James S. Adelman: Visual Word Recognition Volume 1 – Models and Methods, Orthography and Phonology

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Visual word recognition is a research field in psycholinguistics that studies the perception and identification of individual words. Visual Word Recognition Volume 1 provides a great outline of new models used to investigate visual word recognition, more precisely, lexical decision and word naming. Moreover, the volume includes methodological concerns and further theoretical questions that may rise concerning written word recognition. The book provides a deep insight into the word recognition process, including handedness, processing letters and their proximity, similarity and confusability, and the involvement of the spoken-phonological form of the word. The volume consists of 10 chapters describing every extensive aspect of visual word recognition.

Chapter 1, titled 'Dual-Route Theories of Reading Aloud' by Max Coltheart, exposes a functional analysis which depicts how the stimulus is recognized and what the response is. According to Forster and Chambers (1973, p. 627) the pronunciation of visually-presented words involves some kind of acoustic or articulatory coding assigning to a string of letters. There are two ways in which this coding can be done. On one hand, pronunciation can be identified by the application of a set of grapheme-phoneme or letter-sound correspondence rules. On the other hand, pronunciation can be determined by searching the long-term memory for stored information about how to pronounce familiar letter strings. The chapter also highlights two theoretical distinctions that are critical in research on reading. One of the aggravating factors is the distinction between regular and irregular words. Regular words (e.g. 's**ave**') are the ones that obey the standard letter-sound rules of English, and irregular words (e.g. 'h**ave**') are those that disobey these rules in pronunciation. The other factor is the distinction between consistent and inconsistent strings of letters. A consistent letter string is one whose orthographic body is pronounced consistently in all the words in which it occurs (e.g. 'r**eed**', 'f**eed**'), while in case of inconsistent words the pronunciation varies (e.g. 'r**ave**', 'h**ave**').

In Chapter 2, 'Learned Orthographic Representations Facilitates Large-Scale Modeling of Word Recognition', the authors present how orthographic representation contributes to visual word recognition. Orthographic representations are more than just the visual form of a letter string, since they are invariant to a stimulus' particular visual properties. Children acquire orthographic representations in the context of a given writing system and so orthography is considered to be the first language-specific representation used during reading. The authors also introduce the Visual Word Form Area, which is a cortical area where the function of reading skill concentrates. One of the most accurate simulations of word recognition is the Interactive Activation model. In this model the orthographic layer is connected to a lexical layer, where a separate node represents each known word. This activation model contains four levels of representation units that represent visual letter features, letters, orthographic word forms and language information. According to the Interactive Activation Model, visual letter features and letters are stored in a common system, whereas words are stored in different linguistic subsystems.

As its title suggests 'A Parallel Activation Model with a Sequential Twist', Chapter 3 seeks to demonstrate the parallel activation model. As it was stated in the previous chapter, recognizing a word involves finding a match between a coded version of the input stimulus and an internalized lexical representation. The parallel activation model is based on the Interactive Activation Model, which involves a system in which each letter increases the activation level of every word unit that contains that letter in the correct position, and decreases the activation level of every word unit that does not contain that letter in that position. The word unit receiving the greatest activation is the correct word unit. The approach presupposes that the input letter string is compared with every lexical representation in the lexicon simultaneously.

Chapter 4, titled 'Mathematical Models of the Lexical Decision Task', provides an insight into the theoretical and empirical background of visual word recognition and lexical decision tasks. Mathematical modelling has been an important tool for lexical decision tasks. Besides the Interactive Activation Model the author highlights the Multiple Readout Model, which includes a process, so-called modelling functional overlap, in which the task-specific and the task-independent processes are separated. In canonical modelling, the simplest model is refined into more complex formulations (Grainger and Jacobs, 1996).

Chapter 5, 'Megastudies – What do Millions (or so) of Trials Tell us about Lexical Processing?', is one of the central chapters of the book focusing on the methodology of studying visual word recognition. In cognitive neuroscience, words are fundamental elements. When it comes to the processing of words, what can be taken for granted is that word frequency, familiarity, age of acquisition, imageability, number of meanings, letter length, phoneme length, syllable length, syntactic class, orthographic and phonological neighbourhood must be taken into consideration.

Chapter 6, 'Methodological Issues with Words', is strongly connected to the previous chapter. It examines the pitfalls and obstacles occurring in the process of collecting data. In case of collecting words, researchers must monitor word frequency, contextual diversity, orthographic, phonological and phonographic neighbourhood size. Some further significant factors are spelling-sound consistency, length and morphological properties.

Chapter 7, 'Brain Asymmetry and Visual Word Recognition – Do we have a Split Fovea?', provides an insight into the relationship between hemispheres, handedness and language processing. The anatomical division between the left and right brain hemispheres has effects on visual word recognition. Hence, interhemispheric integration is also needed from the first phases of language processing. One hemisphere of the brain (usually the left) is more specialized in language processing than the other. Previously, researchers assumed that information from words in central vision is transmitted to both hemispheres simultaneously, so this asymmetry has rarely been taken into consideration. However, it is clear for now that there is a difference outside of central vision. Evidence for split fovea shows that people with left-hemisphere language dominance show an advantage in viewing a word to the right of centre. As a consequence, interhemispheric integration is needed to recognize written words when they are presented in central vision.

Chapter 8, titled 'The Front End of Visual Word Recognition', analyses letter-based word recognition and goes into the details of orthographic processing, i.e. how information regarding letter identities and letter positions is processed. In languages that use alphabetic script (not logographic, such as Chinese) to represent written language, printed words are recognized via their component letters. It does not mean that the reader has to identify each component letter before they identify the whole string of letters. But certain words are easier to identify than their constituent letters even if word recognition proceeds via the constituent letters. This is explained in the Interactive-Activation model (McClelland and Rumelhart (1981), which contains four levels of units that represent visual letter features, letters, orthographic word forms and language information. According to this model, visual letter features and letters are stored in a common system, whereas words are stored in different linguistic subsystems. This explains why it is easier to identify a letter embedded in a real word as opposed to letters in non-words.

Chapter 9, 'The Orthographic Similarity of Printed Words', explains the terms 'orthographic neighbours' and 'orthographic similarity neighbourhood', and describes how orthographic similarity can be measured. A similarity neighbourhood is defined as the set of words in the language from which a given stimulus word is indistinguishable after a specified loss of information about the stimulus word. The similarity neighbourhood of a word always includes the word itself (Landauer-Streeter, 1973, p. 120). In case of testing bilingual visual word recognition, researchers might test the orthographic similarity of printed words, as well. A full count of a word's neighbours should contain words formed by letter substitutions, transpositions, additions, or deletions. The chapter also reveals that close orthographic neighbours have an inhibitory effect on the word's recognition time.

Chapter 10, 'Phonology – An Early and Integral Role in Identifying Words', examines the phonetic and most importantly, the phonological background of visual word recognition. In bilingual visual word recognition, eye movements are crucial, as well. Eye movement studies have shown that the phonology of words is automatically activated while words are just outside of fixation in the parafoveal region. Furthermore, ERP studies show that skilled readers have access to multi-layer phonological representations during word recognition, and they also identify information about consonants and vowels, syllables, sub-phonemic information (voicing), segmental and suprasegmental features easily and quite quickly.

To sum up, Visual Word Recognition Volume 1 – Models and Methods, Orthography and Phonology offers an excellent outline of visual word recognition and both its theoretical and practical background. This book with all its 10 chapters is a splendid choice not only for researchers but also for those that are interested in language processing and word recognition.

References

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