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A recent study was conducted at Stanford University to determine the degree of correspondence between phonemes and graphemes in English. In past attempts to achieve universal literacy, language reformers have proposed a revised alphabet of one grapheme for each phoneme, a change which anti-reformers have insisted would be costly. Modern linguists, on the other hand, have suggested that the key to spelling consists in understanding the system that determines the orthographic sound-symbol relationship. The computer in the Stanford study classified and sorted 17,310 commonly used words according to a set of rules devised by the researchers for defining the American English language. The results indicated that over 49% of the words could be spelled correctly using phonological clues and that another 36% could be spelled with only one error. Utilizing the findings of the Stanford study, educators can develop a new sequential, structured spelling curriculum that will help students understand the basic relationship between sounds and orthographic symbols in English. (JM)

CUES FOR A NEW SPELLING CURRICULUM

OFFICE OF CURRICULUM DEVELOPMENT

BUREAU OF INSTRUCTION

KENTUCKY DEPARTMENT OF EDUCATION

An elementary teacher of forty years, who had already bumped over new mathematics and the new social studies in his downhill coasting to retirement, had just been told that now his school system would replace traditional language studies with linguistics, an approach he rather imperfectly understood as tedious mathematical exercises conducted in esoteric terms, the culmination of which was to be an eventual agreement between student and teacher that after all is said and done, everything goes. Viewing the whole movement as subversive if not downright Unamerican, he looked forward to the day when the computer would disappear and "the whole mess would come crashing down upon the deserving heads of the linguists." He hoped this would happen before his retirement, he said, so that he could go back to teaching "the real English Language."

While the old gentleman's understanding of linguistics had been badly distorted by his downhill perspective, he had seen clearly one key to the recent acceleration of linguistic science and to its rapid adoption in American schools. If linguists have been able to offer us accurate descriptions of our language, they have been able to do so partly because of the natural maturation of the discipline but chiefly because of modern technological sophistication. The programmed computer, with its marvelous ability to determine the consistencies and aberrations within vast corpuses of language data, has not only confirmed many previously held but unsatisfactorily tested assumptions about language. It has also given linguists startling new insights into the inner workings of this highly complex communication system we call American English.

One of the most significant research projects to be conducted by the cybernetic team is just now beginning to come under consideration of curriculum planners, textbook writers, and classroom teachers. This is the monumental

work in phoneme-grapheme correspondences carried out at Stanford University under the aegis of the Cooperative Research Program of the Office of Education, U. S. Department of Health, Education, and Welfare. Under the terms of their Research Contract Number 1991, Paul and Jean Hanna, Richard E. Hodges, and Edwin H. Rudorf, Jr. set out to determine the degree of correspondence between English sounds (phonemes) and English symbols (graphemes) as these correspondences might contribute to an improvement of spelling instruction in American schools.

What they discovered is that our language adheres much more closely to the alphabetic principle than we had previously thought--that the seemingly chaotic American English orthography is actually a fairly well-defined, predictable system, much of which can be analyzed and taught in terms of its sets and subsets. Only for those comparatively few maverick spellings which stubbornly defy the system should we have to resort to the old system of learning to spelling: memorize a word, practice writing, check with an external authority (the dictionary, the text, momma, the teacher), correct any errors, test, and deposit the visual picture in the memory bank for future withdrawal. In general, this has been the accepted pattern of spelling instruction--to learn to spell each word in the lexicon as the need to use that word arises in the school curriculum or in the intellectual development of the student. Attempts to vary and enliven instruction with group activities (spelldowns, bees, spelling baseball, spelling charades) and games (scrabble, crossword puzzles, word bingo) have provided relief from tedium and frequent triumphs for good spellers but have contributed little to the skill or understanding of poor spellers.

In the published description of the Stanford study, the authors have discussed the implications of their findings for the school program, taking into account current knowledge of the developmental stages of children as well

as new theories of learning and instruction. To understand the potential impact of the study on the teaching and learning of spelling, we have only to look at the state of the art through the fairly recent history of our attempts to achieve universal literacy.

THE REFORM MOVEMENT

Between 1959 and 1961, two professional journals, the Phi Delta Kappan and Word Study, published an amusing if increasingly vehement dialogue between two language scholars over the English spelling system. Helen Bowyer, speaking through the Phi Delta Kappan, opened the dialogue when she voiced her indignation over the "illogical, contradictory, redundant makeshift for a rational spelling that has been put over on our children with all the connotations of the natural, the necessary, the desirable, the approved."[1] At the time Miss Bowyer wrote, the American public was severely chastising American education for its failure to develop sputnik-producing scientists. While its teeth were bared, the public took on not just science education but every other aspect of the system as well. Charges of an all-encompassing illiteracy among American school graduates became the rallying cry for far-reaching, radical school reform.

Miss Bowyer, a retired school teacher, assumed both offensive and defensive positions. Reform was mandatory, she claimed, but it must begin at the very heart of the school curriculum--within the language itself. It wasn't the quality of instruction that had made the difference between Russian and American accomplishments, she contended. The Russians had outdistanced us because the Russian child had the distinct advantage of acquiring his skills of literacy by a "rapid and mind-satisfying assimilation of a self-evident, highly consistent sound-sign relationship." Since each of the thirty-three characters of the Russian alphabet can be counted on to bear the same sound whenever and wherever it appears, the Russian child, Miss Bowyer held, is able to master the

reading and writing vocabulary in three months and then move confidently on to far more sophisticated learnings. The scientific consistency of Russian orthography inculcates in the child a respect for and a lifelong devotion to scientific principles in learning and grounds him in scientific method as a skill in itself. In contrast, Miss Bowyer pointed to our irrational system: twenty-six symbols to erratically represent forty or more sounds, ungoverned by any perceivable scientific principles. Such anarchy at the heart of learning, she claimed, dooms the American child at the outset of his school experience. Citing the chaos of such English language phenomena as fourteen different spellings for "long a," she demanded that reform begin with tossing out the old spelling system and adopting a new forty-unit alphabet comprised of the present Roman letters plus fourteen digraphs of those letters. The alphabet she proposed would represent, in a strict one-to-one relationship, all of the possible sounds of English.

Crusades for spelling reform are not, of course, a post-Sputnik development. Charges that the sound-symbol relationship of the language is hopelessly contradictory and flagrantly defiant of reason have been made since about 1200 A. D., when Orm proposed in his Ormulen a revision of spelling based upon the doubling of consonants. While he made little impact upon the written form of the English language, Orm did begin a long tradition of abortive attempts at spelling reform. Yet, in spite of frequent, sincere, sometimes evangelistic efforts on the part of reformers over 800 years, every would-be reader and writer of English has had at some time--usually at a tender age--to confront this formidable orthography. His degree of mastery is an important criterion of worth in our social values system.

THE CONSERVATIVE VIEWPOINT

Reformers such as Miss Bowyer have always been embattled and beaten back by conservatives such as Louis Foley, who took issue with Miss Bowyer in a subsequent article in Word Study. Abjuring the iconoclasts' lack of interest in "why our words happen to be spelled as they are," Mr. Foley placed the blame for the real difficulty of English spelling on a "built-in quality of the language which lays it open to unlimited corruption of pronunciation, and which seems to have been steadily exaggerated as time has gone on."[2] He went on to point out that the accent pattern of English has seriously affected the misspelling of the unaccented syllables; that our large body of cognates must necessarily retain their difficult spellings because vital associations of meanings would be lost in change; that word families retain their identity through our present spelling; and that such troublesome items as silent e's and doubled consonants do indeed function phonetically. In the manner of "the Battle of the Books," the argument went on, both contenders operating within a centuries-old pattern of liberalism and conservatism in language attitudes.

Individualists though they may be by nature, reformers generally have reached consensus upon a basic rationale as well as a single method for spelling reform. The rationale is that the present Roman alphabet, with its twenty-six graphemes, can never adequately represent the thirty-six (or forty, or forty-six) phonemes or distinctive sounds of English. The method then is to create and adopt a new or revised alphabet in which each grapheme always represents one single phoneme and by which each phoneme is always represented by the same grapheme. In other words, all reformers have aimed to establish a scientific consistency in English orthography. They differ from each other only in the design of the tools through which this consistency can be achieved.

On the other hand, anti-reformers, by nature conservative, have been more individualistic in formulating the rationale for the preservation of the status quo. Some hold, with Foley, that if reform is to take place, it must originate in the realm of pronunciation rather than that of spelling. Others say that the present system provides clarity regarding homonyms and that this clarity would be lost in change of spelling. Some cite the failures of previous reform attempts, using the lessons of history as a basis for today's actions. Also drawing upon history are those who point out that English has never been spelled with a one-to-one correspondence. An attractive and frequently heard argument is that reformed spelling obscures etymologies, many of which are important to our understanding of meaning and to our ease in grouping words into word families. The most amusing argument is based solely on aesthetics: "Phonetic spelling looks so peculiar."

While all of the arguments but the last seem to have a degree of justification, a more convincing argument is a purely pragmatic one: a change in orthography would be inconceivably costly. Consider, for example, the staggering expense of reprinting all of the valuable works in the English language, plus the inevitable loss to scholarship of those documents which have only limited usefulness and would therefore not be reprinted. Or consider the cost of re-educating all of those who have already completed their formal schooling, or the alternative: teaching the new alphabet only as the school standard but providing instruction in our present orthography at an advanced level so that the books and manuscripts of the past will be accessible to those who really want to share in the heritage of learning.

One anti-reform argument is drawn from democratic principles and deserves a thoughtful answer from reform advocates. If we are to have a new spelling

based purely on pronunciation, whose pronunciation will it reflect? The Harvard professor's? The Mississippi gentleman's? The Kansas corn farmer's? And after we have decided whose dialect we will all adopt as our own, so that we can unerringly spell and read the new orthography, which level of speech will we represent? Our pronunciation, as well as our grammatical choices, changes in important ways as we move from one situation to another. Shall our new orthography represent the formal, standard, or everyday situational choices of our representative speaker?

Perhaps the most persuasive of all arguments against spelling reform draws upon the nature of language itself. Language--the lexicon, the grammar, the morphology, the phonology, and even the syntax--changes constantly. To maintain an absolute one-to-one relationship between sound and symbol, would we have to reform the reformed spelling every decade or so to accommodate the inevitable and perfectly natural changes that have taken place?

PERMISSIVENESS--AN ALTERNATIVE TO REFORM?

As admittedly difficult as English spelling is, then, the answer has never seemed to lie in radical reform of the alphabet. Many scholars have suggested instead a change in our attitudes about correct spelling. They cite the idiosyncratic spellings of Shakespeare, Chaucer, and other great artists of the past as evidence that it doesn't matter much how a word is spelled if the "spelling reflects the pronunciation in some adequate way."

It is ironic that those who have advocated this permissive attitude toward spelling have seemed to be totally unaware of the fact that human beings cling jealously to cherished attitudes long after their overt behavior would indicate that a change had taken place in their thinking. Thus, discrimination against minority groups is not removed by Supreme Court rulings nor by federal, state, or local legislation. Discrimination merely becomes more subtle, more sinister,

and eventually more devastating if the prejudice at the base of discrimination is not removed by the slow and difficult process of re-education. In much the same way, our deeply ingrained attitudes about language cannot be removed by edict of the language scholar. Poor spelling has social consequences. American efforts to create a New World culture as self-assured and poised as that against which we rebelled have interpreted language control as evidence of a superior level of culture and have thereby assigned to it the power to open social and economic doors. In a nation that has made a god of literacy and has reinforced by law the social edict that all shall be educated, whether or not they wish to be, we are not likely to decide overnight that Johnny may spell as he pleases, so long as we can figure out what he means.

If, then, we wait for a change in attitudes about correctness to alleviate our spelling difficulties, we may condemn several more generations to language frustration and to a sense of failure. Theoretical democracy is refuted by the practical recognition of an unbridgeable disparity in the distribution of talent and ability. Johnny learns early that all opinions are not equally valid and that all idiosyncratic spellings cannot be equally acceptable in the sight of his teacher.

THE ANSWER SUGGESTED BY LINGUISTICS

The alternative to reform and the alternative to a change in attitude lies in modern linguistic science which, implemented as it is by advanced computer technology, is showing us with increasing accuracy how our language really works, what its systems and subsystems are, and the intricate ways in which these systems interrelate.

Underlying the systems of phonology, morphology and syntax is a yet shadowy system of semology which constantly exerts upward pressures on all

other systems. The writing system--the orthography--is shaped by the systems of spoken English, and if it has seemed less systematic it may well be because it has no identity apart from its accommodation to the phonology, morphology, syntax, and semology of the spoken language.

The key to language power lies in the mastery of the total structure. The key to spelling power lies in an understanding of the system that determines the sound-symbol relationships of orthography.

Every teacher has had students who seemed to be "natural spellers." What we really mean when we say that Susie has an "ear for the language" or that she is a "natural speller" is that Susie has somehow--perhaps miraculously--grasped the structure of the orthographic system; that she has intuitively arrived at an understanding of the intricate sound-symbol relationships in the written language. The child who sits down at the piano and without training plays recognizable tunes, one hand producing the melody and the other touching the appropriate harmonizing chords, may indeed be a musical genius. But there have been musical geniuses who have had to have instruction in the parts of the instrument and in simple musical notation before they could reproduce a single melody on that instrument. The child who plays by ear is merely demonstrating an intuitive grasp of the interacting systems of the music and the instrument itself. After he taps around on the piano for a while, he begins to sense the inner workings of it, how its parts are structured and interrelated, literally, how it is governed by the principle of selectivity. His analysis and eventual synthesis of the instrument's structure and the music's structure may not even have been performed at the conscious level, but his intuitively-arrived at knowledge gives him a power over the instrument that must be taught, step by step, to others.

Occasionally, we see in our classrooms, intuitive mechanics, intuitive mathematicians, and intuitive spellers. The latter have already had access to the structure described by the Stanford study. Our failure to do a better job teaching spelling to all children has been due to the fact that as teachers we didn't have a clear-cut, accurate schema of the spelling system to present to students. For a long time, we have recognized that certain spelling facts occur in pattern in English spelling. Consequently, we have conscientiously called student attention to such rules as "i before e except after c," to other well-known jingles, and to our own private mnemonic devices. We have been reminded by language scholars that historical factors have shaped the language and have found some small comfort in such statements as Jespersen's that if the discrepancies between English sound and English spelling are not rational, they at least rest on historical bases. Others have advised us to build upon the speech habits already well-formed in children--to expose them in the first stages of instruction to the regular core of our spelling with the hope that the gain in confidence will equip them for the arduous battle they must eventually wage with English orthography. The same counsel will often suggest that specialists in the language will supply us with the proper list with which to begin.

THE AMAZING COMPUTER

What we have needed most desperately is not, however, historical reminders, jingles with exceptions, or hortatory, but precise formulation and clear direction, both of which now seem to be within our reach in the very near future. The massive language corpus of the Hanna study has been classified and sorted by the computer according to the fit of 17,310 commonly used words to the algorithm (a set of rules for defining the American English language) designed by the researchers. In Phase I of the research, the team attempted to

determine how many and which of the 17,000+ words could be accurately spelled using no clues but phonological ones. They found that almost half (49+ percent) of the words could be spelled correctly on the basis of such clues. The implication for spelling instruction is that the number of words which must be taught as deviants from patterning is significantly less than we thought.

Another thirty-six percent of the words were spelled by the computer with only one error, and the researchers feel that an examination of these words according to morphological (compounding, affixation, and word families), and syntactical determinants will yield further patterning to correct these single errors.

An interesting comparison might be made between standard lists of commonly misspelled words and the words missed by the computer. For instance, the computer spelled correctly such words as abutment, achievement, apiary, and aseptic; distinguished clearly between such near-homonyms as axial, axil, and axle; handled disagree and dissatisfaction with the appropriate number of s's; and faithfully put two s's on egress while it tacked the essential e on finesse. On the other hand, it goofed on such seemingly simple words as wheel, threefold, fleet, sheet, and teacher; had a bad time with almost all unaccented syllables containing schwa (an indistinct vowel sound used in unstressed syllables); made five errors each in spelling necessarily and unnecessarily, sufficiency and insufficiency; and shamefacedly coughed out shaimfaest for shamefaced. One of its most exotic errors was braecuauter for breakwater; one of its most understandable ones, fisasist for physicist. Like the good American English speaker it was trained to be, it didn't record a single "ph for f" word accurately.

It is important to note that the algorithm coding format included the position of phonemes within the syllable (initial, medial, or final position)

and the stress of the syllable itself (primary, secondary, or unaccented). The position of the phoneme in the total word was also indicated, as was environment (such as "preceded by /s/ and followed by /v/" or "followed by /r/"). Finally then, the computer was asked to select from the possible graphemic options for each phoneme in the word to be spelled according to the phoneme's position in the syllable, the degree of stress, and the environment. The design of the algorithm itself suggests possible groupings of sets and subsets for spelling instruction and clarifies the range of determinants for graphemic choice.

A SUGGESTED SEQUENCE

The average child enters school with the most important skills involved in spelling already under control: he has learned unconsciously to hear and to distinguish between sounds accurately, and he has learned to recognize the importance of their order in the stream of sound. Learning the relationship of sound to symbol--that symbols do not indeed <u>have</u> sounds but that they represent sounds--is his first conceptual task in learning to read. To spell, he must build upon this understanding of relationships and in addition learn the graphemic options available to him for each of the phonemes. Then he must recognize the influence of stress, position, and environment upon his choice from the options available. To gain real spelling power, he must develop the higher level skill of grouping according to distinctive and contrastive patterns and features. Once the regular phonological patterns of the most frequently used words in the lexicon are mastered, he is fully ready to attack words by considering their morphological aspects. Compounds, affixation, and word families derived from common roots create new patterns within themselves. Finally, if he aims at perfection, he will simply have to memorize that comparatively small group of words that resist reason--those words in which the Stanford researchers could find no phoneme-grapheme correspondences. Unless he is supremely self-confident, he'll keep a good, up-to-date dictionary readily accessible.

The overarching purpose of the Stanford team was to determine the extent to which American English orthography approximates the alphabetic principle, or a one-to-one relationship between sound and letter. The conclusions of the team were that the alphabetic principle controls or exerts strong influence upon the spelling of the majority of English words and that many of those which do not adhere to the alphabetic principle are influenced, in patterned ways, by morphology and syntax.

To intelligently implement the sequential spelling program suggested by the findings of the researchers, the teacher himself needs to have a degree of linguistic sophistication. Until quite recently, much of the literature of the linguists was, by its theoretical nature, inaccessible to the non-linguist. At the present time, however, professional literature bridging the gap between linguistic scholar and teacher in the classroom abounds. Textbook companies have sought out and found competent linguists who are willing to examine the implications of their own knowledge for language learning in the schools and to structure new programs accordingly. And colleges and universities are hiring linguists to conduct classes, institutes and workshops to bring language teachers and language instruction in tune with 20th century knowledge about language.

SPELLING AND ITS SOCIAL CONSEQUENCES

Society has assigned to spelling a high priority as a language skill. If linguistic knowledge can contribute to more effective instruction in spelling, we owe it to Johnny and Susie to make it available to them. John Algeo, who has, at another point, stated that it would be sensible to let everyone decide for himself how a word should be spelled, grudgingly joins the conformists among us to outline the school's responsibility:

> Correctness is determined by generally accepted usage. A spelling is not correct because it is listed in a dictionary; it is listed

> in a dictionary because educated people use it. Moreover, spelling correctly, that is as educated people generally spell, is not a sign of intelligence or of moral integrity. In fact, it is a sign of nothing except that one has learned to spell like other people. In the light of eternity correct spelling is somewhat less important than a disposition of the soul to charity, but in the light of this world, it has its own importance. We need to teach our students that the reason for correct spelling is altogether a pragmatic one. It may not be fair that a man's intelligence, background, and character should be judged by the way he puts letters on paper, but that judgment is often made. Every young man who wants to graduate from school, get a job in management training, and be made a vice-president with a secretary to spell for him needs to spell his own way through the lower steps on that ladder leading to the great American dream. Mastering English spelling seems to be such an arduous task that those who have more or less succeeded have a vested interest in seeing that everyone else goes through the same experience and are likely to be rather unpleasant about shirkers. The fact of group prejudice is the only honest reason for teaching the pecularities of our spelling. It may not be an intelligent reason, but it is a real one.[3]

We have now the tools for making the task of learning spelling less arduous and the rationale for requiring such learning of all children more honest. We have also new and important knowledge about developmental stages of the child and a new body of theory focused on the nature of the learning process. The new spelling curriculum then can be a temporal and spatial grid. The concepts, skills, and behaviors--the spatial dimension--which constitute spelling mastery can be arranged into the sequence suggested by the structure of English orthography. The temporal boundaries will be consistent with the developmental stages of the child, literally, with the nature of the individual learner. It may well be true, as Bruner suggests, that any concept stated in its simplest form may be learned at any age, but the development of the child suggests that certain types of learnings may be both more meaningful and more useful to him at certain stages than at others. The content of the spelling curriculum, as suggested by the findings of the Stanford researchers, may never make perfect spellers of all students, but in the hands of sophisticated curriculum designers, it can be fitted into the school program in a structured, sequential way. Finally, we may have to resort to the old one-word-at-the-time learning for the

comparatively few mavericks that defy patterning and categories.

FOOTNOTES

[1]Helen Bowyer, "It's Not Johnny," Phi Delta Kappan, 40(June 1969), 378-380.

[2]Louis Foley, "Upsetting the Alphabet-Cart," Word Study, 35(April 1969), 1-5.

[3]John Algeo, "Why Johnny Can't Spell," English Journal, 53:3(March 1965), 209-213.

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