PROBLEMS THAT FACE RESEARCH IN THE DESIGN OF WRITING SYSTEMS.

'Science has never been averse to visionary pursuits.'

Writing systems are part of the technology of visible language, as much as are the characters, the type-face, the layout and the linguistic conventions of writing. Therefore, like all other inventions in the technology of communication, they are legitimately subject to research and further development. Language planning for many modern languages already includes concern for improvement of their writing systems as a matter of course. That is, regardless of how efficient a writing system is now, research may be able to improve it.

However, research that seeks to find the best possible writing system for reading faces problems which need to be set out clearly. There are competing assumptions and models in relevant theories, there are problems of measurement to overcome in critical investigations, and there are problems of attitudes to change which must be considered in all human engineering, to design and implement innovations. International comparisons are needed but face problems of multiple considerations and equivalent measurements. For example, are there features in Japanese orthography that other writing systems 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 so many Japanese can reach in a writing system that seems so difficult for foreigners?

Criteria for an 'optimum' writing system for a language are that it must be a best fit to the nature of the language itself,[1] 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. A spelling reform should preferably 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 there could be a breakthrough to an international writing system that can cross languages, like Chinese but without its disadvantages.

Writing system design according to the targets set for literacy_

Options in the design of orthographies depend upon decisions about 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 of around nine years old. There are now

claims that only a small elite need to be literate for society to function adequately, 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 be thought to be 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 that the mass of the people can be at least functionally literate. To be universally accessible, a writing system must also suit the great range and variety of individual differences. Is a successful compromise possible, or could 'one size fit all'? See Miller, 1988, on 'The challenge of universal literacy'.

The answer to improving an alphabetic spelling system is not simply sound-symbol correspondence.

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.

> 'On the high ground, manageable problems lend themselves to solutions through the application of research-based theory and technique. In the swampy low ground, messy, confusing problems defy technical solution... in the swamp lie the problems of greatest human concern... (There is) the choice to solve relatively unimportant problems according to the prevailing standards of rigour or to descend to the swamp of important problems and non-rigorous inquiry.' Schön (1987).

Research in spelling design must check that an orthography is linguistically suited to represent a particular language. It must consider the abilities and needs of people who learn and use the system. Directions for improvement that are based on the capacities that are found to be required for reading in the existing writing system may be misleading if applied to the design of reading a system that differs in consistency, relationship to the spoken language or other features. For example, skilled readers in English today will be found to use the strategies that they have had to develop to cope with or avoid standard English spelling as it is now - and these 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 even in some non-English countries, 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 model is understandably easier to conceptualise in detail, to simulate in computer modelling, 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 risking neglect of what may 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 psycho-neurological 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 colour 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. Effects may not appear in the original category of responses expected by the experimenter, required, but at another level of learning (Yule & MacKay, 1991). Unexpected or generalised 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 the more familiar orthography.

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 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. (For further background to these and related issues, see Sampson 1985 on *Writing Systems* and Yule 1986, 'The design of spelling to match needs and abilities'.) Other factors in the text itself include content, context, type-face and layout. Studies often assume that all subjects will use the same strategies - but this can be mistaken. What exactly 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 'misspellings' may be more acceptable to subjects 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 GOVERMENT 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, not evidence. In later research, the word lists can be greatly improved, based on the findings made earlier. (For discussions of further problems for unwary experimenters in this field see Carr 1986, Conrad 1964, Huttenlocher 1968, and Carpenter & Just 1975.)

Control for other factors related to literacy may appear difficult - e.g. cultural and educational differences, problematic 'culture-free' common tests, shifting criteria for literacy and the need for common base-lines. There can be unexpected problems in comparison of bilingual students studying in two orthographies; U.S. Hispanic students may do poorly in tests in their native Spanish because of feelings that it is culturally inferior (See Elías-Oliveres & Valdés 1982) However, as interest extends in this field of research, problems of methodology are being overcome, as in the careful studies by Stevenson et al (1982, 1984) comparing the reading achievements of Japanese, Taiwanese and American children .

Once experimenters have clarified their assumptions and decided on a particular line of are clarified and a particular line of investigation is decided upon, many experimental topics and research paradigms come quickly to mind - some have been described earlier. (And see Yule 1991 and Yule & Greentree 1986.) Such experiments 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.[2] 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 consistently 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 (e.g. Hitzenberger 1987) 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.

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 utilised if a spelling system is made less 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 multi-disciplinary, and to integrate specialist investigations - although Jacks-of-all-trades who cross disciplines to attempt the overview may still risk forfeiting the respect of those very specialists whose assistance is most necessary to prevent oversimplification or over-generalisation through insufficient expertise. The evidence that comes out of psychological laboratories and classrooms could eventually be validated by neuro-psychological reductionism on the one hand, and the demonstrated efficiency of an optimum spelling on the other.

Research on English spelling modifications 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 literate adults perceive the intellectual delights of English spelling, but it is possible that it reflects the anxiety of the assessing committees themselves, who may be feeling consciously or unconsciously that English spellings are icons to reverence, not to touch.

An essential task for research in spelling design is to find out how readers respond when they first meet novel spelling modes, to avoid disruption of habits for a literate society. Easy adjustment is important for practical reasons. Yule & Greentree (1986) have compared readers' immediate responses to four possible types of spelling change for English.

It is also important to investigate whether any proposed change offers long-term benefits for the skilled reader, not just facilitating access for learners, - but long-term

efficiency is difficult to measure. At first, and for a period, skilled readers are likely to recognise faster whatever they have been reading since childhood 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. The most skilled readers may or may not be slowest to respond to even the most potentially beneficial change since their standard spelling repertoire has had probably millions of presentations. They have developed strategies to cope with faults in the present system. Less skilled readers may show benefit more quickly because they have had less practice in that system. However, the more skilled readers are also likely to have more versatile reading strategies and greater natural language skills, to enable them in a short time to take advantage of any improvements in the written representation of the language.

The period of adjustment may be shorter than pessimists predict, although for some aspects longer than experiments can easily cover. The examples of international reform and of other major changes this century prove this. Observe also, how new vocabulary enters a skilled repertoire quickly. The linguistically able rapidly adapt to reading in unfamiliar languages and writing systems. In spelling-modification experiments practice effects from short experiments may be still operating in follow-up (e.g. Kolers, 1975).

Another issue is the relationship of initial learning strategies to final skilled reading and writing. Children learn to recognise logos before they can actually read the words in the sense of being able to recognise them in different print, so this preliminary stage is not an argument for believing that logographic recognition is how children can become expert adult readers of linear letter strings, since these soon become confusable without other means of differentiating them. We have seen that research now demonstrated not only that children with phonological skills learn to read sooner, but also, other children can be shown how to develop those skills in pre-school language play. As words become familiar with reading practice, movement to automatic visual recognition takes place regardless of initial strategies. But some understanding of the spelling system will still be needed for accurate reading of new vocabulary, and phonology remains 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.

It is also plausible that literate adults can 'switch spelling set' in the same way that readers can switch to changes of font, letter-case and even language. Comparative research is required to establish whether Serbs and Croatian 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 becomes an automatic process for them.

Existing sources of research evidence. Findings of existing reading research could be applied and data re-analysed from the new perspective of orthographic design. Yule's cross-disciplinary review of relevant research (1986) shows the extent of these untapped resources.

More detailed studies are also needed of the effects of orthographies and orthographic reforms across the world**.** In modern Korea, widespread illiteracy in the 1940s has given way to a claimed 99% literacy rate, co-temporary with transition from Chinese script to a remarkably simple and original Korean orthography. How great was the contribution of this transition to the dramatic improvement in literacy? Script reforms have also accompanied other dramatically successful literacy campaigns in other countries - such as Turkey, 1920s Russia, Indonesia, and their contribution to facilitating literacy should also be assessed.

Could English spelling be changed?

We have seen how English spelling handicaps the international English language in the modern world. There is increasing concern that English may be losing its role as the global lingua franca, (see for example, Mcrum, Cran & MacNeil 1986, Burchfield, the Chief Editor of the *Oxford English Dictionary,* in *The English language* 1985, Todd on *Modern Englishes* 1984 and the anxiety of the British Council (Wade in the *Guardian Weekly*, May 21, 1995), but there is still inadequate recognition of its international spelling problem. Conventional spelling is not learner-friendly for most English-speakers when they are learning to read and write - taking on average three years instead of eighteen months. Fashions in teaching reading are continually changing because none is effective enough, and a 'phonics' approach that can be set out in a quarter page in Italian takes 218 pages in English. 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!'

English spelling is even more difficult for learners of English as a second language, as well as for the handicapped, socially disadvantaged and learning-disabled. Even literate adults may not be reading and writing as efficiently as they might in their native English tongue.

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 research on spelling design on a scientific basis have tended to be immediately dismissed as

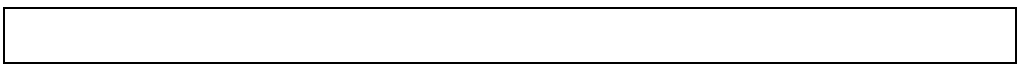
equally forlorn and ill-judged. Reformers and anti-reformers alike have almost universally shared the assumption that the only possible way to improve English spelling is return to the original alphabetic principle of one-sound/one symbol, with 'spelling as you speak.' This is attractive in its apparent simplicity but it would be daunting in its real complexity, since the English language is both morphemic in nature and multi-dialect in its world-wide extent. Yet some reformers, convinced that they have the answers without requiring objective testing, have regarded proposals for empirical research as deliberate delaying tactics to ensure 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 endeavours - such as the centuries of attempts at human flight, and even the recent experience of the introduction of metrication. 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 show ignorance about the number, extent and nature of successful recent reforms of the writing systems of other languages.

Issues to address in research. Different possibilities for English spelling modification must have sound bases in theory and existing research. Novel alphabets would have little practical chance in today's world of the international use of the roman alphabet, and simple phonemic spellings fail to meet complex needs. Failing a brilliant international breakthrough to represent visual language, modifications to clean up the present system may be a more pragmatic way to go - for example, deletions of surplus letters in words (on what principles?), increasing consistency, and 'making English spelling more like Chomsky says it is', perhaps by clearer morphemic relationships. See the example of a 'surplus-cut' spelling modification in Figure 1.

Predicting benefits and costs 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. It would be speculating to quantify these benefits in advance of research to find out, since so many factors are involved, but certainly the financial advantages would far outweigh the slight costs of a reform that simply deleted surplus letters and regulated the spellings for consonants, introduced through dictionary acceptance as alternative spellings, and with the technology of computerised printing. Hundreds of English words today already have alternative

Figure 1



Riting systems ar an essential element of modrn comunications tecnolojy, and English spelling is therfor a lejitimat subject for reserch and development to improve it. Setting up such reserch faces problems. These include th definition of an 'optimum' spelling, and issues of models, methodolojy and experimentl design. Barriers include unawareness of th importance of spelling for litracy, and ignoramce of how improvements hav alredy been made in the orthografies of othr modrn languajs. Empiricl exploration has been preventd by th historic unquestiond assumptions of both spelling reformrs and conservativs, such as that one-to-one sound-symbol corespondence is th only posibl alternativ.

In this paragraph three spelling modifications have been made: -
Letters have been deleted that are surplus to representation of meaning or pronunciation
<ph> → f
soft <g>→ j

Letters that appear superfulous have not been deleted if words would still retain misleading representation, as in DESIGN

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spellings and the simpler alternatives are becoming preferred. The extensive research literature on the development of children's reading strategies assumes conventional English spelling and existing methods of teaching reading. 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. (See for example Feitelson 1988.) Hence the problems with phonics-based teaching that has often been dreary and distasteful, and the attempts to use whole-word and guessing-by-context stratagems instead. John Henry Martin's adaptation (1986) of Paulo Freire's techniques (1974) for teaching peasants to read is a forerunner of possibilities for the teaching of reading with a more consistent spelling system.

An orthography to meet all the different needs that have been labelled as 'dyslexia' would need to be proof against a **range of perceptual and linguistic disabilities**. There is growing evidence that the specific difficulties of 'dyslexias' are a continuation of the difficulties of all beginners, which other learners in time overcome. (See Beech & Colley 1987.) Experiments to improve an initial learning spelling that can merge into the adult orthography could prevent the long-term dyslexic status that can result simply from unresolved initial confusions.

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 - since this comes 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 would lead directly into the underlying system for traditional spelling that they otherwise would fail to comprehend. The Yule & MacKay experiment 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 spelling beyond schooling into adulthood, to find whether their easier introduction to reading has facilitated their reading as adults.

Problems of attitudes

Some literate people feel that as far as they are concerned, spelling reform is undesirable, unnecessary and impossible. 'Not in my time, O Lord.' I find that the less literate are usually enthusiastic - but they cannot read or write well enough to have a voice.

Meddling in spelling is regarded as risky when there is ignorance about spelling. 'Our Spelling' is taken for granted like we once took for granted the air that we breathe, but most people are as ignorant about its nature and structure as they are about the atmosphere. Spelling is often confused with the language itself, rather than recognised as 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. I have a large collection of personal correspondence 1968-1995 showing the annoyance of the set mind, as well as the desires of the underprivileged and the spirit of idealists and lively thinkers.

'Nature knows best' is the slogan interpreted as meaning that English spelling must have developed naturally to be the best possible - according to the common belief that the historical development of English spelling has been a phenomenon of nature untouched by deliberate or accidental human mind or hand. However, so-called 'natural forces' in human affairs do not necessarily maximise what is most beneficial, or get rid of disadvantages without human aid. The most common forms in English spelling and grammar are the most irregular, not because irregularity has been a progressive development, but because these obsolete forms are maintained by their constant use.

Reactions to innovation. Adults who have grown up accustomed to the appearance of English in print naturally find any change at first either disturbing or a charming

novelty. The human desire to preserve forms has a cementing effect in society that is generally positive, but sometimes stultifies. 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 civilisation 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, Indian rejection of the roman alphabet as an alternative, supplementary script for the many scripts now in use for Indian languages, although it 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 arabic innovation. Yet the importance of efficient symbol systems is shown in the tremendous advances that were made possible in mathematics and industry by the adoption of arabic numerals instead of the clumsy classical roman numerals. Another example of British tenacity in clinging to symbol systems is the many years that British mathematicians lagged behind Continental mathematicians who were using Leibnitz' calculus symbols, until at last the British reluctantly changed over from Newton's older method.

Figure 2

'...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.'

Exerpt from 'Simplified Spelling in Ancient Egypt.' by Mark Twain, (Samuel Clemens) Reprinted in *Spelling Progress Bulletin* 15. 3. 1975.)

Thinking may be blocked if graphemic symbols require too much central processing to operate on them (Miller 1956). While the satirical parable, *Numerical reform in Nescoubia,* (Grandgent 1964, Figure 2) supposes a society still dedicated to retain roman numerals, Mark Twain's account of *Spelling Reform in Ancient Egypt* (reprinted 1974, Figure 3) extends the parable further into spelling.

Fear of 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 petrol 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 labelled 'reform', this quasi-political label has been applied to all 'R & D' approaches to English spelling. While estimates of the amount of writing on reading in English this century range from 50,000 - 100,000 books and articles, the ERIC databases for 1976-1988 listed only eight items under 'spelling reform', 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 books 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 recognised, it has still been difficult to find friendly facilities and access to volunteer subjects. However, 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 might recommend 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

Figure 3

In the Land of 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 philosophic 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..'

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

Exerpt from Charles Grandgent. 1964. "Numeric Reform in Nescioubia" *Spelling Progress Bulletin.* 4.3. : 5-6.

authorisation 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 communications technology and international literacy, it will in turn offer a point of entry towards solving many of the puzzles still tantalising scholars in the cognitive psychology of reading. None of these problems cannot be solved, but some problems are easier than others. Yet repeatedly in science, breakthroughs at an impasse have been made by 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 English spelling have changed over time, but their dynamic is still the psychological need to keep the appearance of what is familiar remains. As overseas experience shows, however, once a useful change has proved itself, it then becomes accepted, and is the popular new fashion. Trends for change are accumulating, but the eventual 'critical mass' will result from economic forces as the need for wider communication and rationalisation becomes overwhelming, or from the impetus of social change that is fuelled 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 arguments to lead events.

NOTES

1. See Wang's account (1981) of how an orthography must be related to the structure of its language, so that it cannot be assumed that any mirror of the spoken word would ipso facto be an optimum spelling for all users and learners.

2. 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'. The position has, however, slightly improved in the quarter century following.