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Problems that Face Research in the Design of English Spelling

Writing systems are an essential element of modern communications technology, English spelling is therefore a legitimate subject for research and development to improve it. Setting up such research faces problems including: the definition of an 'optimum' spelling, issues of models, methodology and experimental design. Barriers include unawareness of the importance of spelling for literacy and ignorance of how improvements have been made in the writing systems of other modern languages. Empirical exploration has been prevented by the historic unquestioned assumptions of spelling reformers and their antagonists, such as that one-to-one sound-symbol correspondence is the only possible

alternative and that the preferred method of armchair argument renders research unnecessary. Spelling design remains a field for pioneering research and for re-analysis of existing research which would benefit cognitive and reading theories and be of practical benefit for international use of the English language. We do not yet have a user-friendly English spelling for experienced readers and writers, learners of English as a second language, the educationally disadvantaged and handicapped and for computer transliteration and cross-lingual communication.

English spelling is part of the technology of visible language as much as the characters, the typeface, the layout and the linguistic conventions of writing. Therefore, like all other inventions in the technology of communication, it is legitimately subject to research and further development. Language planning for many other modern languages includes active concern for improvement of their writing systems. English will soon be the only major modern language that has not made drastic or minor improvements to its orthography within the last hundred years, since even in France, some minor changes are currently on the way.

The underlying rationale of all research and development in the modern age is that anything can be improved. That is, regardless of how efficient English spelling is now, research may be able to improve it, to make it even more user-friendly. Many would claim that it is not efficient. There is strong evidence that conventional spelling is not learner-friendly for most English-speakers when they are learning to read and write.¹ There is abundant proof that its unpredictable deviations from a basically consistent system make learning to read and write even more difficult for the handicapped, socially disadvantaged and learning-disabled in the community. It makes reading more difficult to teach than it need be. It is unnecessarily difficult for learners of English as a second language to learn both the spoken and written forms. It is still controversial whether the features of English spelling which handicap other users and learners are actually valuable for skilled readers—research has yet to demonstrate whether this is so, or whether on the contrary they have some responsibility for the low proportion of skilled readers in our society. International comparisons show that the great Anglo-Saxon financial investment in literacy should be far more effective in reducing our severe problems of literacy and semi-literacy. The average length of time to reach

independence in reading is three years instead of eighteen months. Fashions in teaching reading change continually because none is effective enough—a ‘phonics’ approach that can be set out in a quarter page in Italian requires 218 pages in English—and many other countries have no need of ‘spelling lessons’ and well-thumbed dictionaries or spellcheckers to correct adults’ spelling in offices. As a teacher, my commitment to spelling improvement began when I gave a backward ten-year-old a page of text with ‘no spelling traps.’ He began, stumbling, shifted to a gallop and at the end cried in surprise, “But I could read that!”

But any research that seeks to find the best possible spelling for reading in the English language faces problems which need to be set out clearly. There are competing assumptions and models in relevant theories, problems of measurement which must be overcome in critical investigations, and there are the problems of attitudes which must be considered in all human engineering to design and implement innovations. International comparisons are needed, but face the problems of multiple factors to consider. For example, are there features in Japanese orthography that English could learn from, or are social and educational factors the main reasons for high Japanese literacy rates and the competitive efficiency in reading and writing that many Japanese can reach in a writing system that seems so difficult for foreigners?

Criteria for an ‘optimum’ spelling for the English language are that it must be a best fit to the nature of the language itself and to the needs and abilities of many types of users and learners—native speakers and second-language learners, readers and writers, those literate in current spelling and those learning the new, the able and the handicapped, humans and computers. It is desirable that English spelling reform should be backward-compatible with our heritage of print—although this may not be essential, since up to ninety percent of what we read will have been printed or reprinted within the past ten years. It is also possible that at some time there may be a breakthrough to an international symbol system that can cross languages, like Chinese but without its disadvantages.

Spelling design and the target for literacy

Options in spelling design depend upon decisions about where to set the cut-off point for educability in literacy. Our Western education policy is that all educable children must be taught to read. Politically, literacy is a universal right. Yet most adult readers are in many

respects still continuing learners, not expert readers, so that mass print media tend to be pitched for a reading level around nine years old. There are now claims that only a small elite need to be literate for society to function adequately,² and that it may be a waste of funds and energy to try to teach or to 'remediate' the large proportion of adults and children in the population who at present appear incapable of full print literacy. Indeed, as the word 'literacy' is extended to cover visual comprehension of electronic and film media, print may seem less necessary even in schools. A critical question, then, is whether it is more important that an orthography should be optimum for use by the skilled elite although possibly complex to learn, or learner-friendly and simple enough so that the mass of the people can be at least functionally literate. To be universally accessible, a spelling system must also suit the great range and variety of individual differences. Is a successful compromise possible, or could 'one size fit all'?'³

The answer is not simply sound-symbol correspondence

Ironically, the four-hundred-year old history of attempts at English spelling reform has created barriers to research. Because this history has typically consisted of speculation, argument and promotion of hundreds of hopefully ideal systems with limited empirical research and many unquestioned assumptions, plans for scientific research on spelling design have tended to be too quickly dismissed as equally forlorn and ill-judged. There has been an assumption shared by reformers and anti-reformers alike that the only possible way to improve English spelling is to return to the original alphabetic principle of one-sound/one symbol with 'spelling as you speak.' This is attractive in its apparent simplicity but it would be daunting in its real complexity, since the English language is both morphemic in nature and multi-dialect in its worldwide extent. Yet some reformers, convinced that they have the answers without requiring objective testing, have regarded proposals for empirical research as a deliberate delaying tactic to ensure a diversion of effort that will have no practical outcome.

Opponents have also argued against research on the ground that the failure of hundreds of past reform attempts proves the futility of any further investigation. However, a history of frustration and often ridicule has marked many other human endeavors—such as the centuries of attempts at human flight and even the recent experience of the introduction of metrication. More ironically, it used to be said—up until the fifties—that spelling reform had about the same chance

as a man going to the moon. Such arguments have shown ignorance about the number, extent and nature of successful recent reforms of the writing systems of other languages.

Research methods and models

The usual dilemmas of experimentalists apply to spelling design research. The more rigorous and unexceptionable the experimental techniques, the greater the risk of trivial and irrelevant findings. The more important the issues that are tackled directly, the more vulnerable to criticism the methods are likely to be.

Research must check that an orthography is linguistically suited to represent a particular language. It must consider the abilities and needs of people who must learn and use the system. Directions that are based on the capacities that are found to be required for reading in standard English spelling may be misleading if applied to the design of reading a system that differs in consistency, relationship to the spoken language or other features. Naturally, skilled readers in English today will be found to use the strategies that they have developed to cope with or avoid standard English spelling as it is now—and those strategies may be less efficient than might be possible if the orthographic medium set fewer problems.

The design of optimum spelling requires an understanding of *how* people read. One problem is that our theories of reading processes have tended to assume that all findings of English-literacy research are universals, rather than perhaps only applicable to readers of contemporary English spelling, who have had to devise their own stratagems to cope with it. This is one reason why, although there is some agreement, cognitive psychologists still disagree on whether reading processes may be diagrammed in boxes with arrows and described in terms of direct routes and parallel processing, or whether a more organic network model is required with concepts of intensity, range and transformations of information. The first is understandably easier to conceptualize in detail, to simulate in computer modeling, and to test in straightforward experiments on recognition of single words. Such experiments can be carried out in laboratories with rigor, control and sophisticated technology. However, this narrow focus is open to criticisms of neglecting crucial aspects of reading continuous text. Findings from looking at words in laboratories cannot be simply extrapolated to the reading that most matters in every day life, because this involves different reading materials and different purposes and strategies and processes, over and above the elements

that reading words and reading text have in common. There are basic questions here which psychoneurological research can be expected to illuminate.

The essential task of reading is to comprehend meaning and the most efficient spelling system would facilitate readers' competency in this task. However, comprehension of the meaning of texts goes beyond mere input encoding or output decoding of single words, and so it is harder to measure than simple speed or accuracy of word identification. Assessment is difficult, since the reader's purpose may not match the questions set by an experimenter. The reader who wants to find out why an expedition went to Antarctica may not notice or recall the color of the tent-pegs. Even in 'objective' experiments subjects can vary in the degree to which they make trade-offs between speed, accuracy and understanding.

The effects of practice may be delayed, and not immediately available as findings of experiments. These effects may also not appear in the original categories of responses set out by the experimenter, but at another level of learning.⁴ Unexpected or generalized outcomes may be overlooked in post-test assessments.

Findings can be a function of the method of measurement — particularly in studies of attitude. It may be invidious to select what factors should be controlled for, and it may prove difficult to match subjects on more than a few variables, or to control a set of test items on all factors. Explanations for results may be multiple and even conflicting. For example, a reader may read fast because she is fluent and has reached automaticity, or because she is bored, uncomprehending and skimming or skipping. Findings in research on levels of skill in reading novel spellings may be contaminated by subjects' interest or irritation aroused by the novelty or by preference for what is the more familiar.

Reading processes are affected by word-familiarity, length, syllabic composition, abstractness/concreteness, readers' background knowledge, socio-cultural factors, individual differences and age of acquisition, as well as by the writing system under investigation. Reading the gestalts of compact Chinese logographs with their multiple semantic, pictorial and phonetic clues is rather different from even 'whole-word' recognition of linear strings of letters that are a 'linguistic guessing game' of their own, to use Goodman's description of reading in English.⁵ Other factors in the text itself include content, context,

typeface and layout. Studies often assume that all subjects will use the same strategies, but this can be mistaken. Exactly what is being measured may be uncertain or there may be false assumptions about it. For example, a subject in an experiment may insist on rejecting a string of letters as a word because the spelling is wrong even though the instructions have been to reject it only if it cannot be identified. Some 'misspelling' may be more acceptable than others. Some experimenters' classifications of spellings may not match with others—so that to assess any experiment it is essential to see the letter-strings actually used in an experiment. For example, one experimenter classified "government" as a word in the same category of variation as "frait" and "fruat." In experiments on deletion of letters surplus to the representation of meaning or pronunciation of words, the identification of the 'surplus' letters must at first necessarily be ad hoc, based on principles, for lack of evidence. In later research, the word lists can be greatly improved, based on the findings made earlier.⁶

Control for other factors related to literacy may appear difficult—such as cultural and educational differences, problematic 'culture-free' common tests, shifting criteria for literacy and the need for common baselines. There can be unexpected problems in comparison of bilingual students studying in two orthographies; American Hispanic students may do poorly in tests in their native Spanish because of feelings that it is culturally inferior.⁷ However, as interest extends in this field of research, problems of methodology are being overcome, as in the careful studies of Stevenson et al comparing the reading achievements of Japanese, Taiwanese and American.⁸

Once experimenters have clarified their assumptions and decided on a particular line of investigation, many experimental topics and research paradigms come quickly to mind.⁹ They need not all be sophisticated and expensive. In 1908 Huey published his classic on the psychology of reading, with interpretations which still in general stand today, showing how much was already gained from single-case and small group studies, introspections, pocket-watch measurements, acute observation and clear thinking—that is, simple studies can still be very useful.¹⁰ And today increasing sophistication of computer-driven research methods makes many problems of research in spelling that were once methodologically formidable now within the scope of even undergraduate experiment. Classroom as well as laboratory experiments can test which orthographic distinctions for homophones are necessary, and the value of con-

sistently spelled morphemes or grammatical markers. Designs such as masked priming can investigate whether sequencing and other habitual errors of poor spellers extend to the mental representation of the word that will prime the conventional spelling. Computer simulation is developing fast as a method of exploring mental processes, although computers still do not match the human brain in its particular weaknesses and strengths, such as slower learning, greater tolerance and capacity for error and more flexible pattern recognition.¹¹

I am particularly interested in longitudinal studies—of how quickly established readers as well as dyslexics could adapt and improve reading skills, of the more efficient teaching methods that could be utilized if English spelling were not unpredictable for learners, and of the more efficient reading strategies that could be acquired. Video and television now make possible cheap mass testing for the value and acceptability of modified spellings—for example, whether modified subtitles can be read faster and by a wider audience—and this would be my method of choice.

The objective research required to test current assumptions and arguments needs to be multidisciplinary, and to integrate specialist investigations—although cross-disciplinarians who attempt overviews may still risk forfeiting the respect of those very specialists whose assistance is most necessary to prevent oversimplification or overgeneralization through insufficient expertise. The evidence that comes out of psychological laboratories and classrooms could eventually be validated by neuropsychological reductionism on the one hand and the demonstrated efficiency of an optimum spelling on the other.

Research on spelling-modified English has on occasion been faced with the ethical objection that subjects, particularly children, will be stressed by experiments that ask them to play with spellings on a computer. This would be an ironic comment on how educators perceive the intellectual delights of English spelling, but it is possible that it reflects the anxiety of the assessing committees, who may be feeling consciously or unconsciously the English spellings are icons to reverence, not to touch.

Issues to address in research

Exploration of different possibilities for English spelling modification must have sound bases in theory and existing research. Novel

Riting systms ar an esential elemnt of
 modrn communications tecnolojy, and
 english spelng is therfor a lejitmat
 subject for reserch and developmnt
 to improve it. Setng up such reserch
 faces problms. These include the
 definition of an 'optmm' spelng, and
 issus of modls, methodolojy and
 experimentl desyn. Barirs include
 unawarness of th impor- tnce of
 spelng for litracy, and ignorance of
 how improvemnts hav been made
 in th riting systms of othr modrn
 languajs. Empiricl explration
 has been preventd by th historic
 unquestiond asumtions of spelng
 reformrs and ther antagnists, such
 as that one-to-one sound-symbll
 corespondnce . . .

The article abstract is transliterated into
 Upwards' Cut Spelling¹ which takes the
 removal of surplus letters as far as
 possible. Like Yule's original version of
 1981, it removes letters irrelevant to
 pronunciation, but takes as far as
 possible the removal of letters represent-
 ing post-accentual schwa, substitutes <y>
 for <ig> when pronounced as long <y>,
 and uses <f> and <j> consistently for the
 sounds they normally represent.

alphabets would have little practical chance in today's world of the international use of the roman alphabet, and simple phonemic spelling systems fail to meet the needs. Failing a brilliant international breakthrough to represent visual language, modifications to clean up the present system may be the most pragmatic approach, for example, deletions of surplus letters in words (but on what principles?), increasing consistency of a modified alphabetic principle and 'making English spelling more like Chomsky says it is, particularly by clearer morphemic relationships.'¹² (See figures 1 and 2.) Improvements of the present roman-arabic alphanumeric system are also desirable to reduce confusability and increase legibility.

An essential task for research in spelling design is to find out how readers respond when they first meet novel spelling modes. Easy and rapid adjustment is important for practical reasons, so this must be ascertained before the introduction of any backwards-compatible modification of existing spelling, to avoid disruption of habits for those already literate. Yule and Greentree (1986) have compared readers' immediate responses to four possible types of spelling change.¹³

Predicting benefits of change

There would certainly be benefits for writers and young learners if the spelling system bore a more consistent relationship to the spoken language, but it would be speculating to quantify these benefits in advance of the research to find this out. Such research might weigh the many factors involved and make informed guesses of the financial advantages. These would certainly far outweigh the costs of introduction of a modification such as, say Surplus-Cut spelling (*figure 2*), which could be brought in through dictionary acceptance as alternative spellings and through the technology of computerized printing. Hundred of words today already have alternative spellings and the simpler are winning out.

It is also important to investigate what long-term benefits there may be for the skilled reader, although efficiency developed over time is difficult to measure. At first, and for a period, skilled readers are likely to recognize faster whatever they have been reading since childhood rather than what is novel. That is, immediate reader-response is not sufficient evidence about whether a novel or modified spelling will be more efficient in the long run. Skilled readers may be slow to respond to even the most potentially beneficial change since their standard spelling repertoire has had thousands if not millions of presentations.

Writing systems are an essential element of modern communications technology, and English spelling is therefore a legitimate subject for research and development to improve it. Setting up such research faces problems. These include the definition of an 'optimum' spelling, and issues of models, methodology and experimental design. Barriers include unawareness of the importance of spelling for literacy, and ignorance of how improvements have been made in the writing systems of other modern languages. Empirical exploration has been prevented by the historic unquestioned assumptions of spelling reformers and their antagonists, such as that one-to-one sound-symbol correspondence . . .

The article abstract is transliterated into 'Surplus-Cut' spelling which omits letters surplus to representation of meaning or pronunciation. <qu> → <q> (=kw/), <ph> → <f>, soft <g> → <j>. The text undergoes a five percent reduction. Modifications could be extended to take account of considerations such as morphemic relationships, grammatical markers and the needs of international communication.

They have developed strategies to cope with faults in the present system. The majority of the population, who are less skilled readers, may show benefit more quickly because they have had less practice in that system. However, the skilled readers are also likely to have more versatile reading strategies and greater natural language skills that will enable them to also take advantage of improvements in the written representation of the language without any significant disruption.

The period of adjustment may be shorter than pessimists predict, although for some aspects longer than experiments can easily cover. Overseas examples of international reform and of other major orthographic changes this century demonstrate this. We can also observe how quickly new vocabulary enters a skilled repertoire and how rapidly it is possible to adapt to reading in unfamiliar languages and writing systems. We can observe the features of foreign spelling systems that English-speakers find most easy to comprehend for use in reading and speaking. And in spelling-modification experiments it can be seen what practice effects from experiments may be still operating in follow-up (e.g., Kolers, 1975).¹⁴

Another issue is the relationship of initial learning strategies to final skilled reading and writing. Most of the extensive existing research on the development of children's reading strategies assumes conventional English spelling and existing methods of teaching reading. Children learn to recognize logos before they can actually read the words in the sense of being able to recognize them in different print, so this stage is not an argument for believing that logographic recognition is how children can learn to read with linear letter-strings, since these soon become confusable without other means of differentiation. Research is now demonstrating not only that children with phonological skills learn to read sooner, but that other children can be shown how to develop those skills in pre-school language play. It is also clear that movement to automatic visual recognition takes place with reading practice, as words become familiar, regardless of initial strategies. But some understanding of the spelling system is still required for accurate reading of new vocabulary; and phonology is still involved in the short-term memory processes that enable us to retain in mind what we are reading long enough to follow its meaning from the beginning to the end of a sentence. The ideal spelling system would facilitate this flexibility in processing.

Methods of learning to read an alphabetic writing system have been influenced internationally by English-language methods of teaching

that have had to take unpredictable spelling into account.¹⁵ Hence the unnecessary dreariness and distaste built up for phonics-based teaching and the attempts to use whole-word and guessing-by-context strategies instead. John Henry Martin's adaptation for American children of Paulo Freire's technique for teaching peasants to read is a forerunner of future possibilities for the teaching of reading with a more consistent spelling system.¹⁶

An orthography to meet all the different needs that have been labeled as 'dyslexia' would need to be proved against a range of perceptual and linguistic disabilities. There is growing evidence that the specific difficulties of dyslexics are a continuation of the difficulties of all beginners, which other learners in time overcome.¹⁷ Long-term dyslexic status can result simply from unresolved initial confusions. This could be prevented by an initial spelling most suitable for learners that would merge into the orthography most suitable for skilled adults, along the lines pioneered by Martin's *Writing to read* program.

Fears are sometimes expressed that subjects who read modified spellings will become disadvantaged in their own conventional spelling—with examples cited of children who learned to read in the Initial Teaching Alphabet and then tended to spell phonetically because this continued to come more naturally. Research is needed to test whether, contrary to this fear, improved initial spelling might be of advantage to poor learners in enabling them to read conventionally when otherwise they might fail, because the initial spelling can lead directly into the underlying system for traditional spelling that they at present fail to comprehend. The Yule and MacKay experiment⁴ suggested, though replication is required, that practice in reading Surplus-Cut spelling did help poor readers to read conventional spelling more easily.

Research is needed to follow-up learners of initial learning spellings beyond schooling into adulthood, to find whether their easier introduction to reading has facilitated their reading as adults. It is also plausible, but needs confirmation, that literate adults can 'switch spellings' in the same way they can switch to changes of font, lettercase or language. Research is required to establish whether Serbo-Croatians are really untroubled by their extreme form of diglossia. Certainly veteran spelling reformers have no difficulty in switching from everyday reading to reading in their own schemes; it has become an automatic process for them.

Existing sources of research evidence

Findings of existing reading research could be applied and data re-analyzed from the new perspective of orthographic design. Yule's cross-disciplinary review of relevant research⁵ indicates the extent of these untapped resources. More detailed studies are also needed of the effects of orthographies and orthographic reforms in other countries. In modern Korea, widespread illiteracy in the 1940s has given way to a claimed ninety-nine percent literacy rate, contemporary with the transition from Chinese script to a remarkably ingenious and original Korean orthography. How great was the contribution of this orthography to the dramatic improvement in literacy? Script reforms have also accompanied other dramatically successful literacy campaigns in other countries, such as Turkey, 1920s Russia and Indonesia, and their specific contributions to facilitating literacy should be assessed.

Problems of attitudes

Some literate people feel that as far as they are concerned, spelling reform is undesirable, unnecessary and impossible. Some feel what the British Prime Minister, Harold Macmillan, said to the reforming journalist William Barkley, "You convince my head but not my heart. But you are surely right." I find that the less literate are usually enthusiastic—but they do not have a voice because they cannot read or write well enough.

Meddling in spelling can be regarded as risky by those who do not understand how it works. Our spelling is taken for granted like the air that is breathed once was, but most people are as ignorant about its nature and structure as they have been about the atmosphere. Spelling is often confused with the language itself, rather than recognized to be simply a tool to express language. Deliberate change is therefore expected to be deplorable and unsuccessful, since to meddle with the natural flowering of a living language is vain and impudent.¹⁸

A common belief is that the historical development of English spelling has been a natural phenomenon untouched by deliberate or accidental human agency. "Nature knows best" means that English spelling must have developed naturally to be the best possible. So-called natural forces in human affairs do not necessarily maximize what is most beneficial, or get rid of disadvantages without human aid. The most common forms in spelling and grammar are the most irregular, not because irregularity has been a progressive and helpful development, but because their constant use maintains their obsolete forms.

In Nescioubia, 'a good many mathematicians admitted in theory the superiority of the Arabic system, but denied the possibility of its application to Nescioubian problems. Others, more independent, thought the change might very conceivably be advantageous, but declared that it should come about spontaneously, without concerted pressure from any self-constituted body. The Arabic numbers, apparently, were to silently steal in without anybody noticing them. Others still conceded that the substitution might perhaps be assisted by conscious effort on somebody's part (not their own) but stoutly maintained that it should be effected, if at all, very gradually, by the adoption, let us say, of one Arabic figure in a generation. The number nine, they thought, might be a good one to begin with, as it is written in two ways, IX and VIII, neither of them wholly convenient in complex computation.

Not all mathematicians, however, were so revolutionary. Some were convinced that the introduction would destroy at one blow the philo- sophic spirit of their science. How, they asked, could one speculate on the fourth dimension unless four were written IV? What impression would their beautifully elaborated deductions make if they were associated in the students' mind with a horrid Arabic 4? . . .

The conservatives began to be alarmed, especially the manufacturers of those ponderous tomes of numerical reference tables which the Roman notation renders indispensable. In self-defence they enlisted the services of an eminent pedagogue, who proved by a series of psychological experiments that children can perform long division more rapidly, more correctly, with less mental strain by the use of Roman numbers than by the use of Arabic . . .'

Excerpt from
Charles Grandgent.
1964. *Numeric
Reform in
Nescioubia.*
Recreated from
*Spelling Progress
Bulletin*. 4:3, 5-6.

Grandgent's conservatives waxed even more eloquent on the threats to continuity of mathematical thought, and how, if we lost sight of the fact that four presented itself to the Roman mind as five minus one, we should be cut off from all contact with our ancestors . . .

Reactions to innovation

Adults who have grown up accustomed to the appearance of English in print find any change at first either disturbing and irritating or a charming novelty. The human desire to preserve forms has a cementing effect in society that is generally positive, but sometimes stultifying. The fact that almost everything else in our society is changing rapidly makes it understandable but ironic that such a surface manifestation of our culture should remain so highly valued because it is visible, while deeper realms of a humane and rich civilization are being abandoned and even forgotten. Similar resistance, with varying degrees of success and persistence, occurs in almost every country with an established orthography when changes are mooted. For example, Indians reject the roman alphabet as an alternative, supplementary script for the many scripts now in use for Indian languages, although its use would solve many serious internal problems and facilitate international communication. There was a 500-year rearguard battle in the West to retain roman numerals in the face of the advantages of the innovation of arabic numbering. Yet the importance of efficient symbol systems is shown in the tremendous advances that only have been made possible in mathematics and industry by the adoption of arabic numerals instead of the clumsy classical roman system. Thinking may be blocked if graphemic symbols require too much central processing to operate on them.¹⁹ While the satirical parable, Numerical Reform in Nescioubia,²⁰ imagines a society still dedicated to retaining the roman numerals (*figure 3*), Mark Twain's account of Spelling Reform in Ancient Egypt²¹ (*figure 4*) extends the parable further into spelling.

Fear of the consequences of change may be justified. There has hardly been any invention intended to benefit mankind this century that has not been abused and even worsened the human condition in unexpected ways—explosives, nuclear power, pesticides, television, computers, modern drugs, the gasoline engine, irrigation, the green revolution—an endless list. What unforeseen consequences may result from the apparently harmless intention to promote international English and national literacy? The old scientific Luddites are not entirely to be dismissed. As a result of these attitudes and fears, while research and development of all other tools of modern communications technology thrive and are never labeled 'reform,' this quasi-political label has been applied to all research and development approaches to English spelling. While estimates of the amount of writing on reading in English this century ranges from 50,000 - 100,000 books and articles, the ERIC

Uncle Cadmus went to a fresh blackboard and wrote upon it in hieroglyphics: At this time the King possessed of cavalry 214,580 men and 222,631 horses for their use; of infantry 16,341 squadrons together with an emergency reserve of all arms, consisting of 84,946 men, 321 elephants, 37,264 transportation carts, and 28,954 camels and dromedaries.

It filled the board and cost him twenty-six minutes of time and labor. Then he repeated it on another blackboard in Italian script and Arabic numerals and did it in two minutes and a quarter . . .

Uncle Cadmus sat down, and the Opposition rose and combated his reasonings in the usual way. Those people said that they had always been used to the hieroglyphics, that the hieroglyphics had dear and sacred associations for them; that they loved to sit on a barrel under an umbrella in the brilliant sun of Egypt and spell out the owls and eagles and alligators and saw-teeth . . . and weep with romantic emotion at the thought that they had at most but eight or ten years between themselves and the grave for the enjoyment of this ecstasy.

Excerpt from Twain, Mark (Samuel Clemens). *Simplified Spelling in Ancient Egypt*. Recreated from *Spelling Progress Bulletin*, 15:3, 1975.

databases for 1976-1988 listed only eight items under 'spelling reform,' and these mostly dismissive. Some areas of reading research are now so heavily trodden that current books with hundreds of references each may share few in common dated after 1970—yet even large tomes on reading or literacy or even on reading problems often have no reference to spelling, orthography or writing system in their indexes.

The major practical difficulty in carrying out applied research in the past has been lack of colleagues and support. Because the necessity for human engineering in the design of all tools for communication is still not widely recognized, it has been difficult to find friendly facilities and access to volunteer subjects. Theoretical and experimental work in cognitive psychology and linguistics is now converging towards interest in the design of spelling. Foundations for more state-of-the-art research have already been laid in existing knowledge from these fields, as well as from education and the experiences of orthographic change in other languages. The problems of implementing improvements recommended by research are not insuperable since technology can now change over easily to using any new writing system, but it will require international cooperation, dictionary acceptance of alternative spellings, continued access to our heritage of print, retraining those already literate—although 'retraining' is possibly a chimera—finance and authorization for changes and the achievement of public acceptance. The major questions of political and social conditions for orthographic change also need to be understood.

If research into an efficient spelling system is a legitimate part of research and development of all tools for modern communication technology and international literacy, it will in turn offer a point of entry towards solving many of the puzzles still tantalizing scholars in the cognitive psychology of reading. None of these problems is insoluble, but some problems are easier than others. Yet repeatedly in science, breakthroughs at an impasse have been made by challenging and testing assumptions that appeared unassailable or were even invisible. Visionary pursuits have been an essential part of scientific method historically even if not in philosophical principle. And to rephrase Thurstone and other mountain-climbers, 'if a thing exists, someone will want to measure it, to evaluate it—and to improve it.' Orthographic improvement is now a lively area in discussion of language planning in other modern languages—even in French. International English spelling may not remain immune much longer.

The arguments to retain conventional spelling have changed over time, but their dynamic is still the psychological need to keep the appearance of what is familiar. As overseas experience shows, once a useful change has proved itself, it then becomes accepted and is the popular new fashion. Trends for change are accumulating. The precedents of overseas reforms predict that eventually a critical mass for reform will result from economic and political forces as the need for wider and more efficient communication and rationalization becomes overwhelming, or from the impetus of social change that is fueled by optimism for the future.

Even research that is conclusive may have no impact if the time is not ripe, but it is not always obvious when ripeness has arrived. Today power in communication is so concentrated that researchers may only be able to prepare what needs to be done and wait for economic or political pragmatism to lead events.

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Endnotes

1 For examples of research on the handicap of English spelling for beginning readers, see Thorstad, Gwenllian. 1991. The Effect of Orthography on the Acquisition of Literacy Skills. *British Journal of Psychology*, 82: 527-37, Thackray, D. 1980. Readiness to Read with i.t.a. and TO, London: Chapman. The International Association for the Evaluation of Educational Achievement is currently conducting a comparative investigation across 32 countries which should help to settle the issue. The present state of research findings is discussed in Upward's unpublished paper, Writing systems as a factor affecting literacy standards, from the International Reading Conference at Lancaster, September 1993.

2 See, for example, Postman, Neil. 1970. The Politics of Reading. *Harvard Educational Review*, 40:2, 244-252.

3 Miller, George. 1988. The Challenge of Universal Literacy. *Science*, 9 Sept. 1293-1259.

4 Yule, Valerie and MacKay, Ken. Practice Effects for Adults and Poor Readers Reading Text in a Modified Spelling. (Unpublished manuscript)

5 For further background to these and other issues discussed in this paper, see Sampson, Geoffrey. 1985. *Writing Systems*. London: Hutchinson. Also Yule, Valerie. 1986. The Design of Spelling to Match Needs and Abilities. *Harvard Educational Review*, 56:378-297.

6 There are further problems for experiments:

- The modality in which stimuli are presented is not necessarily the modality from which subjects will take information that is relevant for their task. Carr, T.H. 1986. Perceiving Visual Language, in K.R. Boff, L. Kaufman and J.P. Thoma, editors. *Handbook of Perception and Human Performance*. vol II. *Cognitive Processes and Performance*. New York: J. Wiley and Sons.
- Subjects in short-term memory tasks frequently give verbal labels to visual stimuli so that they could rehearse them. Conrad, R. 1964. Acoustic Confusion in Immediate Memory. *British Journal of Psychology*, 55: 75-84.
- Verbal reasoning tasks can be transformed into visual images in order to solve them. Huttenlocher. 1968. Constructing Spatial Image: A Strategy in Reasoning. *Psychological Review*, 75: 550-560.

Both verbal descriptions and visual pictures in sentence-picture verification tasks may be transformed to 'relatively abstract-semantic-propositional representations' so that they can be compared. Carpenter, P.A. and Just, M.A. 1975. Sentence Comprehension: A Psycholinguistic Model of Sentence Verification. *Psychological Review*, 82: 45-73.

- It is necessary but difficult to be sure that if subjects are set to decide questions of visual representations of stimuli, they do not resort to phonological or semantic recodings to do it, or vice versa. A lexical decision about whether a letter-string is a word is unlikely to use the same reading processes as a semantic response giving the meaning of the word presented which is closer to reading for meaning. A needed experiment is to use in text for silent reading the word-changes that can prime target words in masked-priming experiments, since it is possible that what is being taken as information about the nature of the mental lexicon may in some respects resemble what is grasped in skimming rather than noted in reading.

7 Elías-Oliveres, L. and Valdés. G. 1982. Language Diversity in Hispanic Speech Communities. In J.A. Fishman and G.D. Keller, editors. 1982. *Bilingual Education for Hispanic Students in the United States*. New York: Teachers College, Columbia University.

8 Stevenson, H.W., Stigler, J.W., Lucker, G.W., Lee, S-Y, Hsu, C-C. and Kitamura, S. 1982. Reading Disabilities: The Case of Chinese, Japanese and English. *Child Development*, 53: 1164-1181.

Stevenson, H.W. 1984. Orthography and Reading Disabilities. *Journal of Reading Disabilities*, 17: 296-301.

Stevenson, H.W., Stigler, J.W., Lucker, G.W., Lee, S-Y., Hsu, C-C. and Kitamura, S. 1985. Cognitive Performance and Academic Achievement of Japanese, Chinese and American children. *Child Development*, 56:718-734.

9 For examples of research paradigms used in a series of experiments in modified spellings and the range of relevant cross-disciplinary research that is relevant, see chapters 5, 6 and 9 in Yule, V. 1991. *Orthography and Reading: Spelling and Society*, doctoral thesis, Faculty of Education, Monash University, Australia. For examples of useful experimental designs in published research see Yule, Valerie and Greentree, Stephen. 1986b. Readers' Adaptation to

Spelling Change. *Human Learning*, 5: 229-241, which adapted John Beech's original method, and Upward, Christopher. 1992. Is Traditional English Spelling More Difficult Than German? *Journal of Research in Reading*, 15: 82-94.

10 Huey, E.B. 1908/1968. *The Psychology and Pedagogy of Reading*. Cambridge, Massachusetts: MIT Press. Kolers introduced the reprinting of Huey's work in 1968 with the admission that even after sixty years of further research in reading, there was "remarkably little empirical information added to what Huey knew."

11 Hitzenberger provides an example of how research in artificial intelligence may stimulate lateral thinking by suggesting ways in which reading could be done in his algorithm for phonological access to a telephone information system. Names are translated into a fairly narrow phonological representation, and from this form, all possible orthographic representations are generated — e.g., MAKE can generate MacKay, Mackie, McKay, Mackay, MacKie and McKie. This type of phonological grammar gives a very economic basis to generate codes, often deleting vowels and even consonants when they have a low functional load, and it suggests analogies for human coding in reading.

Hitzenberger's scheme involves indexes for words in data bases including the concrete orthographic string, the phonological string, a code and a further 'hash' code which can generate a key element when an algorithm is specified. Hitzenberger, L. 1987. Phonological Access to Data Bases in Luelsdorff, P.A., editor. 1987. *Orthography and Phonology*. Philadelphia: John Benjamins.

12 Yule, Valerie. 1978. Is There Evidence for Chomsky's Interpretation of English Spelling? *Spelling Progress Bulletin*, 18.4.10-12.

13 Yule, Valerie and Greentree, Stephen. 1986. Readers' Adaptation to Spelling Change. *Human Learning*, 5, 229-241.

14 For example, Kolers, Paul. 1975. Memorial Consequences of Automated Encoding. *Journal of Experimental Psychology*, HMM, 1 (6):689-701.

15 See, for example, Feitelson, Dina. 1988. *Facts and Fads in Beginning Reading: A Cross-language Perspective*. Norwood, New Jersey: Ablex Publishing Corp.

16 Freire, Paulo. 1974. *Education in the Practice of Freedom*. London: Writers and Readers Co-operative, and Martin, John Henry and Friedberg, A. 1986. *Writing to Read*. New York: Warner Books.

17 See Beech, John and Colley, Anne, editors. 1987. *Cognitive Approaches to Reading*. New York: Wiley.

18 These criticisms and those following are taken from a large collection of personal correspondence, 1968-1991.

19 Miller, George. 1956. The Magical Number Seven Plus or Minus Two: Some Limits on Capacity for Processing Information. *Psychological Review*, 63: 81-89. Another example of tenacity in clinging to symbol systems is the many years that British mathematicians lagged in progress behind Continental mathematicians who were using Leibnitz' calculus symbols, until the British finally and reluctantly changed over from Newton's older method.

20 Grandgent, C.H. 1964. Numeric Reform in Nesciubia. *Spelling Progress Bulletin*, 4:3, 5-6.

21 Twain, Mark (Samuel Clemens). Simplified Spelling in Ancient Egypt. reprinted in *Spelling Progress Bulletin*, 15:3, 1975.

Notes on Figures

Figure 1 Upward, Christopher. 1992. *Cut Spelling: A Handbook to the Simplification of Written English by Omission of Redundant Letters*. London: Simplified Spelling Society.

Figure 2 For details of theory and experimental investigations, see Yule, Valerie. 1991 *Orthography and Reading: Spelling and Society*, doctoral thesis, Faculty of Education, Monash University, Australia.

