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SPELLING

Many modern languages have a standardized written form. Linguists have been interested in the nature of these **WRITING SYSTEMS** and in the faithfulness with which words' spellings reflect their linguistic forms. Psychologists have studied the acquisition of writing and reading and the processes used by skilled spellers (see WRITING AND READING, ACQUISITION OF). Educators are concerned with individual differences among learners, including **DYSLEXIA**, and with the teaching of reading and writing (see TEACHING READING and TEACHING WRITING).

Linguists have often considered writing mere transcription of oral language (e.g., Bloomfield 1933). According to this view, a perfect writing system would represent each word's linguistic form in a complete and unambiguous way. Most existing systems are imperfect by this definition. For example, English is said to be a deficient alphabet because a given phoneme is not always spelled the same way (e.g., /ɛ/ is *e* in *bed* and *ea* in *health*) and the same letter may represent more than one phoneme (e.g., *i* spells /ɪ/ in *mint* but /aɪ/ in *mind*). Even alphabets with more regular spelling-sound correspondences may be deficient, according to this view, because they often fail to represent such linguistic properties as stress or tone.

Noam Chomsky and Morris Halle (1968) and Richard Venezky (1970) drew attention to spelling as a system in its own right. They also drew attention to the fact that the English writing system is more principled than often believed. Some of the irregularities in sound-to-spelling translation reflect a tendency to spell morphemes consistently, even when their pronunciations change. The *a* in *health* and the *g* in *sign* are not pronounced, but they show the words' relationships to *heal* and *signal*. Sound-to-spelling translation also becomes more predictable when a phoneme's position and its neighboring phonemes are considered. For example, /aɪ/ has several possible spellings, including *i* as in *mind* and *child*, *y* as in *my*, *igh* as in *night*, and *i* followed by final *e*, as in *time*. But spellers would not have to choose randomly among the various possibilities if they knew that *igh* tends to occur before /t/ and single *i* before /ld/ and /nd/ (Kessler and Treiman 2003).

Until the 1970s, psychologists did not pay a great deal of attention to spelling. They saw spelling as a process of memorizing and reproducing letter strings. Spelling ability was believed to reflect rote learning ability and visual memory, rather than linguistic skills. For English, this view was encouraged by the widespread belief that the spelling system of this language is capricious and unprincipled.

Things began to change with Charles Read's (1971) discovery that children do not always learn to spell on the basis of rote memorization. Some young children invent their own spellings of words, analyzing words into smaller units and spelling these units in creative ways. For example, a child might spell *wait* as "yat," choosing *y* for /w/ because this letter's name begins with /w/ and choosing *a* for /e/ on the basis of the letter name as well. Or a child may write "chruc" for *truck*, selecting *ch* because /t/ before /r/ sounds similar to the first sound of *Chuck*. Clearly, these children are not reproducing memorized spellings of *wait* and *truck*. Children's ability to generate plausible spellings of words is linked to their phonological skills and their knowledge about letters. It is more closely related to these linguistic skills than to visual memory or general verbal ability (e.g., Caravolas, Hulme, and Snowling 2001). Such findings speak against the traditional view that learning to spell primarily involves rote visual memorization.

Psychologists' views of spelling were also influenced by the **CONNECTIONIST** approaches to language that developed in the 1980s. According to connectionist models, people benefit from patterns that are statistical in nature, not only patterns that are all or none. For example, a computer model built on connectionist principles can learn from exposure to words like *tight*, *sight*, *might* and *time*, *side*, and *mine* that /aɪ/ tends to be spelled differently in different contexts. This is true even though the pattern has some exceptions, such as *cite*. Researchers have demonstrated that spellers are sensitive to these sorts of statistical patterns (e.g., Treiman, Kessler, and Bick 2002). People, like models, can induce patterns that are not explicitly taught.

Spelling ability is linked to **READING** ability, as the connectionist perspective would lead us to expect (e.g., Caravolas, Hulme, and Snowling 2001). However, spelling is more difficult than reading. One reason is that across languages, ambiguity

tends to be greater in the sound-to-spelling direction than in the spelling-to-sound direction. Another reason is that spellers must produce all of the elements of a word in the correct order, whereas readers can sometimes identify a word on the basis of a subset of its letters or on the basis of its context. People who depend quite heavily on partial cues for word recognition may be above-average readers but below-average spellers.

Because good reading does not automatically ensure good spelling, teachers cannot ignore spelling. Encouraging children to invent their own spellings is valuable early on, but they must learn that each word has a conventional written form. They must learn about the principles and patterns that motivate the spellings of their language. Although learners can induce some patterns without explicit teaching, well-designed instruction can speed their learning.

– Rebecca Treiman

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SPREADING ACTIVATION

Spreading activation is a psychological mechanism that helps to explain such language phenomena as concept meaning, sentence production, and text comprehension. This mechanism consists of 1) **REPRESENTATIONS,** such as concepts in long-term memory, and 2) procedures by which representations activate each other through associative links between them. Spreading activation has been an important part of two theoretical approaches to language: semantic network theories and **CONNECTIONIST** theories.

The first detailed account of spreading activation was developed by M. Ross Quillian (1968), who built a computational model of memory consisting of nodes corresponding to **WORDS** and, along with the nodes, a process that traced from an originating node to all nodes connected to it via linking relationships of many kinds. For example, the meaning of the word (or concept) *machine* is found by tracing from it to many other associated nodes, such as *man-made, moving parts,* and *computer.*

Quillian's model was adapted by psychologists to explain many important phenomena, including retrieval time from **SEMANTIC MEMORY** (Collins and Loftus 1975; Anderson 1983). Activation measures the likelihood that a representation will be useful at a particular moment. A representation that encodes an environmental stimulus becomes a source of activation, which then spreads by association to related representations. Spread of activation can be limited by having the activation of each representation decay and by having the activation of a node divided among related nodes. The resulting mechanism explains why people take less time to decide that an item is a word if it is preceded by an associated word. For example, *father* will be more rapidly judged to be a word if it is preceded by *son,* rather than by some unrelated word such as *apple.*

Spreading activation is also an important mechanism in connectionist models of cognition (Rumelhart and McClelland 1986). Activations spread among nodes called *units,* which may be wordlike representations, as in semantic networks, but usually are parts of distributed representations in which the activity of many units together stand for a single word or concept, just as it takes many neurons in the brain to implement a particular concept. The other main difference between spreading activation in semantic networks and in connectionist models is that the links between units can be inhibitory, with one unit reducing the activation of a negatively associated unit. Connectionist models employing this kind of spreading activation have been applied to such language phenomena as **SPEECH PERCEPTION,** learning, and text comprehension (Kintsch 1998).

– Paul Thagard

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STANDARDIZATION

Standardization is not a process that is limited to language. In its nontechnical sense, it is any process whereby variety in practice, being deemed undesirable usually for external reasons, is harmonized (normalized, standardized) (see LANGUAGE POLICY and INEQUALITY, LINGUISTIC AND COMMUNICATIVE). The single practice (*norm* or *standard*) to be adopted is usually worked out by those already in a position of power and is likely to reflect their own preferences and biases. It is then imposed upon others via a range of mechanisms. Thus, standardization takes place in the context of industry, technology, politics, economics, education, and business, to name but a few examples where those in power would wish to normalize practice, nominally for the common good but more often to perpetuate the power structures from which they themselves benefit. However, linguists have tended to set aside parallels with other systems and treat language standardization as a peculiarly linguistic problem.