquired, “and by what means do we gain access to items in it?”

Oldfield was interested in the chronometry of lexical access. The work of Neisser, Posner, and Sternberg in the mid-1960s had led to renewed interest in response latencies as a means of analyzing mental processes. Lexical access, under normal circumstances a largely error-free process, seemed particularly amenable to chronometric analysis. This intellectual climate was peculiarly hospitable to the lexical decision task and in the seminal work of Rubenstein (e.g., Rubenstein, Garfield, and Millikan, 1970) the latency of word/nonword judgments was brought to bear upon two major questions about access: is the lexicon content addressable or does it have to be searched in order to locate an entry? and, do written word forms have to be transformed into a speech code in order to be matched to entries in the lexicon?

Rubenstein neglected to specify in any detail how written words might be translated into a speech code at a *prelexical* stage of processing. To see how this might work we have to have regard to the second general theme, that of *orthography* and, in particular, what an orthography permits and encourages in the way of translation between print and sound. Of course, talk of spelling-sound rules was not new in itself. Students of written language and teachers of reading had long referred at least loosely to such rules. Nevertheless, there was new work to be done on the problem of translation between written and spoken forms and the work that emerged provides a particularly important illustration of the way in which psychological research on word recognition was becoming more linguistically informed.

The groundwork was found in the empirical descriptions of English spelling-sound correspondences drawn up by Wijk (1966) and Venezky (1970). The intellectual background for this work was the spelling-reform movement. Wijk used his tabulation of spelling-sound correspondence as the basis for a proposed revision of English spelling, and Venezky made certain suggestions about how reading instruction might be shaped by the regularities that he described. However, the impact of these descriptive tabulations on experimental psychology was a somewhat different one. Beginning with the work of Baron and Strawson (1976), a series of investigators sought to show that the rules that had been tabulated by the linguists were psychologically “real.” With surprisingly little debate, a convention developed in which the Wijk/Venezky tabulations were used to dichotomize the lexical inventory into a set of *regular* words and a set of *exceptions*. A word was deemed to be regular if and only if its pronunciation was exactly predictable from its spelling, using the most frequently occurring phonetic correspondence for each grapheme in the word.

Many investigators were able to find small, but usually reliable, differences between such “regular” and “exception” words in the speed with

which they could be named. This finding was therefore taken to indicate that the orthographic regularities that had been described by the linguists were actually represented in the mind of the reader and formed the basis of a system of translation rules that could be used in oral reading.

At this point, psychological and linguistic analysis diverged sharply. The psychologists, having decided that there was a psychologically real dichotomy between regular and exception words, incorporated this discovery into the architecture of their models of oral reading. Fundamental to most of these models was a distinction between two processes for assigning pronunciations. A *rule-based* procedure for translating spelling into sound could operate on any word or pseudoword input. However, it would yield an incorrect output for exception words. Correct pronunciation of such words, it was argued, must depend upon an alternative *lexical* route, which specifies the appropriate pronunciation of each familiar word without relying on general rules. Thus, it can be seen the linguistic distinction between regular and exception words does not quite map directly on to the dichotomy of processes in the models. Regular words can be pronounced by means of either procedure. Exception words, if they are correctly read, must be the product of the lexical process. Pseudowords, in contrast, since they are not familiar lexical items, must depend upon the rule-based process for their pronunciation.

Some version of this distinction between a word-specific, lexical process and a general rule-based translation process underlies the structure of a large number of recent models of oral reading. Virtually all the psychological evidence adduced in favour of the two-process dichotomy rests upon the linguistic distinction between regular words, exception words, and pseudowords. The main lines of psychological evidence can be roughly summarized as: (i) faster naming of regular words than exception words or pseudowords, (ii) acquired disorders of reading in which the ability to read aloud either exception words or pseudowords is selectively impaired.

While this convergence of linguistics and psychology has been sufficiently consequential to merit detailed examination, it represents less of a union of general aims than might at first seem. In a reverse of the conventions usually governing such raids, the psychologists were after data (albeit linguistic) and were prepared to supply their own ideas. There is nothing, for example, in the linguistic analyses that compels the conclusion that regularity is a strictly dichotomous variable. Psychologists have merely resolved to treat regularity as a dichotomous variable in their experiments and have used the Venezky and Wijk tabulations accordingly. The questions as to whether regularity is truly a dichotomous matter and, if so, which of the assorted kinds of linguistic rule is available to the reader has been left almost untouched (though see Shallice and Warrington, 1980; Parkin, 1982).

It seems, therefore, that most recent psychological interpretations of

English orthography have treated it as if it functioned for the reader as an irregular system for representing surface phonemes, what is sometimes called a “phonologically shallow” orthography. In this view *regularity* is a simple matter of conformity to type-count based rules for transforming spelling into sound. Any word exhibiting a correspondence which violates the appropriate type-count rule is thereby a member of the functionally homogeneous class of *exception* words and its pronunciation can only be assigned by retrieval of its entire phonological pattern from the lexicon.

So far, I have only discussed linguistic influences on studies of word recognition in terms of the psychologist’s use of the descriptive tabulations of spelling–sound correspondences. However, at about the same time other linguistic analyses, of a rather more conceptual nature, were afoot. This spirit of the time is well illustrated in several of the essays contained in Kavanagh and Mattingly’s (1972) important collection: *Language by Ear and by Eye*. These investigations concerned themselves with such general questions as how orthographies might reflect language, what principles of representation might be employed by an orthography, and what sort of linguistic units might usefully be delimited in an orthographic system. Particular written languages could then be considered against this perspective. The genesis of this work was linguistic. It stemmed from a variety of intellectual antecedents, including historical and taxonomic studies of scripts (e.g., Gelb, 1963), developments in phonological theory (e.g., Chomsky and Halle, 1968), and philological concern with particular writing systems (e.g. Albrow, 1972).¹

If the major impact that the Venezky work had on psychology was to provide experimenters with an authoritative source of stimulus material, the influence of the more general studies of orthographic representation was altogether more theoretically pervasive. One of the first attempts to digest the implications of this work for psychology is to be found in a somewhat neglected essay by Marshall (1976). Here we can find an early expression of two related themes that have increasingly occupied psychologists. First is the question of how universally applicable is the two-route conception of phonological recoding, initially derived from the

¹Another sort of comparison across writing systems that has enjoyed some popularity since 1970 is that of reading acquisition and reading retardation in children confronted with various types of writing system (e.g., Downing, 1973; Kavanagh and Venezky, 1980). In the absence of proper controls, such comparisons have as yet been incapable of supporting any general conclusions. The supposition, for example, that syllabaries may be easier for the child to learn than alphabets because of the child’s more ready access to the syllabic than the phonemic level of speech, seems in principle more likely to be adequately tested in work such as Bradley and Bryant’s (1983) carefully controlled investigation of the effects of phonemic training on young English readers, than in speculations, for example, based on the surprisingly low incidence of reading retardation in children learning to read (syllabographic) Japanese.

study of English readers. Second is the interest in the form taken by acquired dyslexias in readers of various types of writing system.

The wider applicability of the two-route conception has been tested recently on a number of orthographies of various theoretically interesting types. Clearly, it is of great interest to know, for example, whether entirely regular alphabetic orthographies seem to call upon both of the oral reading routes that have been posited for English. The largest body of information on such an orthography has been collected for Serbo-Croatian (see Turvey et al., this volume). This work has also been able to make experimental use of the fact that Serbo-Croat may be written in either of two distinct, but overlapping alphabets.

A different sort of question about alphabetic writing concerns the role of graphemes in the direct addressing of the lexicon. It might, for example, be held that graphemes only function as phonographic signs that serve spelling–sound translation, playing no necessary role as units in the code for direct addressing of the lexicon. This hypothesis is implicit in various wholistic hypotheses about visual word identification, which are subjected to experimental scrutiny in Besner’s chapter later in this volume.

Invariance of spelling–sound correspondences is not the only factor contributing to the straightforwardness of translation between the domains of orthography, phonology, and meaning. Coltheart has argued that languages in which the mapping of graphemes into phonemes is not reliably one-to-one may pose orthographic *segmentation* problems in addition to any ambiguity about the correspondence. For example, the correspondence PH → /f/ can only be assigned if the segmentation process has first determined that PH should be treated as a functional unit. Another factor discussed in Coltheart’s chapter in this volume is the question of whether an alphabetic script contains homophones. In an orthography possessing invariant correspondences, homophones can be readily assigned a correct pronunciation by rule but this processing strategy will not suffice for comprehension, since the phonological code that results is lexically ambiguous.

Earlier in this discussion of linguistic influences, I suggested that orthography and the mental lexicon were the two principal ideas round which psychological work on word recognition had developed. These two themes are brought together in recent investigations of the notion that scripts such as English might yield up morphemic information directly to the reader. Until the work of Taft and Forster (1975), morphology was a neglected topic in studies of word recognition. Taft and Forster’s radical proposal that lexical access was mediated by a morphemic code implied that morpheme detection must take place quite early in the process of stimulus analysis. Their interest in morphology seems to have been largely inspired by the prospect of storage economy achieved by a lexicon organized on a basis of morphemes. Others, however, have been interested in the syntactic