THE EFFECTS OF FIRST-LETTER MNEMONICS, (ACROSTICS) ON THE LEARNING OF LOWER-SECONDARY SCHOOL CHILDREN

Thesis submitted towards the degree of Ph D at the University of Leicester.

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SEPTEMBER, 1991
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LEARNING OF LOWER-SECONDARY SCHOOLCHILDREN

THESIS SUBMITTED BY STEPHEN D. BOOTH TOWARDS THE DEGREE OF Ph.D.,

ABSTRACT

In a series of eight related experiments, the efficacy of first-letter mnemonics (acrostics) was tested against uninstructed and rote learning conditions in time-matched learning situations. Normal, factual curricular material was used to assess and compare performances of around 250 children drawn from two age-groups, (mode) 11.5 and 13.5. Gender differences were also compared.

Additionally, a limited survey of teachers in seven state secondary schools was also undertaken to establish the range and extent to which mnemonics are used informally in regular teaching situations.

Results are discussed in terms of the significant efficacy of first-letter mnemonics over the alternative learning methods studied, relative to classroom learning, performance and application.
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SUMMARY

During the past two decades in particular, empirical research related to learning strategies has demonstrated that children instructed to use relatively simple mnemonic techniques can learn and recall considerably more factual information than un instructed children. The application of these mnemonic techniques was based upon the highly encouraging results of laboratory experiments, typically using college students as subjects under artificial conditions.

Recent empirical work appears to have focused upon a very narrow range of the mnemonics potentially available to facilitate learning, particularly the so called Keyword method. Common sense suggests that more popular forms of mnemonic are used informally by teachers, but there is little or no objective evidence suggesting that mnemonics do facilitate children's learning, or which types are in current use. Further, there appears to be no evidence as to whether children instructed to use first-letter mnemonics learn and recall more than un instructed or rote learners.

The results of this study suggest the following:

1) A broad range of mnemonics are used by a number of practising teachers, covering a wide variety of curricular areas.

2) Children taught to use simple mnemonic skills and techniques demonstrate the ability to learn and recall considerably more mnemonically encoded curricular-related arbitrary information than non-users, even when matched for time-on-task.

3) Children as young as eleven are fully capable of generating and applying their own first-letter mnemonics, after limited instruction in how to mnemonise material.

4) Children instructed in the use of simple mnemonics considerably out-perform children taught and instructed to use rote-learning methods, even when matched for time-on-task.

KEYWORDS: MNEMONICS, STRATEGIES, CHILDREN, LEARNING.
To my wife Jane, son James
and the
Choristers of Thurmanston Parish
Church, Leicester, 1965-1986
ACKNOWLEDGEMENTS:

Students completing research theses on a part-time basis rely heavily upon the help goodwill and support of many colleagues and friends. With this in mind, I would like to extend my most sincere thanks to the following institutions and people:

Roy Kirk, at Leicester School of Education Library, Northamptonshire Education Department, the Headteachers and staff of the following Northamptonshire secondary schools:

Daventry School, (Daventry) especially Daphne Flavell, J. Blyncow and C. Causebrook
Campion School, (Bugbrooke) especially Daphne Flavell, J. Blyncow and C. Causebrook
Sir Christopher Hatton School, (Wellingborough) especially Rick Pemberton School, (Rushden)
Beanfield School, (Corby)
Montagu School, (Kettering)

In addition, Paul Cain my tireless technician and printer, John Cox for permission to publish the results of our recent collaborative study, John Wilson and Andrew Hope of Leicester University for their valued help with statistical analysis, Denis Straw for his help in publishing the graphs, Gloria Straw for encouraging me to enter the teaching profession.

My particular thanks to David Allan and David Evans, (S.& Q. proof reading division) for their integrity, vigilance and patience, the staff of Lodge Park School, Corby, for making over forty experiments and the survey such a painless exercise, Prof. Brian Allison for his help in commencing this study, Rhona Staintorp for kindly offering to act as an external examiner of this study and Neville Rumbelow, through whose kind permission the empirical aspects of this study were made possible.

Finally, my gratitude to Roger Merry for his indespensable support and guidance throughout the writing of this study, to Jane and James for putting up with countless lonely nights and to my Mother, Beryl, and Father, Dennis, for always believing that a failed 11+ kid could eventually make it - one day!
"It is hard to think of any educational goal for which the ability to retain information is unimportant; human memory is crucial for acquiring the knowledge and skills we learn at school." (Howe and Ceci, 1979, P. 59)

If it is one of the chief and most earnest desires of teachers, that the factual information they impart is effectively remembered and recalled by their students, how strange it is, that although we might clearly specify what we require students to remember, we seldom tell them how to remember it!

Probably our own educational experiences suggest that teachers largely rely upon their students' intuitive responses to deal with the many and varied recall demands placed before them. Teachers may carefully plan and deliver highly stimulating, 'educational' lessons, which enthuse their children, but, if the teacher's main intention is that students remember the factual content of the lesson, the remembering phase of learning also needs to be carefully managed and designed. Howe and Ceci, (1979) make the point clear:

".....the degree of difficulty of many educational tasks is closely related to the burdens of remembering they impose", adding, "...we have also found that individual differences between people's achievements at a variety of skills are closely related to their ability to remember." (ibid.)
Unfortunately, our experiences might further suggest that, although teachers are trained and experienced motivators and imparters of factual information, the retention or remembering phase of learning is often left to chance.

Teachers necessarily require to know how much of what has been taught can be later recalled by their children. This information highlights areas of learning inadequacy and can be obtained through periodic formal or informal assessment. This feedback helps identify the range and nature of learning deficits. Although teachers have a keen interest in minimising these deficits, the extent to which these can be controlled will inevitably be shaped by the teacher's knowledge of how the retention of factual information can be improved.

LEARNING PROBLEMS IN THE CLASSROOM

In a broad context, learning reliability can be improved through the acquisition of more general learning strategies such as the SQ3R (Survey, Question, Read, Recite, Review) method, (see e.g. Morgan and Deese, 1969; Rowntree, 1970). These learning methods appear to be particularly useful in learning certain types of material, especially that which has a meaningful or related structure, (e.g. Bransford and Johnson, 1973) but where arbitrary material has to be learned, other more task-specific learning strategies are available and might be usefully employed. Merry, (1980,) underlines the point:

"If much of what we expect children to learn in school in fact appears highly arbitrary (Bower, 1973), then mnemonics, which are particularly useful in the learning of arbitrary material, might have an even wider role to play, and there is perhaps room for more research which tries to relate experimental findings to actual classroom materials and demands".
In schools children are often faced with learning tasks which require them to remember lists or names which are inherently unrelated and arbitrary in character. In this situation the learning demands are further complicated by the fact that often the same learning material is arbitrary to the child as they are unable to appreciate connections. For example, whereas most adults might intuitively associate the information: "Situation, brief, investigation, solutions, best-solution, model, working-drawing, realisation and appraisal" with some aspect of designing, there is no obvious suggestion of the order in which they should appear. In fact these names, and the processes to which they refer, constitute an organisation of approach upon which Technology examinations are assessed. Given the task of remembering this list, most mature learners typically adopt sophisticated strategies, (e.g., see Gruneberg, 1973) whereas children are far less strategic and "planful", having a very limited vocabulary of strategies at their disposal, (Harris, 1978).

It is important to state here that mnemonics in themselves do not teach meaning [1]. Their normal function is to facilitate the retention and subsequent recall of previously learned material by providing additional cues at the time of learning, which are again available during attempted recall of the material.

1 One possible exception might be the keyword method, (reviewed later)
In the classroom the child frequently encounters many new concepts and names, between which there is no obvious connection or relationship. And yet it is the very relationship and organisation between these items which often form important if not crucial features of each subject's knowledge-base. Two examples might include: a mathematical formula from which other calculations can be made, or convention in musical chord structures from which harmony can be written.

In every curricular area, without exception, there is a need to remember similar types of basic fact. These form the fabric of syllabuses throughout the school curriculum and are reflected in the form of G.C.S.E. (General Certificate of Secondary Education) assessment criteria. Morris and Cook, (1978) write:

"Learning is easiest when the information to be retained is meaningful and can be easily assimilated into the existing knowledge structure of the learner".

For teachers the crucial question is how can this be most effectively and economically achieved?

APPLIED STUDIES USING MNEMONICS
There is now a growing body of scientific evidence demonstrating that the use of simple learning strategies or mnemonics can considerably help children with retention and recall tasks. In the spirit of Higbee, (1977) and Bellezza, (1981), Carrier, et al., (1983, P.235) suggest: "Researchers and practitioners now recognise that mnemonics are an effective way to organize, encode and retrieve information," confidently suggesting that "They do actually work," (Rawles, (1978). But how has this affected educational practice and performance?
During the past decade or so, research in the field of mnemonics has focused almost exclusively upon a specific type of mnemonic system known as the 'Keyword method' [2]. Following encouraging laboratory trials, a number of experimental studies have successfully applied the system to various aspects of classroom learning, e.g., vocabulary instruction, (e.g., Merry, 1980b; Levin, et al, 1982; McDaniel and Pressley, 1989) and assisting the learning disabled, (McGlvern and Levin, 1983; Mastroplier, Scruggs and Levin, 1985b; Condus, Marshall and Miller, 1986. For a fuller review, see the section marked "The Keyword mnemonic" in this study. (pp.127-135) Given the apparent success of the keyword, it seems reasonable to assess the efficacy of other types of mnemonic more regularly used in schools, in particular the acrostic, more commonly called a first-letter mnemonic.

2 A mnemonic system that employs interactive associative imagery to learn material
FIRST-LETTER MNEMONICS

"Throughout life, it will sometimes be necessary to learn apparently unconnected information and a knowledge of what techniques to apply to simplify the task should be one element of education", (Morris and Cook, 1978)

Common sense suggests that teachers are known to employ a variety of mnemonics on an informal basis. (e.g., see the section marked "Staff survey" in this study, pp.293-325) In British Education there is something of a tradition to use first-letter mnemonics to help teach certain items of arbitrary information. For example, in music E.G.B.D.F., the stave-line notation in the treble clef is often 'taught' by the sentence "E-very G-ood B-oy D-eserves F-un" and the sequential order of the spectral colours, (R-ed, O-range, Y-ellow, G-reen, B-lue, I-indigo and V-iolet) is often associated with the sentence: "R-ichard O-f Y-ork G-ained (sometimes G-ave Is used) B-attle I-n V-ain".

Although the effectiveness of this type of mnemonic might at first appear self-evident, in that it is by no means unusual to be able to remember the associated information even after many decades have passed, repeated attempts to verify the efficacy of the mnemonic under experimental conditions have proved largely inconclusive.

Summarising this position, Morris and Cook, (1978) write: "While there is no doubt about the popularity of these mnemonics the evidence for their effectiveness does raise doubts".

Following a flurry of studies designed to test the efficacy of acrostics during the 1970s and early '80s, research activity appears to have largely evaporated. The evidence available presents such a confusing picture (McLaughlin Cook, 1989) that meaningful conclusions cannot be drawn.
The samples used are generally highly selective, typically college-age students, tested under artificial conditions. The materials used have been taken out of context, (e.g., paired-associate learning) and there has been little relationship between the experiment and an intrinsic incentive, other than obtaining some form of accreditation towards a related course.

In a recent review of verbal mnemonics, McLaughlin Cook, (1989) highlights the inadequacy of previous research in this area, suggesting:

"No study has examined the spontaneous use of verbal mnemonics in schoolchildren....."

Selective as previous research has been, it has provided important information relating to the following aspects of first-letter mnemonics:

1) The effects of first-letter mnemonic origination [3], (e.g., Boltwood and Blick, 1970; Kibler and Blick, 1972; Nelson and Archer, 1972; Pines and Blick, 1974; Morris and Cook, 1978)

2) The effectiveness of first-letter mnemonics compared with alternative learning methods, (e.g., Perewiznyk and Blick, 1978; Morris and Cook, 1978; Carlson, Zimmer and Glover, 1981)

3) What benefits the mnemonic may have in examination preparation, (e.g., Blick, Buonassissi and Boltwood, 1972; Gruneberg, 1973).

4) The long-term effects of the mnemonic, (e.g., Kibler and Blick, 1972; Pines and Blick, 1974; Lieury, 1980; Carlson, Zimmer and Glover, 1981)

None of these studies has used children as subjects, none has positively demonstrated the efficacy of first-letter mnemonics over alternative learning methods, none has been successful in matching the 3 e.g., whether supplied by subject or experimenter
learning time of each experimental condition, and none has used real
curricular learning material drawn from children’s regular syllabuses.

The present study addresses these important issues in an attempt
to discover the effects of first-letter mnemonics within a regular
learning setting.
EDUCATIONAL THEORY INTO PRACTICE......?

In 1979, Howe and Ceci wrote somewhat optimistically:

"We have progressed a considerable way, but not all the way, towards establishing that the findings of scientific investigations of human memory can have widespread practical applications for school learning."

Ten years later, even the dramatic learning improvements demonstrated using the keyword have had little impact on the English school curriculum; if indeed, any impact at all. It is very surprising and worrying that the fruits of applied educational research have failed to penetrate educational practice.

Accounting for this position is difficult and likely to be the sum of many variables. One conspicuous problem appears to be related to the awkwardness with which the knowledge gained from experimental studies is communicated to those in the most suitable position to derive some practical benefit, namely teachers and students. There is presently no organised, consistent, or satisfactory method of reporting developments in research to teachers.

Even if this were achieved, a suitable framework does not exist whereby discussion or interaction between classroom teachers and educational researchers could be used to systematically design and appraise curricular innovation. The uneasy relationship between educational practitioners and theorists seems to be more prominent in Britain than in America, where research projects undertaken in schools appear to be more accepted, commonplace and appreciated.

British teachers' apprehension towards innovation is not without foundation. Memories of I.T.A., [4] and the discredited reading test designed by Cyril Burt, (1963) have done little to foster the trust necessary for a more harmonious relationship between research and practice.

4 Initial Teaching Alphabet
The gap between research and practice appears to be as large as ever. A case in point is the highly acclaimed method of teaching language vocabulary using the keyword method — highly acclaimed, that is, among the enthusiastic researchers whose applied experimental results suggested nothing less than an important breakthrough in vocabulary learning.

In reality, common sense suggests that most language teachers are largely unaware of the technique, despite its somewhat ancient pedigree [5]. Although the keyword method has been criticised as a system which avoids the "true" translation and comprehension of material, this claim was never made for the keyword. One assumes that those responsible for designing the literature which accompanies language courses and assists instruction are prepared to forgo the benefits the keyword might afford for the sake of sustaining traditional practice.

Given that teachers may be largely unaware of the benefits the keyword might afford their students, this is hardly the case with first-letter mnemonics. Teachers use these informally with little objective evidence to suggest they do in fact promote more effective learning.

It seems incongruous that studies attempting to assess the efficacy of first-letter mnemonics should provide such negative data. In the writer's experience, first-letter mnemonics learned both separately or in conjunction with related learning material typically lead to c.100% learning improvements. Common sense suggests that other professionals are equally convinced they work. Why else would they waste valuable lesson-time teaching a mnemonic?

5 Atkinson, 1975; Atkinson and Raugh, 1975
This research was designed to assess the efficacy of first-letter
mnemonics when used with children in a regular context, by using
objective methods to elicit new information relating to acrostics. The
methods used to obtain this information were:

1) An applied experimental study designed to compare the efficacy
of mnemonically instructed learning with that of rote-
instructed and uninstructed conditions. The performances of
children in each experimental condition assigned to one of two
age-groups (mode 11.5 and 13.5 years) were compared.

2) A questionnaire issued to each child to elicit the precise
learning of each child following a learning activity.

3) Small-scale follow-up interviews with the mnemonically
instructed group.

4) A survey circulated to staff to obtain information about
current mnemonic practice in secondary schools.
Although considerable amounts of time and resources are devoted to educational research, there appears to be a tradition whereby its findings remain unused and unrecognised as having practical applications in the classroom.

It is the hope of the writer that the findings of this study will demonstrate that educational research does have a positive practical contribution to assist teachers in facilitating and developing the educational process.

Using mnemonics to assist learning has been ridiculed for many decades. In the absence of objective statements of their efficacy or otherwise, conjecture and supposition have condemned them as 'tricks', 'memory crutches' or worse. Over the last two decades in particular, mnemonics have once again attracted an interest not dissimilar to that shown by the Greek philosophers who were fully aware of the considerable benefits mnemonics could provide to human memory.

Despite this rekindled interest in a subject of great mystique and curiosity, research has been limited by inadequate resources, disappointing laboratory results and limited empirical experimental opportunities.
RESOURCES
Research grants in the United Kingdom tend to prioritise projects related to either government or educational initiatives or alternatively those related to bachelors’ or masters’ theses. In submitting an application for a part-time award to assist this project, the writer was informed that research projects beyond the level of a master’s degree "would not be considered".

This position is particularly disappointing for those teachers who wish to develop research which they may have already undertaken as part of an earlier study, and without aid find themselves unable to continue.

Most education authorities are willing to encourage teachers to undertake advanced study up to master’s level. However if this degree is, at least in part, preparation for further research with a view to positive, practical, utilisable outcomes, then this possibility is lost due to a lack of the small provision that would be required to achieve this objective.

LABORATORY RESULTS
With the exception of one specific area, research into mnemonics both here and in the United States has produced such inconclusive results that the momentum of study has declined rapidly. Efforts by American researchers to demonstrate the efficacy of first-letter mnemonics in laboratory trials have been inconclusive. In assessing this type of mnemonic, it does not seem satisfactory to omit testing its efficiency in the classroom. Given the informal tradition among teachers to use mnemonics to help their children acquire learning strategies, the confused and inconclusive laboratory results seem incongruous.
Experimental research is often restricted by the time resources and opportunities available. A researcher who needs to test a hypothesis which itself involves the periodic testing of schoolchildren is faced with considerable difficulty. For example, given the demands of the National Curriculum, with additional constraints on time and resources to meet curricular targets, the researcher will have to be prepared to negotiate extensively to achieve this requirement. Empirical research in schools is not popular among staff. Ironically it is teachers, those most able to negotiate in this situation, who are often those least likely to receive support for educational research.

Until resources are made available by institutions, education authorities or schools [6] to encourage and support higher research, it is difficult to envisage precisely how further empirical research will be undertaken. Equally teachers need to know, and have a right to know, how the results of such empirical research will help them in the classroom.

Clearly teachers have a responsibility to become self-informed through reading current journals or educational publications. In addition, educational institutions which have access to and hold potentially useful knowledge could also communicate this to practising teachers, via teacher or education centres. It would appear that one of the factors inhibiting the sharing of knowledge between teachers and research institutions is ineffective communication. Educational institutions can have a tendency to speak a different language from that of practising teachers. Our own experience can suggest that ineffective communication of the aims and purpose of educational

6 e.g., under the Local Management of Schools
research can lead to teachers taking a somewhat sceptical view of the relationship between educational theory, research and practice.
SUMMARY OF SECTION 1

MEMORY: AN OUTLINE SKETCH OF TWO MODELS

What will be attempted first is a brief chronological review of some approaches towards the study of memory. This is followed by a more specific review of memory processes, which are linked with the functioning of mnemonics. Included in this discussion is the relationship between organisation, meaning, and context in learning and how the child's incremental acquisition of metacognitive processes is related to knowledge acquisition.

Before examining two specific models of memory, evidence from neurological, amnesiac and psychoanalytical sources is explored.

Next, two different approaches to the study of memory are examined. The first is a dichotomous view, hypothesising more than one processing and storage system; the second an approach which links the durability of memory with the depth at which it has been encoded.

In the interests of brevity, both examinations will be restricted to the main evidence related to each model.

A fuller review of theoretical developments during the 19th century, can be found in 'Human Memory', (Seamon, 1980) and also in 'Aspects of Memory', (Gruneberg and Morris, 1978). Two important contemporary reviews have been made by Alan Baddeley: 'The Psychology of Memory', (1985) and 'Memory', (1990). The same author has also written a practical handbook, 'Memory: a User's Guide', (1982) whilst 'Applied Problems in Memory', (1979) edited by Gruneberg and Morris, is arguably one of the most influential discussions related to applications of memory research.
BACKGROUND

"Memory is an abstraction. In everyday speech, we talk of having a good memory, of having a poor memory, of having a better memory for faces than for names...... Yet it is true, although alarming, to say that there is no such thing as memory." (Hunter, 1957/64)

Attempting to account for intangible aspects of thought and perception was a favourite preoccupation of Greek scholars, (e.g., see Yates, 1966, The Art of Memory). Empedocles, (495-435 B.C.) suggested that sight was an extension of touch, and Democritus, (460-360 B.C.) hypothesised that images of objects moulded the air as they travelled en route to the eyes, (e.g., see Marshall and Fryer, 1978).

Two of the greatest writers of ancient times, Aristotle, (in De Memoria Reminiscentia) and Plato, (in the Tabula Rasatus), offer similar analogies of memory, that relating to stamping or printing upon matter. In Aristotle’s proposal especially, the Latin connection with the modern term is self-evident.

Contemporary discussions on the subject are based on more objective information, employing scientific methodology and systematic procedures, thereby avoiding the subjectivism demonstrated in many earlier publications, (e.g., Zedler’s Grosses Lexicon, 1732-1750). Addressing the need for a more "scientific" approach, Estes, (1979) writes:

"What we hope for primarily from models [of memory] is that they will bring out the relationship between experiments or sets of data that we would not otherwise have perceived."
Influential in promoting this type of approach, has been a series of experiments undertaken by Ebbinghaus, (1885) who established many of the principles followed by subsequent psychologists like Bartlett, [1].

Although criticised for the type of 'nonsense', or artificial material he used, [2] Ebbinghaus demonstrated the existence of distinct functions of memory, once independent variables [3] were held constant. Adopting mainly serial learning [4] techniques, he observed the tripartite relationship between: learning time, the number of mental repetitions made of learning material, and its subsequent durability.

Ebbinghaus hypothesised that the effectiveness with which material could be learned was directly related to the exposure of the learning material to higher cognitive functions.

Although work by Glaze, (1928) had already highlighted cognition's capacity to create meaning where none naturally exists, Bartlett's (1932) investigations were a deliberate attempt to investigate memory in a less artificial context, which emphasised "....the central importance of the subject's active search for meaning", (Baddeley, 1985).

1 Among Bartlett's students were Broadbent, Brown and Conrad. The influential Nelsser, (e.g., 1967, p.10, also considers himself as a "disciple" of the Bartlett approach.)
2 For example, consonant-vowel-consonant triagrammes such as C U F; H E Z, et al.
3 Features relating to an experiment, which, unless manipulated, (controlled) are inclined to reduce the purity of results.
4 Where the order of recall reflects the order of items originally presented for learning.
Using a range of materials, Bartlett noted a direct relationship in the delay between initial learning, re-test, and the accuracy with which material could be remembered. He also observed a linear relationship between exposure time and quantity of material that could be recalled, ("total time hypothesis").

Later laboratory research, (e.g., Bugelski, 1962; Jung, 1964; Zacks, 1969) and applied studies, (e.g., Bloom, 1974) have subsequently confirmed Bartlett’s findings, although anomalies relating to how subjects distribute learning time, (e.g., reviewed by Cooper and Pantle, 1967) the reliability of their reporting and the learning methods they sometimes use, (e.g., see Paivio, 1971 on Imagery) are variables often difficult to control, (e.g., see Kail, 1979).

Another important feature of Bartlett’s work, in relation to this study, is that if subjects are unable to recall certain details of a story they tend to fabricate material in an attempt to retain the item’s essential structure and meaning. This finding emphasised the central role of meaning within human memory, and is the basis of many cognitive and mnemonic learning strategies, (see Alexander and Judy, 1988).

During the "arid years" (Richardson, 1980) of the 1940s and '50s, the "strangle hold" of the behaviourists proved almost "impossible to pierce", (Nilsson, 1979) largely deterring work on memory which, like imagery, was considered a "disreputable" subject. In 1972, Tulving wrote:

"...the term "memory" has recently been permitted to return from the limbo into which it was swept by the tide of behaviourism some thirty years ago."

5 This included stories, prose, pictures and picture writing.
6 Members of the scientific community, who interpreted cognitive action within stimulus-response paradigms.
During the late 1950s, specific events once again re-established 
cognitivism as a respectable scientific approach, where the study of 
memory, along with its associative functions, (e.g., imagery and meta- 
concepts) enjoyed a "renaissance".

Working independently, Brown, (1958) and the Petersons, (1959) 
produced quite dramatic evidence that cognition was associated with 
two separate storage systems, a long-term store, where retention is 
affected by interference, and a short-term store where retention is 
affected by the decay of the memory trace.

Facilitating the "new approach", was Broadbent's (1958) interest 
in computer processing. Using computer processing as an analogy, it 
was plausible to view human memory in terms of information flow 
between a series of subsystems.

Although the credibility of a unitary memory-system was still 
actively maintained, (e.g., Melton, 1963) "information processing" 
approaches provided the impetus to identify more appropriate models of 
memory. Adopting such Ideas were proponents of various "duplex" 
models, (Brown, ibid; Peterson and Peterson, ibid.) although a 
plethora of assorted proposals followed.

Norman's (1970) collection of essays on human memory, listing 
thirteen different memory models, (including some twenty-five 
categories of memory) was a more general demonstration of the "new 
era", (Nilsson, 1979) but in associated fields such as imagery 
research, the "veritable explosion" (ibid.) of research was also 
evident, (see Merry, 1980b for a review).
Attractive as the Atkinson and Shiffrin model was, its appeal faded as evidence from a range of sources could not easily be accommodated within its proposed framework. (These issues are discussed in greater detail below).

In 1972, Craik and Lockhart presented a completely new approach which avoided many problems associated with a multi-store view, (see Melton 1963).

Although the levels of processing approach was directly indebted to Broadbent's (1958) proposals, Craik and Lockhart avoided storage problems associated with dichotomous views of memory by suggesting that it is the depth at which material is processed that determines its durability rather than the store to which it is admitted. (This approach is examined in greater detail below).

Like earlier models the levels approach failed to accommodate some important research findings, and expectations that it might form the basis of a more general framework of study remain largely unfulfilled.

In 1974, Baddeley and Hitch supported claims (e.g., Posner and Rossman, 1965; Atkinson and Shiffrin, 1968; Hunter, 1957; Newell and Simon, 1972) for what is arguably the only different contemporary STM model, working memory.

As this particular model is not discussed in detail elsewhere I will outline its main features here.
The diagram on the following page depicts the *central executive* which, in addition to functioning as a short-term processor, assumes a range of higher cognitive functions including problem-solving and reasoning, (e.g., Baddeley, (e.g., 1974; 1985; 1990). The central executive is responsible for what other workers have termed metacognitive functions, (e.g., Flavell, 1971; Brown, 1978; Brown and DeLoache, 1983; Brown, et al., 1983) in addition to acting as a primary store.

This model supposes that the "central executive" is responsible for both visual and phonetic processing.
Baddeley and Hitch, (1974) adopted Craik and Lockhart's notion of "primary memory" as a means of exploring the relationship between: reasoning and mathematics, (e.g., Hitch, 1977); reasoning and reading, (e.g., Baddeley, 1978); reasoning and short-term processing, (Hitch and Baddeley, 1976). These studies reinforced the need to assume an integrated relationship between short-term processing and higher cognitive functions. There was also an accumulation of evidence, from studies related to imagery, (e.g., Shepard and Chipman, 1970; Shepard and Metzler, 1971; Paivio, (e.g., Paivio, 1969; Paivio, 1971; Paivio, 1972; Paivio, 1975) and acoustic storage, (e.g., Conrad and Hull, 1964; Hintzman, 1967; Wickelgren, 1969) which suggested independent phonetic and visual processing components within cognition.

Baddeley himself is the first to admit that although there is abundant phonological evidence to support the loop theory, less is known about the operation of the sketchpad and even less about their particular relationship with the central executive. Nonetheless, the idea is a new direction and although a "tentative" (Baddeley, 1990) model, is helping towards a greater understanding of the nature of short-term processing.

Unfortunately the possibility of establishing a model of memory which both accommodates the evidence available and is acceptable to the scientific community in general, seems as remote as ever. In 1979, Nilsson wrote: "....we do not know very much more about memory now than we knew years ago". The deeper investigations probe the mystery of memory, the more complex it appears to be. But the complexity of memory itself offers students of psychology a challenge, and probably we ought to use Tulving's (1979) words, "....have the courage...to reject ideas and hypotheses that are at variance with the data" in an attempt to know more.
"One of the motivating sources of modern cognitive psychology of memory is the concept of organization." (Mandler, 1979). "When we think of organization processes in memory, we are naturally reminded of an earlier revolution launched under the banner of Gestalt," (Postman, 1972).

A specific measure adopted by Cognitivists to improve the definition of statements related to functions of memory, is to identify with greater precision and clarity, how memory is organised.

This type of approach enabled Tulving (1972) to herald the arrival of a "new kind" of memory, (which he attributes to Quillian, e.g., 1967 [7]) Semantic memory).

In a powerful and influential paper, Tulving, (1972) attempted to elucidate the nature of semantic memory, claiming that the term had been used "inappropriately" by successive authors, (e.g., Rumelhart, Lindsay and Norman, 1972; Kintsch, 1972). Tulving’s proposal suggested that memory was comprised of two underlying storage "categories": Episodic and Semantic, although remaining adamant that these should not be attributed to independent short, and long-term storage systems.

Tulving, (1972) describes Episodic memory as: "...memory for personal experiences and their temporal relations", and Semantic memory as: "a system for receiving, retaining, and transmitting information about meaning of words, concepts, and classification of concepts".

Although the relationship between meaning and memory had much earlier been studied by Cattell, (1887).
A succession of subsequent studies (e.g., Schulman, 1971/74; Kolers and Ostry, 1974; Smith, et al., 1978; ) confirms the power of episodic experiences as providing a context for retention.

Each of us has probably experienced the effects of context on subsequent recall. Certainly Beethoven did. Whilst riding in a coach, Beethoven dreamt of a piece of music which he almost immediately forgot. Riding in the same coach the following day, he suddenly recalled the musical canon and wrote it down, (Dreistadt, 1971).

Baddeley, (1985) describes an interesting study designed to test this specific effect. Deep sea divers were given information to learn in two contexts, on shore and underwater. Godden and Baddeley, (1975) found that information learned in the underwater context was better recalled in that context, and vice-versa, (see also Smith, 1988).

Both the above descriptions of context-dependent memory would, using Gestalt theory, be interpreted within "organisational frameworks". That is cognition has a "natural propensity" to link cognitive and environmental events in such a dynamic way, that recalling specific cognitive data can only result in the recalling of traces (memories) which were laid down simultaneously with, and in association to, the target trace, [8].

"Environmental reinstatement effects" although well supported by both theoretical (e.g., Smith, 1988) and empirical findings (e.g., Canas and Nelson, 1986) should be interpreted cautiously, as additional contemporary research is at some variance with the findings of Baddeley and his associates. Two recent (laboratory) studies related to learning/examination context effects, (Saufley, et al., 1985; Fernandez and Glenberg, 1985) report little context effect,

8 e.g., the trace of the item that is being recalled.
contradicting Melgren's (1984) data, but as Chen (1984) points out, students normally study outside their regular classroom environment.

The present discussion is important to some theoretical and practical aspects of this study.

One of the main functions of mnemonics in general, and first-letter mnemonics in particular, is to elaborate or attach additional meaning to learning material. Given the preceding discussion it would be reasonable to hypothesise that different environmental cues might interfere with the mnemonic material itself. This is not found to be the case, as the "outshining hypothesis" predicts that stronger cues have the effect of masking weaker ones, (see Eich, 1980; Nixon and Kanak, 1981).

If a mnemonic provides better and more "distinctive" cues than those within the immediate context of the learning material, (e.g., see Jacoby and Craik, 1979) it will be the cues the mnemonic provides that will dominate those less salient, (e.g., Geiselman and Bjork, 1980, and see Smith, 1988 for a review). As Morris, (1979) points out: "The central problem for a memory system is to lay down at the initial acquisition stage a record in a form which can be retrieved when retrieval is appropriate". Tulving, (Tulving and Osler, 1968) addressed this issue in more detail through the proposal of his "encoding specificity hypothesis", where;

"....specific retrieval cues facilitate recall if and only if the information about them and about their relation to the to-be-remembered words is stored at the same time as the information about the membership of the to-be-remembered words in a given list," (Tulving and Osler, 1968, p.599).
In the case of reduction systems such as acronyms, this is achieved by stripping away all but the most essential cues of each word, e.g., the first letters. These, in turn, can be deliberately organised to form a recognisable word, thereby creating both context, (e.g., Smith, 1988) and meaning, (Tulving, 1972) where none "naturally exists", (Baddeley, 1985).

Acrostics [9] also function to strengthen first-letter cueing by generating additional meaning in a different way. Here the first letters (and sometimes additional ones) of each to-be-learned word are used to provide the first letters of more memorable words. These are organised to provide a statement, sentence or phrase which is typically more memorable than the original learning material. To decode the acrostic, the individual uses the cues provided by the first letters to prompt the learned words, (for a more detailed discussion, see the sections in this study marked "Mnemonics, a brief historical perspective", pp.103-105; "Mnemonics in contemporary society", pp.106-109 and "First-letter mnemonics", pp.137-140.

Adopting Tulving’s hypothesis, the elaborative nature of mnemonics cause associated material to be processed at a deeper level within memory structure, which has a powerful capacity to categorise and organise at the level of meaning, (Baddeley, 1966; Baddeley and Levey, 1971). When material is of an arbitrary nature, and arbitrary relationships exist between items comprising the learning material, its memorability is considerably reduced.

How many readers have experienced anxiety and frustration during attempts to remember a telephone number, delivered via a pre-recorded British Telecom (BT) taped message?

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9 For example, "Richard Of York Gained Battle In Vain" (more commonly called a "first-letter mnemonic") is sometimes used in the learning of the sequential order of the spectral colours.
Whilst I am sure BT have the interests of the hard-of-hearing at heart, when they decided to present telephone numbers in an artificial, dissociated, 'automatic' way, surely their advisers would have known that this type of presentation is at variance with our present knowledge of how memory operates.

Even writers within the field of mnemonics might be forgiven for failing to remember a simple six-digit number transmitted by a 'synthesised' voice recorder which fails both to group the numbers, and also to offer any meaningful association between the digits, (e.g., in the form of rhyme) which might make numbers more memorable — surely the point?

The mechanically delivered number offers recipients little opportunity to apply cognitive strategies within their normal repertory (see Cavanaugh and Perlmutter, 1982), as the very information which is to be remembered is in a form that makes it least memorable, (e.g., see Wallace and Rubin, 1988).

Baddeley, (1990) illustrates the relationship between organisation and meaning nicely. I paraphrase:

If presented with a randomly arranged sequence of mixed consonants and vowels, eg., G D O I A L A Z N R A E N E N R, most learners would find it difficult to remember the sequence, unless given sufficient opportunity to rehearse or re-code the material.

The same letters arranged so that the vowels occur in positions that suggest nonsense syllables, e.g., N A R E L A D E N I Z A G R O N is more memorable, but "O R G A N I Z E A N D L E A R N", demands little retention effort at all.

Adopting a multi-store view of memory the learner could transfer this material to a secondary or long-term store in at least two ways:
Through laying down successive traces of the material within short-term store (STS) "maintenance rehearsal", (the action of continuous vocal or subvocal repetition of the material, Craik and Lockhart, 1972) or by associating the material with items already secure within the incredibly durable semantic long-term store (LTS).

Although the digit sequence presented above is beyond the immediate span of normal subjects, (e.g., Miller, 1956; Ericsson and Chase, 1982) material can be grouped, (e.g., Ebbinghaus, 1885) "chunked" (e.g., Wickelgren, 1964) or recoded, (e.g., Slak, 1970) in order to facilitate its transfer to a more durable LTS with an "enormous" capacity, (e.g., Baddeley, 1990).

For a range of reasons, based on evidence from a number of sources (discussed in more detail later), models of memory which failed to differentiate between short-term and long-term components, (despite their plausibility, e.g., Melton, 1963) and those which inadequately addressed issues like storage capacity and information transfer, (e.g., Tulving, 1972) lost their appeal.

Contemporary knowledge makes it difficult to sustain either a unitary or dichotomous model of memory. Evidence suggesting how memory is organised will be reviewed next.
EVIDENCE OF MULTIPLE MEMORY STORES FROM FORGETTING

"While the nature of forgetting is no longer regarded as an important argument in favor (sic) of a dichotomy, it remains an interesting question in its own right and provides a useful framework for exploring STM (short-term memory) in greater detail." (Baddeley, 1985)

During the early post-war years, a succession of laboratory work, using animals, produced highly conflicting evidence about how short-term memory might function, (see Mayes, 1983 for a review). The *stimulus-response associationists* were almost solely preoccupied by the functions of memory per se, rather than becoming involved in dichotomy issues. Interaction between these two fields of study was stagnant.

It may be remembered that, in the late 1950s, two pieces of research once again brought the dichotomy issue into sharp focus. Independently Brown, (1958) and the Petersons, (1959) demonstrated that if subjects were prevented from rehearsing between learning trials, (e.g., by loading cognition with an activity requiring attentional and analytical demands) the target material would be rapidly forgotten. (See also, Neisser, 1982; Baddeley, et al., 1984).

Typically items at the beginning of a list (hypothesised as having been transferred to a "deeper level" or more durable store, e.g., Craik and Lockhart, 1972) and those at the end, displaying the "recency effect", [10] (e.g., Postman and Phillips, 1965; Glanzer and Cunitz, 1965) are remembered better than intervening items. The available evidence led many psychologists into reasoning that memory was at least a "duplex" system, [11] (e.g., see Klatzky, 1980).

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10 Where it has been proposed that more recently presented items are still circulating within an immediate, primary, or temporary memory store.
11 e.g., comprising short and long-term memory systems.
Given the knowledge that cognition has the potential to store "massive" (Baddeley, 1990) amounts of information relating to a wide range of perceptual experiences, if there were but one underlying memory-system, why should it not be possible for normal individuals to possess a "span of apprehension" (Galton, 1883) greater than six or seven? (Hamilton, 1859, see Watkins, 1977) "six simple impressions"? (e.g., Wundt, 1887/1905) or a string of digits fewer than nine? (Jacobs, 1887; Miller, 1956).

And, why is it, that unless individuals make some effort to remember, say a telephone number, it will normally be forgotten? (e.g., see Bartlett, 1932; Broadbent, 1958; Brown, 1958; and later, Watkins, 1977). The dichotomy issue was further strengthened by evidence that recall errors, associated with LTM were typically related to semantic encoding, whilst errors associated with STM were related to acoustic encoding, (e.g., Baddeley and Dale, 1966).

The issue of forgetting was actively pursued using both interference and trace decay paradigms.

Developed along the lines proposed by the British associationalists, Hobbes and Locke, associative interference theory was used in an attempt to explain the phenomenon of forgetting. Muller and Pilzecker, (1900) adapted the theory to facilitate empirical tests of its efficacy and at its height, it was claimed to be "one of the most successful and established theories in psychology", (Kintsch, 1970).

Subsequently criticised for its limited capacity to account for more recent knowledge about how memory functions, (e.g., see Baddeley, 1985, pp. 76-99, for a discussion) the theory has nonetheless brought certain aspects of forgetting into sharper focus.
Two distinct types of interference were claimed to be responsible for "unlearning", "extinction" (e.g., Melton and Irwin, 1940; Underwood, 1948) or, more informally, forgetting. Although **Proactive interference**, [12] (e.g., Greenberg and Underwood, 1950) and **retroactive interference**, [13] (e.g., Briggs, 1954) were assumed to be responsible for once-learned material being progressively eroded within memory, studies on long-term memory, (e.g., McGeoch and McDonald, 1931) have shown that by the careful manipulation of material in recall tasks, interference effects can be minimised.

The Petersons proposed that **short-term forgetting** was the result of trace decay, and assumed that **long-term forgetting** was the result of interference. Such an admission generated a good deal of inertia within the dichotomy discussion.

A series of investigations followed, (e.g., Keppel and Underwood, 1962; Wickens, et al, 1963) who disputed the Petersons' interpretation of data, and Melton, (1963) who published a classic paper which supported the principle of a **unitary** view of memory.

The premise of Melton's argument was that so many features of proposed short-term and long-term memory functions have **similar** attributes, that to assume an underlying dichotomous system whilst 'convenient', is a misrepresentation and oversimplification of how memory is organised. Strong evidence from both neuropsychological, amnesic and psychoanalytical sources, contend with Melton's proposal.

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12 When previously learned material confuses the learning of preceding material.
13 When subsequently learned material confuses the learning of that previously learned.
FREUD AND PENFIELD

"A normal man, is he not an acquirer of information, a creature who forgets a host of things and at once those hundred thousand precepts per second he has no need to register?" (Michaux, 1966)

Although the procedure has been disputed, (e.g., see Shor and Orne, 1965) students of the psychoanalytical school have now adequately demonstrated that under hypnosis, [14] normal individuals are capable of recalling vast amounts of information that in their conscious state they would find quite irretrievable. Although scholars themselves disagree about what hypnosis might be, (e.g., Barber, 1969; Barber and Ham, 1974; Hilgard, 1977) it has been used successfully to treat various forms of anxiety, (e.g., Freud, 1892/3) and to facilitate the recall of "accurate knowledge" (Oakley, 1983) relating to unattended [15] events, (e.g., see also Hilgard, 1977).

Typically memories recalled under hypnosis are accurate, vivid and reliable, (e.g., Bower, 1981) suggesting that cognition has the unattended capacity to record complete events in considerable detail, without the individual's conscious awareness of this occurring, (see also Gardiner, 1989). Under normal circumstances much of the finer details relating to events is unrecallable. However, for some reason unclear as yet, they are potentially available, (see also Hart, 1965; Brown and McNeil, 1966; Reason and Lucas, 1984; Salame' and Baddeley, 1987; 1989).

In flamboyant style Reason and Lucas, (1984) hypothesised that once cognition activates a search schema, "The unrequited schema, like Heathcliff, continues to scan both the inner and outer worlds until the target is found" until it "pops up" (Hunter, 1964) sometime later.

14 An induced state designed to "widen the field of consciousness", (e.g., Puysegur, cited in Erdelyi,1985) from the Greek, "hypnos" meaning sleep. 
15 Events recorded without conscious awareness or attention.
There is important additional evidence supporting the idea that cognition contains a complete autobiographical "experiential record", (Oakley, 1983) "extra-marginal and outside of primary consciousness altogether". (James, 1902) During cortex examinations of several patients, Penfield, (1969) discovered that when a probe was introduced to specific areas of conscious patients' temporal lobes, they reported past events in rich and vivid detail, (see also Penfield and Perrot, 1963) being "aware of all that was in [their] mind during an earlier strip of time" as though "the stream of earlier consciousness [was] flowing again". (Penfield 1969, p.152).

Freudians would argue that the inability to recall such detailed information during periods of normal consciousness, is caused by cognition deliberately repressing (masking) material to avoid becoming saturated by a plethora of sensory stimuli and irrelevant information, (e.g., Freud, 1856-1939).

Theorists arguing from the Gestalt tradition [16] would contend that if rehearsal or other cognitive or mnemonic strategies are prevented, the trace comprising the target material and/or strategies would progressively decay to a point where the original sensory input is irretrievable. In simple terms, this assumes the fading or complete loss of a stimulus "print" as the result of a breakdown of the synthesised proteins and neurons of a once consolidated trace. (see Barondes, 1970 for a more detailed discussion)

Given the natural problems associated with translating the results of hypnotic and contextural stimulation studies into objective data, the next section reviews some of the more tangible evidence relating to the dichotomy hypothesis.

16 Founded in Germany, (e.g., Kohler, Wertheimer, et al.) particularly influential between the 1920s and '30s.
MEDICAL EVIDENCE

"We do not yet know much about the physiological bases of retaining. But we have no reason to doubt that retaining is accomplished by modifications of the nervous system and, furthermore, that these modifications are of a structural kind whenever retaining persists for longer than a few minutes." (Hunter, 1957/64)

In virtually all discussions relating to the dichotomy issue, memory-impaired patients and the effects of drugs and amnesics are used to illustrate claims supporting multiple-store hypotheses.

DRUGS

Barondes, (1970) describes how chemicals (e.g., acetoxycycloheximide) known to affect the synthesis of proteins required for long-term storage, can be manipulated to inhibit long-term retention [17]. By manipulating the timing during which the drug was administered, Barondes was able to demonstrate the existence of two memory functions, one with a duration of around four-and-a-half hours, and a second, more durable component, which was not affected if the drug was injected thirty minutes post trial.

Similar experiments (e.g., Greenough and McGaugh, 1965) using central nervous stimulants (e.g., strychnine sulphate) suggest that stimulants can facilitate learning if they are introduced soon after initial learning has taken place. Such findings are conducive with a trace decay theory associated with short-term forgetting.

17 The work was undertaken with rats.
AMNESIC AND NEUROPSYCHOLOGICAL EVIDENCE

Amnesics, [18] temporal lobe surgery, (e.g., Whitty and Zangwill, 1966) sufferers from cogno-degenerative diseases, e.g., Huntington's chorea, (e.g., Meudell, et al., 1978) Alzheimer's disease, (Miller, 1977) and aetiology associated with alcoholism, are other useful sources of data in the memory structure debate. (see e.g., Barbizet, 1970 for a review)

For example, alcoholics suffering from Korsakoff's syndrome, are known to have considerably impaired LTM (long-term memory) functions, whilst often demonstrating normal immediate memory [19], (e.g., Schneider, 1912; Moscovitch, 1982; see also, Mayes and Meudell, 1983).

Barbizet, (1970) writes:

"Sometimes the disorder is less than total affecting only certain of the mental capabilities: the patient may have difficulty only in retaining a spoken or written message, or in finding his way about in a new locality, yet will retain (although doubtless in an impoverished way) the ability to remember new experiences."

A similar type of Korsakoff effect has been noted by Zangwill, (1946) and Drachman and Arbizu, (1966) who found that similar patients are typically unable to recall information learned prior to their alcoholism, and also more obvious facts, such as the present month, or the name of the present Prime Minister. When tested on immediate memory tasks, their performance appeared unimpaired.

Sufferers from Korsakoff's syndrome clearly demonstrate the ability to recall from LTS, but appear largely unable to process or transfer new information between ST and LT stores. Each store has the capacity to function separately, but subjects have little or no

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18 Amnesia has been described in psychological terms, as an abnormality where individuals suffer from the inability to form cognitive links between separate events, (e.g., Welskranz, 1982).
19 "...the maximum amount of information that a patient can retain and simultaneously and repeat immediately after having grasped it." (Barbizet, 1970, p.13).
ability to transfer material between stores in order to make material more durable.

Although the data relating to amnesics is both important and interesting, sometimes sample sizes are very small. However, there are two patients who can be quoted as examples.

The first, famous as 'K.F.', was an amnesic with a grossly impaired span of one item but with normal long-term learning and recall, (studied by Shallice and Warrington, 1970). The second, known as 'H.M.' was a patient whose temporal lobes were surgically lanced to treat his chronic epilepsy, (described by Milner, 1970). It seems somewhat inappropriate to generalise findings obtained from individuals and apply them to broader populations, especially as "memory deficits are seldom pure". (Mayes and Meudell; 1983 Baddeley, 1990).

Despite "current uncertainties" (Mayes and Meudell, 1983) taken as a whole, the evidence from a variety of sources appears to support a memory system which accommodates two or more distinct stores: at least one responsible for manipulating material rapidly, and another, responsible for long-term storage, from which information is accessed more slowly.
MODAL MODEL

"By the late 1960s, the weight of opinion was coming to accept the need to distinguish two types of memory." (Alan Baddeley, 1985).

Reflecting developments in ST processing originally proposed by Broadbent (1958), Atkinson and Shiffrin (1968) proposed their highly influential "modal" model of memory which was able to accommodate most of the research data. (see diagram overleaf)

Sensory information is received by sensory "buffers" or "registers" which act as a filter for further processing. Material selected for this purpose enters an "immediate", (e.g., Jacobs, 1887) "primary", (e.g., James, 1902; Craik, 1968) "short-term" (e.g., Estes, 1979) or "temporary working memory" (e.g., Atkinson and Shiffrin, 1968) store.

For Atkinson and Shiffrin rehearsal and coding are among the most important "control processes" of STS enabling the transfer of material from ST to LTS. Adopting a Gestalt approach, attending to or focusing upon material temporarily within the STM effectively lays down subsequent memory traces, thereby consolidating the information along with associated traces and enabling transfer to a more durable LTS.

Like Baddeley's hypothesis of a working memory, Atkinson and Shiffrin conceive the STS to be considerably more than a repository of limited capacity. The STS is also seen as a processor of "thoughts and information", an executive decision component synchronised with the LTS with which it constantly interacts.

Although the modal model offered an attractive alternative to that proposed by the unitary theorists, it too contained inconsistencies incompatible with the evidence.
THE MODAL MODEL - Based on Atkinson and Shiffrin, (1968).

ENVIRONMENTAL INPUT

SENSORY REGISTERS

VISUAL

AUDITORY

HAPTIC

SHORT-TERM STORE (STS)

TEMPORARY WORKING MEMORY

CONTROL PROCESSES:
REHEARSAL - CODING - RETRIEVAL STRATEGIES

LONG-TERM STORE (LTS)

PERMANENT MEMORY STORE

RESPONSE OUTPUT
Assumptions that rehearsal is a "sufficient" (Seamon, 1980) prerequisite for material to be transferred to LTS, (e.g., Bjork and Jongeward, 1975; Dark and Loftus, 1976) conflicted strongly with evidence from other sources, (e.g., Jacoby and Bartz, 1972; Craik and Watkins, 1973).

The hypothesis that LTS categories are simultaneously accessed at the point of stimulus reception, and the view that STS is the sole "arbiter" in transferring material between ST and LT stores, could not be empirically supported.

For example, although we do not consciously attend to much that is happening around us, under hypnosis obscure aspects of events (that would not appear to warrant long-term processing) can be recalled in considerable detail. Whereas this knowledge is not totally incompatible with the modal model, this evidence does at least suggest that material is stored in a very durable form without conscious processing or awareness, (see also, Gardiner, 1989).

Given the evidence it was becoming increasingly clear that some form of model was required which was free of storage complications.
LEVELS OF PROCESSING

In 1972, memory research made a radical departure from dichotomy models. Craik and Lockhart proposed the idea that it was the depth at which material (traces) was encoded that affected its subsequent durability and not the transfer from one type of memory store to another, (see diagram overleaf).

As an alternative to "structural theories" (Craik and Lockhart, 1972) of memory, the model had instant appeal. It could accommodate awkward issues like the disparity between neuropsychological evidence and multi-store hypotheses. It was also attractive to unitary theorists, (e.g., Postman, 1975) who stressed compatibility between the levels of processing approach and one-type processing models.

In the levels of processing approach, three types of encoding are viewed as leading to qualitatively different levels of processing, the most superficial being mere sensory processing at the level of reception. At the intermediate level, phonological [20] processing leads to deeper processing depth, whilst semantic processing, (where material is embellished, associated with existing memories or made meaningful by deeper structuring/restructuring of the material) processes material at the very deepest level, (e.g., see Fisher and Craik, 1977).

Craik and Tulving (1975) supply a nice example of how meaning can affect processing, by comparing the sentence:

"The wizened old man hobbled across the castle courtyard and dropped the gold watch down the well."

with

"The man dropped the watch".

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20 Material that is processed in relation to its acoustic structure.
The *Encoding Theory* associated with Craik and Lockhart's, (1972) *Levels of Processing* approach to memory.

Sensory processing occurs at a superficial level and is the least durable form of processing.

Phonological processing facilitates deeper more durable processing.

The deepest and most durable processing is semantic processing.
Craik and Lockhart view rehearsal as playing a fundamental role in trace consolidation, but mere repetition is not considered sufficient to process material to deeper levels, (e.g., Craik and Watkins, 1973). Moreover, it does have the effect of sustaining material for sufficient time to enable deeper processing to be undertaken, (e.g., Woodward, et al., 1973).

Two distinct types of rehearsal are identified: *maintenance* rehearsal, which sustains the memory trace within a primary processing subsystem and *elaborative* rehearsal, which functions interdependently with semantic associations, thereby processing the material in a more integrated form at a greater depth.

Note that Craik and Lockhart's suggestion of a primary processing unit has given rise to suggestions that the *levels* approach conceals the identity of two underlying memory systems, (e.g., see Baddeley, 1985) and even Craik has subsequently adopted a more flexible interpretation of the *levels* approach. (e.g., Craik and Levy, 1977)

Levels of processing do not necessarily imply *separate* ST/LT storage, more a holding system which is an integral part of a complex information and reasoning processor. The primary 'store' (processor) is also seen as being responsible for executive decision-making, problem-solving and reasoning. (e.g., Craik and Levy, 1977)
IMPLICATIONS FOR MNEMONICS

Adopting the *levels* approach, mnemonics might be seen as a means of processing material to deeper levels, as "....words for which meaningful decisions are made show higher levels of retention". (Jacoby and Craik, 1979) This can be achieved in a number of ways dependent on the *type* of mnemonic used. For example, material associated with reduction mnemonics, such as acronyms, facilitate stronger (deeper) traces through the action of de-coding and subsequent re-coding. This activity has the effect of laying down additional traces at the time of association and during each recall attempt. Acronyms also generate separate, but associated traces by the conversion of arbitrary or unrelated material to a more memorable form, e.g., typically, a stronger trace is laid down by the word "LASER", than "Light Amplification (by the) Stimulated Emission (of) Radiation".

Acrostics, whilst functionally similar, (e.g., see Mulvenna, 1982) facilitate deep processing, because of the additional *meaning* they generate through association with learning material, especially if they are accompanied by rhyme, (e.g., Wallace and Rubin, 1988). The *levels* approach suggests that proactive and retroactive interference *between* items is minimised because the semantic associations (traces) formed are sufficiently "rich", (e.g., Klein and Saltz, 1976) or "distinctive" (e.g., see Craik and Jacoby, 1979) to prevent interference. This hypothesis has subsequently been supported at both visual, (e.g., Einstein, McDaniel and Lackey, 1989) and auditory, (e.g., Moscovitch and Craik, 1976) levels of information reception.
Addressing the issue from an interference perspective, Baddeley, (1990) suggests:

"...there is abundant evidence in support of the general interference tenet that degree of forgetting is a function of the similarity between the material that is to be remembered and the interfering material."

PROBLEMS WITH THE LEVELS HYPOTHESIS

There are at least four main problems in assuming that memory is processed through hierarchical levels, related to encoding depth.

First, within the levels hypothesis, it should be anticipated that visual or verbal traces, once processed to comparable depths of encoding, would result in the generation of independent traces of equal strength. (Hyde and Jenkins, 1969; Johnston and Jenkins, 1971)

Unfortunately, the evidence to support this hypothesis cannot be accurately obtained, as there is no objective measure of encoding depth, (e.g., see Winograd, 1976) and studies related to maintenance rehearsal suggest that material can be semantically encoded, in the absence of processing depth. (e.g., Nelson, 1977; Graf and Mandler, 1984)

The second problem relates to the first. Attractive as the idea of hierarchically structured encoding levels is, the levels themselves lack specification. This makes it problematic to ask reasonable questions like: "How many levels are there?" Have adults more levels than children?" Are the levels different between adult populations?" "How is information retrieved from each level?" (e.g., see Morris, Bransford and Franks, 1977). In successive attempts to address these
issues with greater precision, Craik and his associates, (e.g., Craik and Jacoby, 1975; Craik and Tulving, 1975; Lockhart, Craik and Jacoby, 1976) have modified a number of hypotheses contained in their original proposals, but these developments still present a confused picture, (see Baddeley, 1990).

Third, although devotees of the levels theory have presented medical evidence supporting the hypothesis, (e.g., see Cermak, 1979) evidence relating to amnesic studies have largely failed to demonstrate the "encoding depth hypothesis". (e.g., see Baddeley, 1978) The processing capacity of amnesics would be reflected in their inability to process material to deeper levels, (e.g., Cermak, Butters and Moreines, 1974). This hypothesis has not been substantiated. (e.g., Mayes, Meudell and Pickering, 1985)

Fourth, arguably the most difficult evidence to accommodate with the levels approach, is that related to psychoanalytical and cortex-stimulation studies. For some reason this evidence is little emphasised in discussions relating to memory. One possible reason for this is that few theories are capable of dealing with the fact that detailed unattended information can be coded and subsequently quite effortlessly recalled under hypnosis.

Equally difficult to accommodate is Penfield's data. If Cortical stimulation can demonstrably promote the recall of any episodic [21] material within memory, like the evidence from hypnosis, this suggests some form of autonomic [22] memory system which stores all perceptual material regardless of processing or encoding depth.

More awkward is the fact that this knowledge is largely incompatible with either the trace-decay or interference theory.

21 That aspect of memory which is hypothesised to be responsible for recording timescale-event relationships, (e.g., see Tulving, 1972).
22 e.g., a system which operates without the individual's conscious perception.
In what amounts to a scathing attack on Craik and Lockwood's levels theory, an influential paper by Michael Eysenck, (1978, pp.157-169) identified a number of related problems. Eysenck's objections may be summarised as follows:

1) Concerns related to the objective "indexing" and specification of the levels proposed.

2) Objective measures which might identify the specific relationship between encoding depth and strategic encoding.

3) That to assume that mere encoding depth is a major determinant of subsequent recall is a gross oversimplification of how memory functions.

The main thrust of Lockhart and Craik's (1978, pp.171-175) reply to these criticisms relate to acknowledging the many limitations associated with the levels theory, whilst persistently affirming that the theory itself is under constant "revision" and evolution. (e.g., Craik and Tulving, 1975; Lockhart, et al. 1976; Fisher and Craik, 1977)

Despite the overall finding that it is inadequate to describe memory in terms of levels synchronised with encoding depth, the model has promoted more current interest in the relationship between meaning and encoding, (e.g., Baddeley, 1985). As evidence accumulated from a range of sources, it became increasingly clear that a model of memory was required which not only adequately accounted for medically associated evidence, but which could accommodate the relationship between sensory processing and higher order reasoning functions.

Although progress in identifying the nature of memory has been both slow and ambiguous, associated fields of study have revealed some interesting information. From an educational perspective, probably one of the most interesting developments in memory research has been that directed toward developmental aspects of the relationship between memory and higher cognitive functions.
COGNITIVE STRATEGIES AND MNEMONICS

"Developmental trends indicate that strategy use increases with age, generalising to a wider range of contexts as the individual becomes older". (Andreassen and Waters, 1989)

Reaching an understanding of precisely how the growing child comes to adopt cognitive and mnemonic strategies is a complex issue, (e.g., Cavenaugh and Perlmutter, 1982). On the other hand as the volume of research increases, previously unexplored relationships between children's cognitive maturation and strategic thinking can be more fully understood.

Knowledge about the particular relationship between cognitive maturation and the young child's use of cognitive and mnemonic strategies is important to this study for the following reasons:

1) When requested to remember information, very young cognitively mature children have been observed to use unsophisticated strategies such as pointing or touching to assist them with learning tasks, (e.g., DeLoache and Brown, 1984; DeLoache, Cassidy and Brown, 1985) Even this type of simple strategic behaviour enables more strategic thinkers to make more accurate and effective use of their memory.

2) The spontaneous use of more sophisticated strategies such as rehearsal, (e.g., Ornstein and Naus, 1978; Ornstein, et al., 1985a) attention, (e.g., Vliestra, 1982) and the organisation of learning material, (e.g., Moely and Jeffrey, 1974; has also been shown to be related to cognitive maturation. (see e.g., Stainthorp, 1989) Again, children who actively engage these types of strategic behaviour during learning outperform those who do not. (see Kali, 1979 for a review)

A number of studies related to a range of strategic behaviours have now demonstrated that children can obtain lasting educational benefits from both strategy, (e.g., Keeney, et al., 1967) and mnemonic, (e.g., Atkinson, 1975; instruction.

Study of how and under what circumstances children engage cognitive strategies to promote learning, may illuminate the circumstances in which more sophisticated strategies such as mnemonics may be used by the child.
3) It has been demonstrated that children can be instructed both how and under what circumstances to use cognitive strategies, such as rehearsal, with beneficial results, (e.g., Weinstein and Mayer, 1986). Instructed use of the "keyword" mnemonic has also proved a highly successful aid to normal, (e.g., Merry, 1980b; Levin, et al., 1982) and less able children's learning, (e.g., Con dus, et al., 1986; Scruggs, et al., 1987).

This evidence suggests that even quite sophisticated mnemonic strategies can be taught to young children, even those disadvantaged by metacognitive immaturity, with immediate beneficial effects upon learning, (e.g., Mastropieri, et al., 1985b; Con dus, et. al., 1986. The child's spontaneous strategic use of mnemonic strategies, appears to be inseparably linked with some form of regulative executive control mechanism of cognition which has been termed metacognition. Recent research has demonstrated that the metacognitive processes responsible for strategy deployment can also be manipulated and facilitated by appropriate instruction, (e.g., Lodico, et al., 1983; Pressley and Ghatala, 1989) provided the teacher or instructor appreciates the specific relationship between developmental aspects of strategy acquisition and the metacognitive abilities of their children, (e.g., Howe and Ceci, 1979).
DEFINITIONS

The term "strategies" is a concept which has been imprecisely defined and lacks "specificity", (Alexander and Judy, 1988) and has been used somewhat indiscriminately to describe a variety of cognitive activities such as: Strategic time-monitoring, (e.g., Ceci and Bronfenbrenner, 1985) rehearsal, (e.g., Ornstein, et al., 1985b) the use of mnemonic mediators, (e.g., McDaniel and Pressley, 1989) the elaboration of learning material, (e.g., Pressley, 1982) labelling, (e.g., DeLoache, et al., 1985) and revision techniques, (Beal, et al., 1990).

A probable cause of this "fuzzy" (Wellman, 1983) articulation of the term is the fact that it is unclear how strategies are related to each other (Swanson, 1990), or how to separate cognitive learning skills from metacognitive operations, (e.g., Cavanaugh and Perlmutter, 1982; Jacobs and Paris, 1987; Garner and Alexander, 1989).

Ann Brown’s influential contribution to this discussion has been to clarify precisely what is meant by metacognition, (e.g., Brown, 1975; 1977; Brown and Palincsar, 1982; Brown and DeLoache, 1983). She separates metacognition into two components: "knowledge about cognition" and "regulation of cognition". Brown herself acknowledges the problem of differentiating between these two interrelated aspects of higher reasoning, (Brown, 1982) wondering if the construct of metacognition merely describes a range of cognitive functions "elevated and dignified with a new title." (Brown, 1978, p.7)
A DEFINITION FOR THIS STUDY

Subsequently, *cognitive strategies* will refer to cognitive activities, engaged in by individuals, with a view to facilitate learning. Typically these activities will involve the learner in making some form of deliberate effort to make learning material more memorable, (e.g. rehearsal or grouping strategies) but will not refer to cognitive activities which elaborate (visually or phonetically) or restructure (extending or reducing) learning material. The deliberate elaboration and/or restructuring of learning material will subsequently be referred to as a *mnemonic strategy*, (see Baddeley, 1985).

The literature suggests the existence of a third type of "executive" strategy, those related to the regulative self-monitoring of cognition itself. An example of this is the capacity to reflect accurately upon the limitations of one's own memory capabilities (*metamemorial strategies*) enabling cognition to select and regulate the most effective task-appropriate learning method/strategies available, (*metacognitive strategies*), (see Cavanaugh and Perlmutter, 1982, for a review).
STRATEGIES AND LEARNING

It has been recognised that cognitive and mnemonic skills, (strategies) play a crucial role in learning, (e.g., Socrates, d. 399 B.C. - Pokay and Blumenfeld, 1990). As children develop, their mastery over a broadening repertory of cognitive skills enables them to select task-appropriate options with improved competency and precision, (e.g., Brown, et al., 1983; Andreassen and Waters, 1989; Stipek and MacIver, 1989). Typically, young children are less "strategic" and "planful" (Flavell, 1971) in monitoring their own strategic needs, (e.g., Ceci and Bronfenbrenner, 1985) and inaccurate in selecting task-appropriate strategy options. (Stipek and MacIver, 1989) They often approach learning events with little knowledge or understanding of how to organise material to facilitate subsequent recall, (e.g., Bjorklund and Zeman, 1982).

The acquisition of cognitive strategies has been shown to be a powerful indicator of cognitive performance and aptitude in a broad range of situations, e.g., rehearsal, (e.g., Weinstein and Mayer, 1986) labelling, (e.g., Vliestra, 1982) organisation, (e.g., Bjorklund and Marchena, 1984) persistence at task, (Corno, 1986) attention, (e.g., Schiff, and Knopf, 1985) motivation, (e.g., Gottfried, 1990;) and retrieval, (Ornstein, et al., 1985).

THE CHILD’S ACQUISITION OF STRATEGIES

"...strategy awareness initially arises after reflection of one’s own strategic behaviour, and only later does strategy use result from planful, pretask activities". (Andreassen and Waters, 1989).
There is now a growing body of evidence which suggests that cognitive maturation is more closely related to the child's incremental acquisition of cognitive strategies and metacognitive development, (e.g., Waters and Andreassen, 1983; Brown and DeLoache, 1983; Ornstein, et al., 1985; Cross and Paris, 1988; Kurtz and Weinert, 1989; Andreassen and Waters, 1989) than to children's "differential rates of universal development" (e.g., Piaget and Inhelder, 1968; Bruner, 1964/71; Vygotsky, 1934/62; Case, 1985; see Kell, 1986 for a review).

"The early competencies that serve as building blocks for subsequent mnemonic activity", (Flavell, 1979) emerge initially as labelling (e.g., DeLoache, Cassidy and Brown, 1985) and rehearsal strategies, (e.g., Flavelli, et. al., 1966; Keeney, et. al., 1967). In the young child "strategy-like behaviours are imperfectly tuned to task demands", (DeLoache, Cassidy and Brown, 1985) and because young children are inexperienced and "nondeliberate" memorisers, (e.g., Perlmutter and Myers, 1979) they typically underestimate the need to engage some form of strategy to help them remember, (e.g., Andreassen and Waters, 1989).

The older child not only approaches learning with a broader repertory of learning strategies, but is more "pianful" (Harris, 1978) in orchestrating learning, in order to ease the demands upon memory, (Ornstein, et. al., 1985b). Despite differences in the sophistication of strategic thinking of younger and older children, the somewhat rigid developmentalist approach (e.g., Piaget) of memory and strategy acquisition has required some revision, (e.g., see Meadows, 1987).
It has been demonstrated that children less than one year old are capable of performing memory-related tasks, (Cohen and Gebler, 1975; Meltzoff, 1988) and that children between four and eight months will search for a complete object if a part is displayed. At eight to twelve months, children will search for a concealed object, (DeLoache, Cassidy and Brown, 1985) whilst eighteen-month-olds are able to display accurate memory for the location of objects even after protracted display intervals. (e.g., DeLoache and Brown, 1979; 1983; 1984) Further there is now important evidence suggesting that even very young children display nearly all aspects of "mature causal knowledge", (Bullock, Gelman and Baillargeon, 1982) "number conservation", (Gelman and Gallistei, 1978) and "concrete operational thought", (Rosch, et al., 1976) and Chi, (e.g., 1978) has been persistent in suggesting that there appear to be no structural differences between the cognition of children and adults. (see also, Mills and Funnell, 1983).

Cognitive developmentalists now appear to support the view that whilst cognitive maturation follows a similar schema in normal children, qualitative differences between the thinking of children are largely the product of how effective each child is in analysing and regulating his or her own reasoning, (e.g., Keil, 1986).

Further, there appears to be an inseparable relationship between the acquisition of more sophisticated metacognitive reasoning and access to qualitatively superior strategy acquisition and task-matching judgement, (e.g., DeLoache and Brown, 1983).
Time does not permit the discussion of a broad range of cognitive strategies in this thesis. However, in the next section, rehearsal has been selected as a particularly suitable subject for discussion. This is because an examination of its development in the young child, the benefits it affords learning and its transfer through instructional programmes have been well documented. Moreover, these aspects of rehearsal are not atypical of other cognitive strategies.

REHEARSAL

Although Thomas Aquinas advised us to "mediate frequently", it was not until the first objective studies of memory, undertaken by Ebbinghaus, (1885) and the writing of James, (1902) that the important relationship between rehearsal and learning was first formally established.

Rehearsal, "primary rehearsal", (Bjork and Jongeward, 1975) "echoing", (Darley and Glass, 1975) or "memorising", (Hunter, 1957) principally involves the activity of re-circulating learning material within a temporary or short-term memory store using either overt (audible) or covert (silent) repetition, (e.g., Rundus, 1971).

According to twin store [1] theorists, (e.g., Atkinson and Shiffrin, 1971) rehearsal is a conscious cognitive act engaged by the individual to sustain the life of information held within a "labile" "primary" (e.g., Waugh and Norman, 1965) "working memory", (e.g., Baddeley and Hitch, 1974) or "short-term" memory store, (e.g., Atkinson and Shiffrin, 1971). This store has been shown to have a limited capacity of holding around six "simple impressions" (Wundt, 1874), or seven items or "chunks" of information (Miller, 1956) at any one time.

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1 Psychologists who advocate two memory stores, one with a limited processing capacity of around seven chunks or items, the other, capable of holding "massive" (Baddeley, 1990) amounts of information.
If the individual makes no effort to keep alive the memory trace, [2] it is normal that the information will be unprocessed by cognition and subsequently forgotten, (Murdock, 1967).

Rehearsal is an important method of transferring information from the primary to the secondary, or long-term store, (e.g., Modigliani, 1978) and provides time for other cognitive processes which are known to facilitate recall to operate selective retention, (Gruneberg, 1983). But there is now sufficient evidence to suggest that mere repetition of material alone cannot accomplish this process. (e.g., Jacoby and Bartz, 1972; Craik and Watkins, 1973; Modigliani, 1976) In fact subjects in a study by Glanzer and Meinzer, (1967), who were asked to fill the interval between word presentation and recall with rehearsal recalled fewer words than un instructed subjects!

Glanzer and Meinzer's results have led to a reappraisal of the type of rehearsal which leads to transfer from a store of limited capacity, to the long-term store. It is now generally agreed that effort fully "attending" (Darley and Glass, 1975) the learning material, or "elaborating" (ibid.) either its context or content, are features of learning which generate stronger semantic links (Kintsch, 1972; Tulving, 1972) and tend to lead to deeper, more durable processing, (Craik and Lockhart, 1972).

Evidence from the Psychoanalytical School [3] suggests that once information is registered in the secondary or long-term store, it is permanently retained, but periodic "maintenance rehearsal" has been shown to facilitate access to material held in the long-term store, (Gruneberg, 1983).

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2 The momentary after-image or after-sound that follows the presentation of a stimulus.
3 Under hypnosis distant events can be recalled in vivid detail, suggesting that ineffective recall is a defect associated with the recall system rather than the encoding system.
A levels of processing analysis of this activity (e.g., Craik and Lockhart, 1972), would suggest that the act of rehearsal processes material through deeper levels of cognition, thereby strengthening the material's structure and making it more "distinctive" (e.g., Jacoby and Craik, 1979) among the milieu of memory events within cognition. Such a view is not dissimilar from that proposed by trace theorists, (e.g., Brown, 1958; Peterson and Peterson 1959) who would suggest that rehearsal has the effect of laying down successive identical traces, one on top of the other. The individual is able to repeat successively this process through subsequent acts of rehearsal, successively transforming the material from a weak trace after a single repetition to a very durable trace following subsequent repetitions. Ultimately the material is processed at the optimum level required for recall of complete competence, 100% accuracy.

AGE AND REHEARSAL

Given the task of remembering the names of common objects, Flavell, et al., (1966) noted that the approach of ten and five-year-olds were markedly different. Seventeen of the twenty ten-year-olds in his study used either overt or covert rehearsal to facilitate the retention of the position of objects, whereas only two of the twenty five-year-olds employed rehearsal. Flavell found a positive correlation between the use of rehearsal and memory performance.
Keeney, et al., (1967) extended Flavell, et al’s findings by observing the lip movements of children asked to learn items in list form. Those who failed to rehearse, or were "production deficient", (Flavell, 1970) received rehearsal instruction and thereafter 75% reached the learning competence of the spontaneous rehearsers. Further, Keeney's team noted that children who initially benefited from rehearsal instruction would subsequently neglect to adopt the strategy unless prompted to do so, (see also Harris, 1978).

Keeney, et al’s findings have more recently been challenged by Digby and Lewis, (1986) who conclude:

"....that rehearsal training led to lasting increases in the use of rehearsal, and greater expressed knowledge of metamnemonic awareness. Improved recall was particularly evident among those six-year-olds who did not spontaneously rehearse."

Whilst it is true that "children can easily be taught to rehearse with immediate beneficial effects on their performance," (Kail, 1979; Fivush and Hamond, 1989) unless they are consistently encouraged to apply the strategy to task-appropriate learning situations by way of "maintenance rehearsal", the indications are that the instructed rehearser may revert to nonrehearser status, until becoming a natural spontaneous rehearser at some future date, (e.g., Ornstein and Baker-Ward, 1983).

These differences between the reasoning and cognitive maturation of younger and older children have now been confirmed in a number of more general areas, such as attention, (e.g., Schiff and Knopf, 1985) motivation, (e.g., Booth, 1981) and recall, (e.g., Perlmutter and Myers, 1979). It has also been demonstrated in areas specifically related to learning strategies, such as rehearsal, (e.g., Ornstein, et al., 1985) cueing, (e.g., Yuill & Joscelyne, 1988) clustering, (e.g., Mandler and Stephens, 1967) organisation of material, (e.g., Bjorklund and Marchena,
1984) problem-solving, (e.g., Swanson, 1990) labelling, (e.g., Vlietstra, 1982) and time-monitoring, (e.g., Ceci and Bronfenbrenner, 1985).

I will finish this section with a personal anecdote. I recently asked my five year old son James, to remember the three digit number, 405. After about twenty seconds had passed, he was unsuccessful in attempting to recall the number. Enter the rehearsal instructor! Having asked him to repeat the number over and over to himself a few times, I was pleasantly surprised he could recall the number accurately several minutes later. Upon getting up the next day, he asked my wife, "Why did Dad want me to remember 405 yesterday?!"
COGNITION'S REGULATION OF STRATEGIES

Although it is unclear precisely how the acquisition of cognitive skills is related to cognitive maturity, (e.g., Brown, 1978) or how they are selected and regulated by cognition, (e.g., Andreassen and Waters, 1989) once acquired, their effect upon the child's reasoning appears to have a crucial bearing on learning outcomes, (e.g., Perlmutter and Myers, 1979).

AGE, METAMEMORY, METACOGNITION AND STRATEGY ACQUISITION

"There is little doubt that most of the activities that go under the general headings "strategies" and "metamemorial processes" can be acquired through learning. It follows that the memory improvements that are due to improved strategies and metamemory processes can be induced, by appropriate training." (Howe and Ceci, 1979)

The terms "Metamemorial processes" and "metamemory" (e.g., Fiavell, 1971; 1978; 1981) refer to the individual's "knowledge about how the memory system operates", (Andreassen and Waters, 1989) and along with the more general concept of metacognition, [4] have become subjects of renewed interest and research. Children's metamemorial processes have now been evaluated in a variety of settings, e.g., giftedness, (Jackson & Butterfield, 1986; Kurtz & Weinert, 1989) age, (Stipek and MacIver, 1989; Andreassen and Waters, 1989) strategy generalisation, (Borkowski, 1985; Pressley, et al., 1984) reading, (Cross & Paris, 1988; Byrd & Gholson, 1985) et al.

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4 Introspective knowledge about one's own cognition: Its strengths, limitations and its projected accuracy in dealing with a broad range of cognitive actions.
HISTORICAL PERSPECTIVE

Knowing about how we know what we know and knowing about knowing has interested psychologists for a number of years, (e.g., Ach, 1905; Kuhlmann, 1907; Baldwin, 1909) but these early studies investigating an "awareness of an awareness" [5] tended to define the subject-area with a lack of precision, (e.g., Boring, 1937). Some critiques went further, suggesting the phenomenon did not exist at all, (e.g., Duniap, 1912) and reviews as late as 1982 (Cavanaugh and Perlmutter) had concluded that metamemory in particular, required "considerable definitional clarification" (ibid) "to have future utility", (Slife, Weiss and Bell, 1985) as it was a "fuzzy concept", (Wellman, 1983) imprecisely defined.

Attitudes towards the possibility of a "self-regulative", self-interactive and "self-interrogative" component of cognition, (e.g., Brown and DeLoache, 1983) responsible for specifying and assigning task-appropriate cognitive judgements, gained momentum following the publication of work by Hart, (1965) and Brown and McNeill, (1966). The subject of both publications was interrelated, though approached from a somewhat different perspective. Hart, (ibid.) addressed the tip of the tongue phenomenon by investigating a range of circumstances in which subjects expressed a positive feeling of knowing related to the character of words, omitted from scripts viewed on a second occasion. Hart noted that there was a highly positive correlation between the strength with which subjects felt they knew (but could not recall) information, and subsequent recognition. Hart interpreted his findings to suggest a memory monitoring system, capable of self-interactive judgement, (e.g., Gardiner, 1989) an hypothesis compatible with earlier work by Broadbent, (1958) on auditory memory, and by Sperling, (1960) on

5 A description of metacognition, offered in 1982 by Cavanaugh and Perlmutter.
visual memory, and similar to the term "unattended memory" or "memory without awareness", a concept recurring in the work of Ceci, (e.g., Ceci and Howe, 1982; Ceci, 1983; Ceci, 1984; Ceci and Bronfenbrenner, 1985).

Brown and McNeill, (ibid) induced their subjects into a feeling of knowing state by asking them to recall definitions of unfamiliar words. Subjects reported that information sought was "on the tip of the tongue" (TOT). In a TOT state, subjects were typically able to remember certain features of words, such as first or last letters or the number of syllables comprising the word, temporarily beyond recall. Again, this type of "awareness of an awareness" suggests some form of unattended monitoring system regulated by cognition. For example, by remembering the first letter, number of syllables, or certain consonants of a word the "forgotten" word could be re-cued or recalled.

Realising the importance metamemory might have as an explanation of memory processing Tulving and Madigan (1970) wrote:

"We cannot help but feel that if there is going to be a breakthrough in the psychological study of memory...it will, among other things, relate the knowledge stored in the individual's memory to his knowledge of that knowledge." (P.477)

A range of subsequent findings supported the view that the "strategic" and "spontaneous" use of memory strategies was strongly related to cognitive performance, but not necessarily to any pre-prescribed developmental stages, (see Brown, 1975 and Flavell 1977 for reviews). Further, it was noted that children who failed to adopt particular strategies, were nonetheless able to use them successfully following appropriate instruction. These observations "led to a search for the critical variable(s) that underly spontaneous strategy use", (Cavanaugh and Perlmutter, 1982) as it was felt that there was a strong relationship between metamemory, metacognition, and strategy

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6 Rational cognitive activity which occurs in the absence of one's conscious intention.
generalisation, (e.g., Campione and Brown, 1978; Pressley, et. al., 1984: Borkowski, 1985). A number of studies have emphasised the concept of children's "readiness" in association with strategy acquisition, (e.g., Kail, 1979) but it should be noted that whilst cognitive maturation is an important aspect of spontaneous strategy generalisation, the "planful" manipulation of to-be-learned material is often crude and unrefined until post adolescence.

METACOGNITION

"Children who are higher in metacognitive knowledge learn new strategies more quickly and generalise them more readily than their metacognitively poorer peers". (Kurtz and Weinert, 1989)

It is unclear whether metacognitive functions are indeed separate functions of cognition, (e.g., Slife, Weiss and Bell, 1985; Jacobs and Paris, 1987; Garner and Alexander, 1989). Even Brown herself deliberates the point (Brown 1978), but further knowledge about the metacognitive-cognitive relationship may not necessarily bring definitional clarification for as Wertsch, (1978) has pointed out:

"....as we pursue problems in this area further and further, the distinctions between cognitive and metacognitive abilities will become less and less clear."

If it is accepted that meta-functions are relatively independent aspects of cognition, (e.g., Brown, 1975; Brown and DeLoache, 1983) they appear to play a crucial role in the way individuals organise learning and deploy cognitive and mnemonic strategies, (e.g., Kurtz and Weinert, 1989; Andreassen and Waters, 1989; Swanson, 1990) and seem to be inseparably related to intelligence, (e.g., Borkowski, 1985) reading, (e.g., Cross and Paris, 1988) mathematics, (e.g., Shoenfeld, 1987) and Memory, (e.g., Pressley, et al., 1985).
One of the most influential figures in contemporary metacognitive discussion is Ann Brown, (e.g., 1975; 1977; Brown and Palincsar, 1982; Brown and DeLoache, 1983) who discriminates between different aspects of metacognition as follows:

"The basic skills of metacognition include predicting the consequences of an action or event, checking the results of one's own actions (did it work?), monitoring one's ongoing activity (how am I doing?), reality testing (does this make sense?), and a variety of other behaviours for coordinating and controlling deliberate attempts to learn and solve problems." (Brown, 1978)

This interactive relationship between metacognition and strategy deployment is important. Kurtz and Weinert, 1989, write: "....one of the most reliable differences between the cognitive behaviours of gifted and average children is their use of strategies on memory and problem solving tasks." (see also, Siegler and Kotovsky, 1986; Jackson and Butterfield, 1986).

Young children are typically naive, "unskilled", "less planful" and "production deficient" (e.g., Flavell, 1971) in the manipulation and management of their metamemorial [7] and metacognitive functions [8] (e.g., Brown, et al, 1983; Corno, 1986; Zimmerman and Martinez-Pons, 1986, 1988) but there does appear to be convincing evidence which suggests that younger children can benefit from programmes of instruction aimed at raising metacognitive awareness, (e.g., Levin, et al., 1982)


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7 Knowledge gained through introspection about how one's own memory works.
8 Knowledge gained through introspection about how one's own cognition functions.
Slife's team identified a positive relationship between knowledge of cognition and problem-solving performance, but concluded:

"Is knowing how to solve problems a different skill or ability from knowing that one knows how to solve problems? The results appear to answer the question in the affirmative." (Silfe, et al., P. 441, Ibid.)

In a recent study by Swanson, (1990) a cognitive ability test (Thorndike and Hagean, 1978) was used to identify high and low aptitude children. Using a 2 x 2 experimental design, [9] children were given an adapted test of metacognition taken from questionnaires produced independently by Kreutzer, et al, 1975; Myers and Paris, 1978.

Swanson demonstrated that, regardless of general aptitude, children with developed metacognitive skills were superior problem-solvers. Swanson interpreted these results to suggest that "high metacognitive skills can compensate for overall ability by providing a certain knowledge about cognition." Swanson's position seems somewhat precarious, for research attempting to establish a relationship between memory and metamemory using correlational [10] studies has been disappointing, (e.g., Perlmutter, 1978; Cavanaugh and Borkowski, 1979, 1980; Ringel and Springer, 1980; Kendall, Borkowski and Cavanaugh, 1980) albeit plausible explanations have been offered as to why this disparity should exist, (see Cavanaugh and Perlmutter, 1982 for a review).

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9 High aptitude - low metacognition v low aptitude - high metacognition.
10 Where some aspect of memory knowledge is assessed, with a view to establishing correlations between memory-metamemory performance.
THE RELIABILITY OF CHILDREN'S REPORTS ON THEIR OWN MEMORY JUDGEMENTS

As two aspects of the present study, [11] required children to make verbal and written judgements related to their own use of strategies, problems related to this type of reporting are briefly discussed.

Ericsson and Simon, (1980) have focussed attention on the relationship between eliciting information from subjects about their memory activities, and the accuracy with which these statements are reported. Making an important contribution to this area of knowledge, Andreassen and Waters, (1989) have recently conducted a study to test the hypothesis that post-performance reports on a free-recall memory task would reflect metamemory-behaviour relationships in younger children whereas more accurate pre-performance reports would be characteristic of the older children studied. The hypothesis was supported, leading to the observation that older children's metamemorial thinking is characterised by pre-task estimates of what strategic action is required. Further, at the pre-task point, ".....it would be possible to use previous experience and acquired knowledge to infer what would be an appropriate memory strategy in the particular situation and then put that knowledge to use." (ibid).

There would appear to be numerous cognitive activities associated with the selection, monitoring and implementation of appropriate task-related strategies. Whereas adults and older children tend to "planfully" manage their learning, (e.g., Flavell, 1971) and retrieval operations, (e.g., Ornstein, et al., 1985b) young children are inexperienced, inexacting and inarticulate in prescribing task-appropriate strategies, (e.g., see Kail, 1979). Indeed, they may not be able to describe the type of cognitive activity they have themselves directed, (e.g., Cavanaugh and Perlmutter, 1982) lacking both the

11 The pupil questionnaires following experiments in the 7 series, and also, the selected follow-up interviews related to the questionnaires.
vocabulary and appropriate introspective skills to articulate metamemorial actions with accuracy, (e.g., Ericsson and Simon, 1980). Further, young children may not feel motivated to do their best, (e.g., Booth, 1981) or understand what is being asked of them, (e.g., see e.g., Vlietstra, 1982; Kall, 1979; Case, 1975) leading to unrepresentative results, (e.g., Meacham, 1972).

Young children especially, might have difficulty in interpreting the statements, requirements and questions of experimenters, may have difficulty in following the operating instructions offered, (e.g., Hagen and Hale, 1973) or may fail to concentrate effectively, (e.g., Vurpillot, 1968)

In an attempt to improve metamemorial data-collection methodology, Ackerman and Bailey, (1989) suggest that inferences made and data collected from concurrent metamemorial activity are likely to be more reliable than data drawn from subjects prospective predictions and judgements; children being more able to explain what is happening as a cause of memory activity rather than what might happen. Other experimenters have emphasised the need to approach the study of metamemory from a range of methodological approaches, using material obtained from prospective, (future), concurrent, (present) and retrospective (previous) metamemorial activity. (e.g., Cavanaugh and Perlmutter, 1982; Brown, et al., 1983; Fabricus and Hegen, 1984).
SOME PRACTICAL IMPLICATIONS
The growing interest in metamemory, strategies and mnemonics has considerable relevance to the management of classroom learning.

If, as the literature suggests, there are no fundamental *structural* differences between the memories of children and adults, (e.g., Chi, 1976; 1978) it seems reasonable to assume that children possess the necessary "software" to apply the same cognitive strategies and mnemonics, typically adopted spontaneously by older people. As their acquisition has been shown to lead to more effective learning with broad populations, it should be in the keen interest of educationalists to teach their students these skills. Such a position of course, would require the availability of local authority-based or independent training programmes, targeted at teachers responsible for teaching subjects relevant to strategy skills, although it could easily be argued that strategy skills are relevant to all subjects. The teachers responsible would then be in a position to transfer their knowledge to other staff during training days or at other suitable times.

Schools opting out of such programmes for financial [12] or other reasons, would do well to remember that schools are entering a free-market situation where *effective* learning (results) may be the "cornerstone" of survival!

From a philosophical perspective, children have a right to anticipate that teachers will inform them of how best to study and learn information, given that teachers expect children to learn what is placed before them to learn.

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12 Under the Local Management of Schools, it is likely that institutions will make less money available for in-service training programmes.
Were this knowledge unavailable, educationalists might be forgiven for proceeding with learning activities in much the way as they have for millennia, but the growing body of knowledge relating to how children learn, and how they can learn more resourcefully and effectively, should now be in the hands of practising teachers. One wonders whether this will ever be the case......
CLASSROOM CONSIDERATIONS

Meta-training, has been shown to lead to considerable learning gains both with normal children, (e.g., Lodico, et. al., 1983; O'Sullivan and Pressley, 1984; Pressley, et al., 1985; Andreassen and Waters, 1989) and with gifted children, (e.g., Jackson and Butterfield, 1986; Siegler and Kotovsky, 1986; Kurtz and Weinert, 1989).

Although this training takes many forms, it is essentially designed to raise children's awareness of their own cognition's operational capabilities, with the specific aim of extending the strategic and/or mnemonic options available to them. As in rehearsal intervention programmes, this may not be sufficient to promote the spontaneous use of a strategic behaviour, although intervention may lead to immediate learning gains. This issue may be clarified as evidence from longitudinal meta-training studies becomes available.

Given this knowledge, the teacher's role in developing each child's metamemorial awareness of when to use a task-appropriate strategy or mnemonic will be a complex issue. But if the metamemorial consciousness of children can indeed be raised as the literature suggests, intervention programmes ought to bring about a number of invaluable improvements in the child's reasoning and learning through the more effective use of strategic thinking and self-monitoring.

It is necessary to say that the management of classroom strategy instruction, (cognitive or mnemonic) is principally dependent on the classroom teacher and is most likely to be successful if children can be taught to adopt "particular cognitive programmes" (Belmont and Butterfield, 1977) "....that are suited to the task and are based on an understanding of the child. This can only be achieved if the (teacher) understands the requirements of the learning task in some detail and knows a fair amount about the processing limitations of the learner. It
is then possible to develop plans which are within the individual’s capacity.” (Howe and Ceci, 1979).

To be most effective in this role, the teacher should have knowledge of the following:

<table>
<thead>
<tr>
<th>a) the development of strategic cognition in children</th>
<th>Strategies are acquired incrementally. An appreciation of their relationship with the child’s evolving cognition may facilitate appropriate strategy-task matching.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) how to identify the child’s current strategic competency</td>
<td>This would provide the evidence required to make more accurate judgements about the child’s current strategic capabilities and needs.</td>
</tr>
<tr>
<td>c) how and when the child’s strategic thinking may be advanced</td>
<td>For the child to apply a task-appropriate strategy, he must a) know of the strategy and b) appreciate the situations where it is likely to be most effective. This may require metacognitive instruction.</td>
</tr>
<tr>
<td>d) how the child can be taught to use the strategies already known more effectively and how the range of these might be successfully extended</td>
<td>This would enable the child to make learning more deliberate and planned. Strategies related to each stage of learning, (e.g., learning, retention and recall) but currently outside the child’s repertory, could be introduced by the teacher as part of the normal teacher as part of a normal learning programme.</td>
</tr>
</tbody>
</table>
SUMMARY OF SECTION 2

Mnemonics in general and first-letter mnemonics in particular are used in schools to promote children's acquisition of basic facts, (e.g., see the section marked "Staff survey in this study, pp.293-325). Every curricular area relies upon children acquiring facts, around which a knowledge-base [1] can be established.

Given that assessment has evolved as an important part of the educational process, informal schemes aimed at remembering more have received attention at both theoretical and practical levels.

It seems a necessary part of the more general mnemonic discussion to explore the historical links between knowledge, assessment and the curriculum, and inappropriate merely to take this relationship for granted.

The discussion which follows includes an appraisal of how the more traditional contexts of mnemonics have been changed by the introduction of National Curriculum. It is argued that far from there being less opportunity or reason for using mnemonics within the new curriculum, there are even greater opportunities available to improve children's learning leading to lasting educational benefits, benefits which schools might ignore at the risk of being less cost-effective.

1 "...the extent to which knowledge acquired in one context might generalise to other contexts." (Prowat, 1989).
Following a description of the term "knowledge", the relationship between knowledge, assessment and the curriculum is explored; first from an historical perspective, and second, in relation to the importance of promoting knowledge within the framework of National Curriculum and the practical implications of this approach.

THE NATURE OF KNOWLEDGE

"Promoting the transfer of knowledge and skill in students is a major - many would say the major - goal of education." (Prawat, 1989).

What it is "to know" has been a persistent theme throughout mankind's philosophical enquiry, (e.g., Plato, 427-347 B.C.; Prawat, 1989) and is still a popular topic in scientific and educational journals, (e.g., Shuell, 1986; Slavin, 1987; Vosniadou and Brewer, 1987; Eylon and Linn, 1988; Alexander and Judy, 1988; Carr, 1988, et al. and official reports, (e.g., The Munn Report, 1985, esp. chs 3 & 4).

To "know" is to "identify", to "have in the mind", to "have learned" [1] and has its origin in the Latin "noscere" (to recognise) and the Greek, "gno" meaning to "become acquainted with, come to know a thing."

From an academic perspective, the term "knowledge" is generally considered to be consensus agreement between scholars regarding particular statements or events, (e.g., Jacob, 1987; Carr, 1988). Such statements are subject to "vigorous revision and interrogation", (Jacob, in press) with a view to extracting "deeper" clarification and analysis of the subject matter, (Socrates, Plato, 427-347 B.C.; Protagoras; Cobb, Yackel and Wood, 1988) "even in the course of a single lifetime", (Simon, 1980).

1 The Concise Oxford Dictionary (1990)
In the spirit of Schwab, 1964, Kuhn (1970) suggests knowledge merely reflects a "tradition" among scholars at particular points in time, who generally agree upon the specific "nature of the universe they are examining, the questions raised, the research problems and appropriate methods of enquiry". As Griffiths, (1986) puts it: "...there are not a limited number of forms of knowledge", but rather a universe open to enquiry. (see also, Hirst, 1969).

The discussion which follows is principally related to the curriculum, education and assessment of pre-16-year-old secondary children. For a contemporary discussion on post-16 educational provision, see Roby, (1990, pp.172-177, and Jones, 1990, pp. 179-199).

KNOWLEDGE, LEARNING AND ASSESSMENT - A BRIEF HISTORY

"The primary missions of educational institutions, from elementary to graduate and professional schools, are to impart knowledge and to teach cognitive skills." (Frederiksen, (1984, p. 363)

From ancient to contemporary times, identifying precisely what aspects of knowledge education should transmit to learners, and how this can be most effectively accomplished, has proved problematic, (e.g., Socrates; Rousseau, 1911; A. S. Neill).

The Roman, Tacitus, suggests that Agricola established some form of structured learning and oral assessment for local and regional administrators in England around AD 78, (Lawson and Silver, 1976) and although AEIfric's Colloquy (c. 1000 AD) presents dialogue between a monk and some boys, (probably choristers) it is generally assumed that education at that time was restricted to those of noble birth or those with some form of monastic affiliation. There is certainly evidence which suggests that certain monastic foundations [2] had scholastic reputations during the period 600-1066, but it was not until the later

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2 For example, Winchester, Glastonbury, Ramsey and Worcester.
medieval period (1300-1530) that the universities of Oxford and Cambridge, (with the King's support) routed learning away from the direct control of religious orders and laid academic foundations which were later to dominate English education. (For a review, see Lawson and Silver, 1976, ch.1).

Although not a recent innovation, new grammar schools [3] were established following the various outbreaks of plague (1348/9), during which the numbers of learned masters and clerics serving ecclesiastical institutions were reduced by as much as a third. The improved economic security of many philanthropists, noblemen and merchants during the late 1400s, combined with the diversification of knowledge resulting from better communication and developing literary resources, accelerated the rise of educational foundations unattached to religious orders.

In the English "secular world", it was only during the mid 1800s that written assessment replaced visits to grammar schools, by so-called 'locals', [4] whose various responsibilities included monitoring the progress of schools by periodic "oral inspection".

Having introduced written assessment in 1858, the universities of Oxford and Cambridge, issued their first certificates of accreditation to candidates in 1877. The "Oxbridge" model, where course instruction culminates in written assessment, has, for nearly one-and-a-half centuries, dominated the English education system.

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3 e.g., in 1382, William of Wykeham (Bishop of Winchester) founded a grammar school in Winchester. Archbishop Chichele founded a college at Higham Ferrers, in Northamptonshire.
4 Visits by a University fellow who assessed competence through oral examination.
The 1944 Education Act promoted the tripartite division of schools [5], each designed to cater for children of specified ability, but because each curriculum was markedly different in character, a different approach to student assessment and course evaluation was required.

Responding to a recommendation of the Secondary Schools Examinations Council (1943), in 1951, G.C.E. [6] examinations replaced the old School Certificate which largely failed to differentiate between curricular areas and was unable to provide the flexibility, range of subjects, or competence required of post-war society, (e.g., Taylor, 1964; Butterfield, 1990).

It was not until 1965 that the secondary modern schools [7] achieved comparability, through the introduction of the Certificate of Secondary Education (C.S.E.).

Given concurrent limitations of assessment design, and innovation, there was an inevitability that the performance of candidates should adhere to the traditional style of summative evaluation, (e.g., Butterfield, 1990) typically during timed, written, formal examinations. This type of assessment offered candidates little opportunity to demonstrate the broad variety of their knowledge and also the many skills related to each subject's syllabuses, (e.g., Buckle, 1990). Additionally, traditional assessment offered little or no opportunity for children or teachers to specify positive achievement, other than that directly related to specified assessment criteria, (see McGuff, 1990 for a recent review).

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5 Grammar for the most academically able; technical, for those with technical aptitude; and secondary for children of lower ability.
6 General Certificate of Education.
7 Offering a curriculum for the less academically able.
Innovation in both curricular design and assessment methodology was further impeded by inconsistencies between curriculum bodies and planning groups who appear to "be drawn to different models and theories of knowledge", (Carr, 1988). Despite these difficulties, over time, the clearer, less ambiguous specification of precisely what learners ought to know at various stages of a syllabus or course of instruction, together with a clear description of the criteria and concepts associated with this process, have been progressively refined.

THE INFLUENCE OF OBJECTIVES UPON CURRICULUM DESIGN AND ASSESSMENT

"There is already a voluminous collection of pious works on curriculum objectives. Perhaps that is why there is a curious unreality about the subject. Statements about objectives seem to be little more than a rationalization of activities which are conducted for other, forgotten or only half-suspected purposes." (Musgrove, 1968, p.216).

Space only permits an outline sketch of the objectives [8] influence on school learning and the formulation of examination criteria. Although the particular relationship between the child's possession of factual knowledge and academic achievement is now well known, (e.g., Glaser, 1984; Chi, 1985) the clarity with which this and other comparisons can now be made owes much to Bloom's (1956) taxonomy of educational objectives. Some go further in suggesting that Bloom's contribution to our understanding of the term knowledge, has "influenced almost every specification of (educational) objectives", (Deale, 1975) and curriculum [9] design, (e.g., Francis, 1981).

8 The classification of outcomes through specified intentions
9 "A curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation into practice." (Laurence Stenhouse, (1978, p. 4)
In addition to clarifying various aspects of educational knowledge:

Knowledge of specifics
Knowledge of terminology
Knowledge of specific facts
Knowledge of ways and means of dealing with specifics
Knowledge of conventions
Knowledge of trends and sequences
Knowledge of classifications and categories
Knowledge of criteria
Knowledge of methodology
Knowledge of the universals and abstractions in a field
Knowledge of principles and generalisations
Knowledge of theories and structures

Bloom identified six major categories of educational objectives:

1) Knowledge; 2) Comprehension; 3) Application;
4) Analysis; 5) Synthesis; 6) Evaluation

Bloom identified the necessity to *synchronise* the relationship between the content of curriculum and assessment methodology. Unfortunately, whilst he stated this relationship with unprecedented precision, "the great problem has been.....that the external examination system has made it difficult to ensure that teaching objectives and assessment objectives coincide". (Macintosh, 1974).

The impact of Bloom’s taxonomy on contemporary educational thinking has been considerable.

The introduction of the National Curriculum has offered curriculum designers a unique opportunity to synchronise both curriculum and assessment objectives. It has been designed so that objectives interrelate at each stage of the learning process, from syllabus design, through various forms of assessment objectives which are themselves directly related to teaching objectives and syllabus infrastructure.
The influence of the objectives approach, (e.g., Bloom, 1956; Bobbitt, 1924; Tyler, 1949; Taba, 1962) although not without its critics, (Eisner, 1967; 1969; Kliebard, 1968) is evident in a review of the present G.C.S.E. assessment objectives. Here, there is a striking similarity between the relationship between curricular objectives and the aspects of knowledge to which they relate, and Bloom's taxonomy. Indeed, there is a "...strong influence of some form of objective approach in all the subject areas", (Buckle, 1990).

For example, the Physics, Maths and Technology curriculum documents include as their lower objectives: "Recall" or, "Know and recall", progressing through to comprehension and the manipulation of facts to produce analysis, synthesis and evaluation.

KNOWLEDGE AND EXAMINATION PERFORMANCE

"To restrict the measurement of the pupil's attainment to the consideration of evidence consisting solely of a written script or scripts, completed in stipulated periods of time on certain dates, is insufficient data to presume to deduce results of such consequential importance to the individual." (Rogers, 1974, p.158)

The approach of Bloom and his contemporaries has had a decisive impact upon all modern syllabuses, (e.g., Francis, 1981) and the strong influence of the objectives approach is evident in all contemporary assessment criteria. Perhaps not surprisingly, a review of the 1992–1993 G.C.E. Regulations and Syllabi, (London Board) identifies the child's acquisition of knowledge in each subject area as an essential feature of courses.
For example, the A-S [10] Biology assessment objectives commence:

"The examination will test the following (objectives):

a) Knowledge and understanding of

(i) biological facts, terms, principles, concepts and relationships, et al.

b) Application of biological knowledge in

(i) constructing hypotheses, designing and conducting experiments and interpreting results, et al."

Traditionally, the main thrust of assessment has been directed towards placing candidates in rank ability by testing the quantity and quality of factual information (knowledge) learners can recall, (e.g., Roby, 1990) but during the past half decade in particular, there has been an erosion of the type of timed written assessment which emphasises a learner’s ability accurately to recall facts within this type of framework.

Buckle, (1990) suggests:

"The purpose of traditional public examinations was to certify that a candidate had reached a certain standard in the subject. That is to say that the candidate possessed skills of recall, understanding and application of the knowledge in the subject at a level appropriate to the qualification."

During the past five years in particular, there has been a dramatic shift of emphasis away from the norm-referenced assessment methods, typically associated with G.C.E. and C.S.E. courses. Current trends in assessment tend to emphasise the quality of the children's work over pre-prescribed periods (continuous assessment) as well as the variety of their personal qualities and attributes [11], which are not examined in the normal, formal way.

10 Advanced_Supplementary
11 Records of Achievement
THE ROLE OF KNOWLEDGE IN THE NATIONAL CURRICULUM

"It is the attention of the assessment objectives (within National Curriculum) to skills and processes which determines the need for a coursework element, and which marks the greatest departure from the emphasis upon recall of knowledge and upon timed, written examinations" (Butterfield, 1990).

Until recently, examination innovation largely consisted of "augmenting rather than replacing conventional techniques" of assessment, (Rogers, 1974). For many decades, assessment has been almost exclusively directed toward educational outcomes related to cognitive skills.

This type of approach neglected the assessment of important affective skills, such as the development of disciplined working habits, the acquisition of study skills and social sensitivity, (e.g., Kelly, 1971; Mathews, 1974) and although The Schools Council Examinations Bulletin No 1, officially offered teachers greater involvement and flexibility in the assessment process, [12] the need to streamline the school curriculum and its assessment methodology became apparent.

On 20th June, 1984, Sir Keith Joseph announced his intention to implement a National Curriculum, with the first courses commencing in September 1986.

The initiative was to mark the demise of examinations which rely heavily upon timed assessment alone to assign children to different levels of achievement, (e.g., Butterfield, 1990).

12 eg., through the provision of regional examining boards and external moderation,
Within the framework of National Curriculum, the whole concept of the curriculum-assessment relationship and children's attainment has recently been radically re-defined, making explicit the precise level of attainment a "normal" learner of given age should have achieved in each area of the curriculum. Given that this task has been considered both impracticable and unresourcable, (N.U.T. conference, 1991) and also that it has been considered a retrogressive step to test youngsters with such vigilance, (Labour Party Conference, 1991) the reality appears to be that periodic formal testing is to form part of the normal school assessment programme. The tools used in this differentiated [13] approach to learning and assessment are as many and varied as the skills they seek to evaluate and provide evidence of a child's cognitive and affective attainment throughout a child's schooling.

This clear, unambiguous specification of precisely what knowledge children should have at specific chronological ages, is an issue central to this study, but the origin of such discussion can be traced to numerous influential papers and writings produced between c. the mid 1940s onward, (e.g., The Norwood Report, (1943) The Waddell Committee Report, (1978), The Cockcroft Report, (1982) Mathematics Counts.

Frustrated by the lack of a coordinated approach towards curricular design, Hirst, (1969) writes:

"Anyone who today advocates curriculum changes on pure philosophical grounds without considering the psychological and sociological factors that are relevant is simply irresponsible. For rational curriculum planning, we must, for instance, have sound empirical evidence on how children learn, we must know the demand in our society for people with specialist knowledge."

13 Differentiation by task involves the setting of assessment tasks at differing levels of difficulty. Differentiation by outcome, the use of a common task which reveals wide ranges of performance. (e.g., Buckle, 1990)
Changes to the rigid, inflexible secondary curriculum were accelerated by the needs of the rapidly evolving technological society of the seventies. In a further influential paper, Musgrove, (1968 p.229) suggested:

“Our curricula are still geared to a society in which the majority would be engaged in manual work, knowledge once acquired had a permanent value, the age of puberty was 17, life was over at 40, and father never bathed baby.”

As the decade of the seventies passed, the clear appeals for a radically different curriculum, with assessment opportunities carefully matched to each syllabus were addressed. It was clear that the "bolt-on" remnants of the tripartite system's examining structure (G.C.E./C.S.E.) would provide inappropriate measures of assessment for a differentiated curriculum so markedly different in character. Although timed examinations were to be retained as an important feature of the overall G.C.S.E. assessment plan, they were to supplement the information relating to students' achievements gained through other measures. These include project work, profiling, records of achievement, [14] self-assessment and extensions of aural and oral testing.

Although the new style of assessment has extended the range of cognitive and affective [15] skills which are tested and more readily accommodates individual learning styles, (e.g., Entwistle, 1981; Riding, 1990) the emphasis of assessment is still focused upon the knowledge candidates possess and the quality with which this can be applied.

14 Assessment which has some element of student involvement or control in the specification of personal achievement.
15 Skills connected with attitudes and self-expression
For example, the national criteria for physics lists three key skills, the first is "Know and recall: factual information; conventions; requirements for safety...." et al.

Among the Statements of Attainment for the Science G.C.S.E. [16] syllabus, (p. 6) are:

(level 1) "Know that there is a wide variety of living things, which includes human beings."

(level 2) "Know that plants and animals need certain conditions to sustain life."

(level 3) "Know that living things respond to seasonal and daily changes."

Perhaps not surprisingly, documents for each curricular area place a similar emphasis upon the role the acquisition of knowledge plays in the formulation of a child's multilateral [17] and unilateral [18] knowledge base.

Although one of the emphases of National Curriculum is upon setting national requirements related to specified criteria of attainment, (e.g., Brown, 1990) repeated attempts to reduce the emphasis placed on recall as an assessment measure related to these criteria are being met with increasing resistance.

For example, although recent recommendations of The History Working Party requested more flexible approaches to learning through children's "empathy" with historical characters and events, these appeals have been firmly rejected in favour of a move back to "basics", (John MacGregor in the tabloid press, July, 1990).

16 General Certificate of Secondary Education
17 Knowledge or skills which readily transfer to a range of situations, e.g., telling the time, or using a calculator.
18 Knowledge or skills which have restricted application outside a specific knowledge base, e.g., knowing that a narrow strip of land connecting two larger bodies is called an isthmus, (Geography).
MacGregor argues for a return to knowledge of "facts, dates, people and places", adding "I attach great importance to securing assessment arrangements that test the knowledge and understanding of the history studied", (ibid).

Using Bloom's model, MacGregor's argument, that "feelings" should not be taught at the expense of facts and basic knowledge, appears to have some rationale, in that facts provide the framework from which higher reasoning proceeds, (see also e.g., Vosniadou and Brewer, 1987; Alexander and Judy, 1988). Further, if Bloom's taxonomy is a valid statement of the development of cognitive organisation in children, it follows that strategies, cognitive or mnemonic, which can facilitate the acquisition of factual information are at the very least important, if not essential tools of learning.

Next will be discussed:

1) How knowledge is related to the school curriculum

2) How the incremental acquisition of knowledge facilitates higher cognitive judgements to be made

and

3) How one's knowledge of personal learning strategies [19] can lead to a more efficient use of the knowledge base [20] children possess.

19 "The collection of mental tactics employed by an individual in a particular learning situation to facilitate acquisition of knowledge or skill." "Thus conceived, learning strategies lie within the domain of "cognitive strategies" (Bruner, Goodnow, and Austin, 1956).

20 Prawat, (1989) defines a knowledge base as "the extent to which knowledge acquired in one context might generalise to other contexts"; p. 1
It would be naive to suggest that either domain knowledge or strategy acquisition alone are a prescription for examination success. Amongst other important variables are: intelligence, (Wagner and Sternberg, 1984) motivation, (Booth, 1981; Ames and Ames, 1984) effort, (Holloway, 1988) anxiety, (Covington and Omelich, 1987; Hembree, 1988) self-concept, (Chapman, 1988) learning context, (Smith, 1988) attention, (e.g., Carver and Scheler, 1986; Wigfield, 1988), et al. But probably none of these variables is as important as the interrelationship between domain-knowledge [21] and strategy knowledge, (e.g., Alexander and Judy, 1988) or the "planful" way in which the child manages and regulates his or her own knowledge, (e.g., Flavell, 1971; Andreassen and Waters, 1989; Hanley and Collins, 1989).

THE RELATIONSHIP BETWEEN DOMAIN AND STRATEGY KNOWLEDGE

"....effective and efficient learning in the classroom is dependent upon the continual orchestration of one's content and strategy knowledge". (Alexander and Judy, 1988)

Recent research has explored this particular relationship, (e.g., Derry and Murphy, 1986; Shuell, 1986; Vosniadou and Brewer, 1987; Alexander and Judy, 1988; Andreassen and Waters, 1989) suggesting that a well-defined knowledge base is an important, if not "essential" feature of effective "schema" [22] or strategic knowledge, (e.g., Glaser, 1984; Chi, 1985).

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21 The declarative, procedural, or conditional knowledge one possesses relative to a particular field of study." (Alexander and Judy, 1988)
22 (Anderson, 1984)
This position has been shown in a number of curricular areas such as reading comprehension, (e.g., Pearson, Hansen and Gordon, 1979; Taft and Leslie, 1985; Recht and Leslie, 1988) mathematics, (e.g., Hiebert, 1984; Cauley, 1988; Murray and Mayer, 1988) where it has been repeatedly demonstrated that prior knowledge "facilitates both the quantity and quality of recall", (Recht and Leslie, 1988)

Both Anderson (1984) and Baddeley (1985) have clearly pointed out, "totally new" knowledge is in constant interactive exchanges with pre-existing or prior-knowledge. But although the child's possession of a "minimal base" of domain knowledge "would appear to be a necessary but insufficient condition for effective utilization of strategic knowledge", (Alexander and Judy, 1988, p. 388) adequate domain-knowledge is not a prescription for effective learning, unless accompanied by appropriate metacognitive strategies, (e.g., Hanley and Collins, 1989). For domain-knowledge to facilitate learning effectively, it requires to be "assimilated", organised, accessed and manipulated by the child, (e.g., Simon, 1980; Glaser, 1984; Rabinowitz and Chi, 1987).

The corollary reflects similar interdependencies. Studies by Gitomer (1984) and Schoenfeld (1987) have demonstrated that the adoption of inappropriate strategies not only impedes performance, but is costly in terms of time and effort. In accounting for such deficits, Simon, (1990) rather forthrightly suggests: "bare facts do not solve problems...." but facts are the rubrics which once "accommodated" by and "assimilated" within the individual's repertoire of knowledge, provide the "necessary condition" for strategy-generalisation, (e.g., Piaget, 1972).
More recently, Alexander and Judy, (1988) have attempted a synthesis of research at the "intersection" between domain and strategy-knowledge, extending the earlier proposals of Winograd, (1975) and attempting to avoid the criticisms levelled at related research relying principally on "descriptive, observational and correlational analyses", (e.g., Willson, 1987 & 1988). Given that present knowledge of this interactive-relationship is "very much in its infancy", (Alexander and Judy, 1988, p. 382) what does seem clear, is that: "A foundation of domain-specific knowledge seems requisite to the efficient and effective utilization of strategic knowledge," (ibid. p. 384; Newell, 1980; Resnick, 1982; Chi, 1985) and in solving a range of problems in fields as diverse as genetics, (Smith and Good, 1984) avionics, (Gitomer, 1984) writing, (McCutchen, 1986) or computer programming, (Klahr and Carver, 1987).

Further, once acquired, domain-knowledge in the form of factual information has a sense of 'redundancy' associated with it, unless the individual possesses the necessary skill to exploit it in other task-appropriate situations.

Insufficient time precludes more detailed discussion about the 'universal' concept of knowledge, but it is hoped that these comments have at least set the context of further discussion, whilst identifying some of the problems with which describing the term "knowledge" is inevitably associated.
KNOWLEDGE, THE NATIONAL CURRICULUM AND MNEMONICS

"School examinations are part of the English way of life. They have become established to the point that their need is seldom questioned. And if there was any doubt about their immediate future, this uncertainty seemed to have disappeared with the introduction of the General Certificate of Secondary Education in 1988 and the proposal to test pupils at the ages of 7, 11 and 14 also", (Brown, p.78, 1990).

It might at first appear that the introduction of the National Curriculum suggests the progressive erosion of learning strategies such as mnemonics, which were largely developed to support the recall demands associated with summative timed written examinations which are in decline. This may not be the case.

Far from eroding the necessity for students to engage recall and learning strategies such as first-letter mnemonics to assist the learning and organisation of factual information, the National Curriculum might even increase the need for learning strategies. Although there will now be less emphasis upon timed written assessment which emphasises candidates' ability to recall and apply knowledge, there will be an increased emphasis on precisely what knowledge children of different ages should possess.

It is not that recall and knowledge have less weight in National Curriculum assessment. It is merely that the emphasis on the particular way in which this knowledge is assessed has changed. By making a range of knowledge components explicit, it is now possible for teachers to collect a variety of evidence concerning the knowledge of each child relating to their area of the curriculum.
Irrespective of the ethics involved in competitive education, it will be in the interests of schools to consider opportunities which may facilitate the more effective transfer of learning. To this end, new learning methods and strategies which promote the more effective transfer of knowledge, will become increasingly sought.

Such methods exist and those schools which take the initiative to capitalise on the efficiency they can bring to the learning situation, will gain the most.

The National Curriculum attainment targets will promote these opportunities, by highlighting those concepts which children should know at specific ages.

As schools progress from the more comfortable climate of security, where achievement is not made public, nor compared with other schools, towards attainment-related accountability, the "best" schools will attract the "best" customers, and it is not inconceivable that the best schools will be judged as those where the attainment of their children more closely approximates to national attainment criteria.

Sue Butterfield, (1990) makes the point clear:

"The Education Reform Act has established assessment as the measure by which the implementation of the National Curriculum and school success will be judged." (ibid).

The market for strategies which facilitate attainment may be further developed by the impact of the Local Management of Schools initiative.
Deliverying the National Curriculum will require all the expertise of teaching staff and more. To be cost and time-effective, teachers will need to change the way in which they have traditionally taught their subjects. With attainment targets such a prominent feature of learning, teachers will of necessity employ these as a reference for mastery, [23].

Unrefined as these initiatives are at present, they appear to offer improved opportunities for schools to monitor and specify each child’s knowledge in a range of cognitive/affective situations. Further, the intention is that this information will be systematically updated and recorded in a form that will display each child’s progress throughout formal education. Riding and Butterfield, (1990) suggest:

"Current initiatives assume, for the first time, the possibility of a new partnership between curriculum and assessment."

Whilst offering a number of benefits to education, it is not inconceivable that such radical revision of assessment methodology may also create numerous novel problems. Among these will be how learning performance compares between local, regional and national institutions.

It seems almost inevitable that parents, authorities, employers and schools themselves, will be forced to examine and compare the academic and social performance of their students with other institutions who have an equal right and desire to attract "customers"!

23 Mastery learning is a concept which presupposes minimum criteria of learning
As a service to the community, industry, academic institutions and the nation, education now enters the infamous phase of becoming not only self-sufficient but also academically self-accountable, concepts shed by post-Victorian curricular innovation as "evils" best avoided. One can only hope that the reasons for such policy reversals reflect intentions sympathetic to the child and intentions commensurate with children's individual development rather than a cheap method of comparing production at various stages of cognitive manufacture.
SUMMARY OF SECTION 3

Section 3, begins with a general review of mnemonics, including an historical description. This is followed by some examples of the contexts in which mnemonics are employed in contemporary society with discussion relating to some of their strengths and limitations.

Next, the traditional belief that bizarre imagery is more potent than plausible imagery is explored, in a review that addresses this theory in relation to so-called "visual mnemonics". This is followed by an examination of some of the evidence related to visual mnemonics, focussing upon three examples: The method of loci, the pegword system and the keyword mnemonic. The loci and pegword systems form the basis of many commercial mnemonic systems and memory courses, whereas the keyword method is the first type of mnemonic to have been successfully applied to learning within the classroom context.
MNEMONICS - A BRIEF HISTORICAL PERSPECTIVE

"Researchers and practitioners now recognise that mnemonics are an effective way to organise, encode and retrieve information." (Carrier, et al., 1983, p. 235).

The word *mnemonic* is a derivative of the Greek word 'mnene', which means memory or the effect of experience, and is also attributable to the goddess of memory, Mnemosyne.

From an historical perspective, it is known that mnemonics were a highly favoured aid memoire of the orators of ancient Greece, (see "method of loci" below). These "crafts" became such valued memory-aids that they can be found in some form penetrating almost every human society, (e.g., see Hunter, 1979, pp. 1-23). Within western culture, mnemonics have had a variable and often turbulent reception. This has possibly resulted through the association of mnemonics with philosophers of the occult, (e.g., Fludd, 1574-1637). In this context, they became despised and ridiculed as part of the "black-arts".

Even today, "masters of deception", magicians like Paul Daniels, and professional mnemonists such as Bruno Furst and Harry Lorayne, perform memory-feats which captivate the interest of astounded audiences.

At the turn of the century, the cautious reservation of the religious and secular world towards mnemonics became even more evident within the scientific community. The recently established discipline of psychology was making the transition from introspectionist psychology, "the science of mental life", (Richardson, 1980, p. 5) to behavioural psychology, the "science of behaviour", (ibid). For numerous reasons which are beyond the scope of this paper, the introspectionist approach, failed to address many issues related to what we now term cognitive psychology. Within the *behaviourist* framework, the study of mnemonics
and more specific mental activities became equally difficult, as the behaviorists placed an important emphasis upon objective scientific methodology. Such a disciplinary philosophy did not readily lend itself to the study of unique personalised events and processes. Watson (1914, pp.9, 27), made the position clear:

"Psychology, as the behaviorist views it, is a purely objective, experimental branch of natural science, which needs introspection as little as do the sciences of chemistry and physics. It is granted that the behaviour of animals can be investigated without appeal to consciousness. The position is taken here that the behaviour of man and the behaviour of animals must be considered on the same plane..."

Within such a restricted context, it was virtually impossible for researchers to find the freedom to investigate either mnemonics or mental imagery, (e.g., Holt, 1964).

With the advent of cognitive psychology, (cognitivism) previously restricted areas of study became legitimate targets of research. Describing the transition from behaviorism to cognitivism, Neisser, (1976, p. 5) writes almost rejoicingly:

"The behaviourist taboos have been broken, and the mind suddenly seems worth studying after all."

The present interest in mnemonic skills evolved in the late '50s and early '60s largely as a result of experimental work on memory-tasks involving paired-associate free-recall. Given the task of learning lists, typically in the form of word-groups or Consonant-Vowel-Consonant triads, subjects commonly reported using various strategies to facilitate learning, (e.g., Clark, Lansford, and Dallenbach, 1960; Rock, 1957; Underwood and Schulz, 1960). Upon further analysis, it became apparent that to help learning, normal adult populations draw upon a broad repertoire of cognitive strategies ranging in complexity and diversity from simple rote-repetition, to grouping, re-coding and imagery-association. Although these skills might seem unsurprising, and certainly it is not unreasonable to assume they have played a similar
role in learning throughout "civilised" mankind's history, (e.g., see
Hunter, 1956 and Yates, 1966 for a review) their efficacy had previously
been based upon what behaviourists might call subjectivism rather than
scientific verification and fact.

Gradually, what was once considered something of a suspect area of
study has again become popular and the focus of considerable research,
even "a research topic in its own right". (Bellezza, 1981, p. 248).

Although Bower's (1972) comment:

"Many experimental psychologists cannot entertain thoughts about
imagery without some deep sense of guilt associated with forbidden
tabooes."

may no longer be completely applicable, it still colours mnemonic
investigation with reservations which appear largely unjustified. The
approach of this study is that associated with the principles of
cognitive psychology.
MNEMONICS IN CONTEMPORARY SOCIETY

"The value of information depends upon its being available when required. It is no use my owning a book on accounting if I do not understand it when I open it, if I do not remember that I own it when faced with an accounting problem, if I cannot find the solution without reading the entire book or if the book is packed in a trunk in the attic when I need it in my office." (Morris, 1979, p. 52)

The media, especially television, have offered professional mnemonists or "memory men" the opportunity to demonstrate the benefits that mnemonic systems can afford. Further, items relating to mnemonic systems frequently appear on the front page of tabloids and popular magazines, (e.g., The Independent, 21-2-90) informing readers that by using the system proposed, in a prescribed time they will obtain a "powerful memory". Of course, what is meant, is that mnemonic systems can be purchased to assist people with a number of everyday memory problems.

In a recent article for the 'Readers Digest', Stephen Powelson discussed his memorisation of twenty-two of the twenty-four books of the Greek Iliad. Such a feat might have received little attention had he not completed the exercise between the ages of sixty and seventy years!

In his article, (Readers Digest, October, 1988 PP 130-133) Powelson reviews a number of mnemonic devices including chunking, (grouping to-be-remembered items together) the loci method and imaging, (creating bizarre images of to-be-remembered items). For a more comprehensive review of the work of mnemonists see eg; Hunter, (1957); Luria, (1968) Rawles, (1978) and Lorayne & Lucas, (1972).

A further example of mnemonics in contemporary learning appeared in a recent television broadcast generated by the Adult Literacy and Basic Skills Unit, ('Spelling-it-out', B.B.C. T.V., broadcast on 14th October, 1988). Mnemonics were used to help literary-handicapped adults with spelling. Two examples will illustrate the suggestions made to viewers.
The word "island" it was suggested, could be divided into two separate words; 'is' and 'land' and thought of as "an island is land". The word 'island' was superimposed onto a picture of an idyllic tropical island with palms and white sand, in order to further strengthen the association by means of interactive imagery and association. In this example, both visual and auditory strategies are employed and by mispronouncing the target-word in a phonetically regular way, the information is more readily encoded through the elaboration imposed. The second mnemonic, was one to assist the spelling of "necessary". The viewer was invited to visualise a vicar in his pulpit wearing his clerical collar and two red socks. In animated graphics, he leans out from the pulpit and exclaims: "There is one collar and two socks in necessary". Again, by richly elaborating the target material, and using both phonetic and visual association, the material's coding and subsequent access is facilitated.

I recently visited the Leicester University Computer Centre in order to process some figures connected with this study and, looking through the handbook for the guidance of users, discovered the following suggestion related to remembering one's "password":

"Do **not** choose a password that can easily be guessed by someone else; a useful tip is to think of some phrase that you can remember easily, and then take the initial letter of each word to form the new password. For example, the phrase "Computer programmers are the salt of the earth" would yield the password "CPATSOTE". - What support for first-letter mnemonics!
With my family, I recently visited a large inner-city swimming bath. During our visit, we encountered two important situations where a good memory was not only useful but essential. First, upon changing, one was expected to lock one's valuables and clothing away in a locker for which a key was exchanged (in a reciprocal mechanism) for a ten pence coin. There was a number upon the key-fob and I unwittingly assumed that this number corresponded to my locker number. Had I not returned to the locker to deposit my watch, I would have had no idea what my locker number was. Fortunately, a bemused fellow-bather had noticed which locker I had used and distinguished it from the plethora of others.

Second, upon returning from bathing, my son and I, knowing our shared locker number, set about locating the locker, only to find that the myriad rows of lockers were arranged out of numerical sequence! Had I been aware of both problems from the outset, a digit-letter mnemonic (1) would have helped with the number problem, and imaging (2) with the location problem. How other strangers cope..... who knows!

More recently, I was teaching a group of twelve-year-olds some mnemonising skills, to fill a few minutes at the end of a lesson. The focus was on digit-letter conversion, in a variety of forms, a pre-medieval mnemonic in which digits 0-9 are converted to letters of the alphabet. A common form is 1 = A, 2 = B, 3 = C and so on, naught can be considered an O. After very brief instruction, I explained that first-year children often experienced difficulty in remembering the School's telephone number, (203817). The group were quick to point out that converted, this would become "B O C H A G" and at the same time,

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1 The technique of converting numbers to letters of the alphabet in order to make them more memorable.
2 For example, accentuating geographical features in the proximity of our locker.
appreciated that this acronym was probably less memorable than the telephone number itself! (What would they think of the hypothetical 5 0 2 6 8 - E O B F H?)

I then demonstrated how "bochag" could be made more meaningful by converting it into an acrostic, requesting the children (in groups of three) to do the same. In a very short while, a multitude of first-letter mnemonics were excitedly suggested. Among my favourites were:

"B-illy O-f C-orby H-ad A G-oose"

"B-en O-nly C-omes H-ome A-fter G-ames"

and the memorable?

"B-en O-nly C-atches H-aggis A-nd G-uppies"

As a final example, I recently received a credit card from one of Britain's largest credit companies; the card was complete with instructions about how to remember my "PIN" (3) number. A squared-grid, with what appeared to be randomly scattered numbers on it was used as an example of how the chances of remembering one's pin number "could be improved". It was suggested that the card-holder might form a similar grid to "help remember" the number. It appears that not many of the 'fruits' of experimental cognitive psychology have 'grown' within the policy-making departments of the multi-nationals, suggesting that Gruneberg's 1978 statement:

"..."If psychology is going to make any contribution to the man in the street in helping him with his own memory problems, it will have to come through an understanding of the processes over which the individual has control, in other words, strategies of learning and retrieval."

is a solution still searching for a problem!

3 P-ersonal I-dentification N-umber.
IMAGERY AND MNEMONICS

"It is quite clear that, under the circumstances investigated by cognitive psychologists in their formal laboratory experiments, the elaboration and construction of integrative, mental images may lead to substantial and reliable improvements in the ability to remember". (Richardson, 1980, p.80)

For "30 arid years", (Neisser, 1972a) prior to the mid 1960s, the powerful influence of the behaviourists had largely consigned mental imagery to a status "unfit for serious study", (see Merry, 1980a for a review).

Dissatisfied with introspectionist [1] theory and methodology, the behaviourists made a determined attempt to eradicate all approaches which employed subjective measures to formulate hypotheses and obtain data. Watson, (1914, pp. 9-27) was uncompromising in his suggestion that:

"Psychology, as the behaviourist views it, is a purely objective, experimental branch of natural science, which needs introspection as little as do the sciences of Chemistry and Physics.... It is possible to define [psychology] as 'the science of behaviour' and never to go back upon the definition: never to use the terms consciousness, mental states, mind, content, will, imagery, and the like.....".

By the mid 1950s, there was what Neisser, (ibid.) has termed a "paradigm shift" in psychological thinking, leading the behaviourists to "allow so-called mentalistic concepts back into their discussions", (Richardson, ibid. p.6). The weakening behaviourist position is clearly reflected in data found in Psychological Abstracts, where, between 1955 and 1977, the momentum of research into the study of human imagery accelerated quite dramatically. Frustrated at the constraints Watson and his associates had imposed upon imagery research, Hebb, (1960) wrote somewhat cynically:

1 Subjective or "private" assessment of one's mental processing.
"In the psychological revolution, the second phase is just now getting underway. The first banished thought, imagery, volition, attention and other such seditious notions. The sedition of one period, however, may be the good sense of another".

By 1974, confidence in imagery research, its methodology and highly encouraging experimental findings, had led to such optimism among psychologists, that Starker's (1974) proclamation: "Once abandoned as non-measurable and hopelessly subjective, the mental image has begun to yield its secrets to the tools of cognitive psychology", appeared to herald a second renaissance for introspectionalism.

Along with others, (e.g., Neisser, 1972b) the hopes of Starker were to be short-lived. There was to be no "major change in the direction of experimental psychology" (Richardson, ibid. p.1) leaving Newell, (1973) "half distressed and half confused"! Despite uncertainties over the specific direction imagery research should adopt, underlining the new "respectability" of imagery research, Neisser, (1976, p.5) wrote with optimism: "The behaviourist taboos have been broken, and the mind suddenly seems worth studying after all. Ideas and images are once again discussed in respectable journals...".

The more recent interest in imagery has been at least partly attributed to the re-publication of Galton’s (1883) research [2]. In a unique survey, Galton requested a number of his learned colleagues to supply explicit imagery-details, related to their recollections of breakfast, on a prescribed date. Although ridiculed by behaviourists as "unimportant" and "inappropriate" at the time of initial publication, the survey-returns, emphasised a number of important differences in the way people both construct, retain and recall images. Some of Galton's

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sample reported vivid recollections of their meal. Further, they could do this with extreme ease, whereas others reported difficulty in generating any images at all.

Galton's work has subsequently received substantial empirical support, proving internally consistent, (e.g., Juhasz, 1972) and re-test reliable, (e.g., Evans and Kamemoto, 1973; Sheehan, 1967; White, et al., 1977) although Baddeley, (1985) has found little relationship between "rated imagery" and performance, and Richardson, (1980, pp.118-119) urges caution in the interpretation of subjective reporting.

Contemporary research into the study of human imagery was at first largely dominated by the work of Allan Paivio, (e.g., Paivio, 1965; 1969; 1971; 1972; 1975; 1976 and 1979) whose attempts to accommodate the study of imagery, within a framework acceptable to the behaviourists, has had a dramatic and influential impact upon research design and methodology.

Prominent among Paivio's contributions to psychology, is the dual coding theory, (e.g., Paivio, 1971; Paivio, 1978). This assumes two "interdependent but richly interconnected symbolic systems": (Paivio, 1979) an image system, specialised for encoding perceptual, non-verbal information and events, and a verbal system, responsible for coding linguistic information. Paivio's theory has received some support from the neuropsychological work of Milner, (1970) who has demonstrated that damage to the left hemisphere impairs verbal performance, and to the right, visual and spatial performance. Baddeley and Warrington, (1973) also note that amnesic patients who possess normal linguistic abilities, are impaired in visual processing, suggesting that this inability is associated with the amnesic damage, whilst (separate) verbal processing functions largely unimpaired.
Pylyshyn, (1973) further argues for an "amodal" third code, which regulates the interchange between visual and verbal encoding, but this position has been rejected as an hypothesis leading "to an infinite regress" (Anderson, 1978) in psychological thinking on imagery, (see Richardson 1980, pp. 4-24 for discussion). An alternative contemporary view maintains the argument for a single or "common coding system", (e.g., Bower, 1972) on the grounds that a "common generative grammar" between visual and auditory encoding was more analogous to a "conceptual deep structure" (Bower, 1970) handling both audio and visual encoding.

The confusion among psychologists about the dependence or interdependence between visual and verbal processing, has impeded the original inertia and direction of imagery research. Clearly, considerable research has yet to be undertaken in order to illuminate a more precise and acceptable position.

IMAGERY IN LEARNING

Despite speculation that children younger than 8 could generate elaborative imagery only if the target items were visible to the child, (e.g., Wolff and Levin, 1972) the beneficial effects of elaborative mental imagery with adults, (e.g., Atkinson, 1975; Raugh and Atkinson, 1975) and children, (e.g., Levin and Pressley, 1978; Varley, et al., 1974; Yuille and Catchpole, 1973; Merry, 1980a; Condus, et al., 1986) have now been well documented.

It has further been demonstrated that children are able to benefit from imagery-instruction at a much earlier age than had previously been considered possible, (e.g., Bender and Levin, 1976) and that imagery-instructions given to children as young as 4 years can result in learning improvements, (e.g., Danner and Taylor, 1973).
In common with cognitive development in general, the child's ability spontaneously to generate and utilise elaborative imagery appears to be age-related, (Levin and Pressley, 1978) and related to the maturation of higher cognitive reasoning, (see Pressley, 1982 for a review). These incremental improvements in imagery-manipulation have been demonstrated between narrow age-groups. For example, Pressley and Levin, (1977) discovered differences in imagery-competence between 5 and 7-year-olds asked to image word-pairings. Whereas instructed children in both age-groups out-performed the non-instructed controls, it was found that only the older instructed children could generate images at the faster of two presentation rates, (6 sec pair v 12 sec pair). Evidence supporting the particular relationship between cognitive maturation and imagery-utility appears in neuropsychological studies, where cognitive impairment caused by amnesia, (e.g., Baddeley and Warrington, 1970; 1973) or bilateral temporal lobectomy, (e.g., Jones, 1974) results in imagery-production deficiencies. The same type of generative deficiencies have been identified in the learning-disabled, (e.g., McGivern and Levin, 1983; Condus et al., 1986) where imagery-production deficiencies can defer or deny those learners using elaborative associative imagery in their learning. Given the strong case for teaching material through the use of associative imagery, it seems reasonable to ask: "What type of imagery is the most effective learning aid"? Further, although it is beyond the scope of this study, it would be useful to know if there is an age-related relationship between the manipulation and effectiveness of different types of imagery.
BIZARRE v PLAUSIBLE IMAGERY

"...bizarreness is not a factor determining the value of mental imagery in improving recall". (Richardson, 1980, p.73)

Since antiquity, (e.g., Ad Herennium, 86-82 B.C.) the ancient Greeks had prescribed associative interactive imagery to facilitate the recall of prose and oratory, (see Yates, 1966 for a review) aware that by enriching the context and content of learning material, recall could be improved. Although the practice of forming bizarre associative imagery is the basis of a number of contemporary "rapid" language and vocabulary courses, and an important tool of the professional mnemonist, (e.g., Furst, 1954; Luria, 1968; Lorayne and Lucas, 1972) what is less apparent, and still confused, is the question "Does bizarre imagery produce superior learning to plausible imagery"?

Experimental studies testing the "widespread conviction" (e.g., Cornoldi, et al., 1988) that bizarre imagery is the most facilitative form of imagery, have produced a range of inconsistent findings. Despite numerous claims that, "vivid, striking and fantastic...far-fetched, exaggerated and distinctive" images, facilitate superior learning, (Hunter, 1957; see also, Delin, 1968; Perensky and Senter, 1970; Merry, 1980a; Pra Baldi, et al, 1985) some studies have failed to find a positive bizarre effect, (e.g., Wollen, Weber and Lowry, 1972). Further, a number of studies comparing bizarre with 'normal' images, suggest that the facilitative effect of normal images is at least equivalent to that of bizarre images, (e.g., Bergfeld, Choate and Kroll, 1982; Kroll, Schepeler and Angin, 1986) if not superior, (e.g., Collyer, Jonides and Bevan, 1972). Wollen and his associates (1972) confirmed Gombrich's (1972) suggestion, that the best facilitators were unusual, in fact, "the more bizarre and unlikely the better".
The claim by Postman, (1975) "that the unimportance of bizarreness was one of the few established conclusions of recent research on imagery", seems a premature conclusion.

There are four main explanations related to these anomalies:

**ORIGINATION**

One possible reason suggested for the discrepancies between research findings, (e.g., Cornoldi, et al., 1988) is that the origination of imagery production is an important determinant of its success. After Wollen had modified his experimental design to remove the effects of experimenter-instruction, Nappe and Wollen, (1973) concluded that if subjects had autonomy in selecting learning material there was no appreciable difference between either type of imagery. Further, bizarre imagery took "appreciably longer" to form than plausible imagery! (see also, Neisser, 1976, p.140).

There are at least three studies which fail to concur with this view: Jamieson and Schimpf, (1980) Merry and Graham, (1978) and Merry, (1980a). In both Merry and Merry and Graham's study, schoolchildren, who "rated" bizarreness themselves, produced superior learning, a position confirmed by results using verbal material, (e.g., Jacoby, 1978; Glover, Bruning and Plake, 1982; McDaniel, 1984; Pressley, et al., 1987).

**MATERIAL**

Typically, the material used in the plausible-bizarre debate has been the association of word-pairs, drawn either from an item-bank by the researcher, (experimenter-generated) or alternatively, by subjects themselves, (subject-generated) rather than free recall or recognition tasks. Attempting to isolate aspects of the "treatment" as important
variables affecting the success of bizarre imagery, Cornoldi, et al., (1988) followed Merry and Graham's experimental procedure, but changed the material, "...the bizarreness effect disappeared". These results prompted Cornoldi's team to differentiate between a situation that is "strange because it is unusual and yet possible" (e.g., "the dog suckles the cat") and a situation impossible outside of the imagination, (e.g., the dog gives a lecture") a distinction proposed earlier by Collyer, Jonides and Bevan, (1972). Supporting the findings of Cavedon, et al., (1984) and Cavedon, et al., (in press). Cornoldi's team reject the efficacy of bizarreness in favour of the "unusual", claiming that unusual associations are more susceptible to processing because of their feasibility than less-feasible bizarre items. What constitutes 'a bizarre sentence'? Merry, (1980a) has attempted to clarify this point. He discriminates between "anomalous sentences", which may contain "several discrepancies", and *truly* "bizarre sentences" which contains one anomaly only. Adopting a strong interference approach, it is reasonable to hypothesise that multiple bizarre associations may compete for "distinctiveness" whereas a single bizarre association is less likely to be affected.

**DURABILITY**

There is at least tentative evidence that bizarre images lead to more effective long-term recall, (e.g., Andreoff and Yarmey, 1976; Webber and Marshall, 1978; Merry and Graham, 1978; Merry, 1980a; 1980b) and are less susceptible to interference, (e.g., Einstein, McDaniel and Lackey, 1989). Like Andreoff and Yarmey, (1976) Merry and his associate, (ibid.) found bizarre imagery facilitative at both immediate and delayed recall, unlike Webber and Marshall, (ibid.) using line-drawings as stimuli, who found plausible images *superior* at immediate re-test, but
bizarre images superior at 1-week re-test. Webber and Marshall's (1978) findings have subsequently been supported by at least two later studies, (e.g., Marshall, Nav, and Chandler, 1980 and O'Brien and Wolford, 1982) who conclude that there is a "crossover effect" between plausible and bizarre imagery, bizarre imagery becoming superior after a period of around one week.

SUBJECTS
Nearly all of the research has used college students as subjects, (Merry, 1990) often as part-accreditation of a psychology course. The results of such studies have been criticised from a number of perspectives.

First, students are not representative of the population in general, (e.g., see Richardson, 1987)

Second, it is known that social class is an important variable connected with imagery, (e.g., Richardson, 1987) and that college populations are unrepresentative of wider class-distribution.

Third, it is known that performance on imagery tasks is affected by age, (e.g., McDaniel and Kearney, 1984; Parkin and Street, 1988).

Fourth, mature learners employ a wide range of metacognitive skills to resolve recall demands, (e.g., McDaniel and Kearney, 1984; Cunningham and Weaver, 1989) and more able learners have a more developed repertory of learning strategies at their disposal, (e.g., Kurtz and Weinert, 1989).

College and university students do not provide balanced samples. It is therefore with caution, that the results of experimental work employing adolescents and adults as subjects should be generalised to children or other populations.
Given the inconclusive evidence available, the main variables that appear to be important determinants of the efficacy of bizarreness, are:

a) The origin or ownership of the material to be learned, (e.g., Delin, 1968; Merry and Graham, 1978) and the type of material used, (Cornoldi, et al., 1988).

b) The relationship between the time available to construct or form bizarre-associations, (e.g., Nappe and Wollen, 1973; also see Neisser, 1976,) and the point at which recall is required, (e.g., Webber and Marshall, 1978; O'Brien and Wolford, 1982).

c) The particular age-range of the experimental sample, (e.g., McDaniel and Kearney, 1984; Parkin and Streete, 1988)

d) Whether free recall tests retention (where bizarre images help) or cued recall (where bizarre images appear to be unhelpful.

There follows discussion related to three types of mnemonic which employ interactive imagery to facilitate recall:

The 'method of loci' (which usually requires the formulation of plausible interactive imagery) and the so-called 'pegword' and 'keyword' mnemonics which both employ bizarre interactive imagery. The keyword system is of particular interest to the student of mnemonics, as it has been very successfully used with children in the classroom.
THE METHOD OF LOCI

The method of "Loci" [3], was an important mnemonic of the Greek philosophers, and accredited to Simonedes, whose skill in identifying the mangled bodies of colleagues, crushed by temple masonry in 477 B.C., gave birth to Ars memorie artificiali, or mnemotechny. (e.g, Hunter, 1957; Young, 1961; Yates, 1966; Wittrock, 1975; Marshall and Fryer, 1978; Baddeley, 1985).

The facilitative effect of the loci method is obtained by associating each complete aspect of the learning material as vividly as possible, (e.g., Gruneberg, 1983) with a "physical place", or places familiar to the learner, one place for each "chunk" of information that is to be learned.

The Greek orators imaged a key part of a speech, together with a particular location within the temple such as the doorway. Another part of the oratory is associated with the ante-chamber and so on, until each section of the speech had been interactively imaged with a specific location. During the speech, the orator simply 'journeyed' the imagined route, starting at the doorway and stopping to retrieve each aspect of the speech from each location. Not only does the loci method organise the material to be recalled sequentially, facilitating serial-access, it also avoids an associated problem of the pegword method, (see below) where the number of loci or pegs might be limited to the mnemonising time or effort available.

3 Latin for "places"
For the Greeks particularly, knowledge was a cherished 'commodity' (Rawles, 1978; Yates, 1966) and those who could recall and present arguments with precision and clarity were revered. Simonedes' successful discovery quickly penetrated oratory and philosophical mediation skills, (e.g., see Sorabji, 1972) leading Cicero, in De Oratore 11 to urge all would-be philosophers to engage "memoria technica". Essentially, the use of the method of loci remains "unchanged" (Richardson, 1980) and can be traced through the Middle-Ages, (e.g., Petrus Ravennas, (c. 1448-1508) through to the occult-philosopher Fludd, (1574-1637) and Stokes' (1868) "mnemonic globe," [4] upon which a "face" is superimposed with various mnemonic instructions designed to facilitate geographical recall, (see Hill, 1978). In 1907, Meiklejohn included the system in a textbook, circulated to L.C.C. secondary schools [5] hoping that it would "make the getting up of history as easy as remembering the situation of a street".

Under scientific conditions, the loci method has been used successfully to facilitate recall both using adults, (e.g., Groninger, 1971; Bower, 1973) and children as subjects, (eg, Brown, 1975 and Kobasigawa, 1974). Among the first experimental studies, the loci method proved an important and successful learning mediator, (e.g., Bugelski, et al., 1968) and capable of facilitating access to incidental aspects of pre-learned text, (e.g., Rothkopf, 1971). Later, Zechmeister, et al., (1975) reported that both item and spatial recall was proportional to subject's memory for visual position.

4 Displayed in the British Museum
5 Local County Council
It seems to matter little whether the interactive images formed are bizarre or ordinary, (e.g., Wood, 1967; Bower, 1970; Wortman and Sparling, 1974) but although there is some evidence to support bizarre-imagery effects, (e.g., Delin, 1969) as Gruneberg (ibid.) suggests, "bizarreness is associated with vividness" and this may be the cause of Delin's result. The traditional faith in the efficacy of bizarre imagery, (e.g., see Ad Herennium, 86-82 BC; Wollen, et al., (1972; Gombrich, 1972) has been further eroded by the results of Morris, (1978) who found that bizarre images took around twice as long [6] to form as "conventional" images. Even when Morris maximised the circumstances which "favour" bizarre images, conventional imagers performed marginally better, but the difference was not statistically significant. What appears to be important, is the type of recall required of subjects. There is evidence that free-recall, [7] can be considerably facilitated by bizarreness, (e.g., Merry, 1980a). It is hypothesised that in a cued recall condition, such as that associated with the loci method, subjects might find it easier to generate plausible links between items, (Merry, 1990).

The method of loci then, has an ancient 'pedigree' which has received little modification during its passage to contemporary magicians and scholars. Its range and utility is relatively unrestricted, provided enough loci or places can be identified. Unlike chain or linking mnemonics, failure to recall one or more of the cues, (in the form of loci) does not inhibit access to other cues. Ordinary or conventional images are at least as effective as bizarre images which take twice as long to construct and manipulate.

6 (4 seconds v 2 seconds)
7 Where subjects are able to recall previously learned information in whatever order they find most comfortable
THE "PEGWORD" MNEMONIC

"Distinct, preferably unique retrieval cues, integratively associated with the information to be recalled are the ideal for efficient retrieval. The Peg mnemonic provides these conditions." (Morris, 1979)

The "peg-word" (e.g., Miller, et al., 1960) or "hook" (e.g., Gruneberg, 1983) mnemonic system, appropriately classified by Bellezza, (1981) as a peg-mnemonic, is closely derived from the loci-method, using interactive imagery to facilitate recall. Studies comparing the method of loci and the pegword system, (e.g., Bower and Reitman, 1972) essentially find "identical recall" characteristics, (e.g., see Bellezza, 1981; Lesgold and Goldman, 1973).

A series of cues, pre-learned to criterion (complete competence) are associated with the learning material. Later, to retrieve the learning material in serial order, the cues are recalled, thereby prompting the recall of the associated learning material. An example will illustrate the technique.

The learner must first learn to criterion a sequence of words which will later act as recall-cues. Typically, these are as follows:

One is a Bun
Two is a Shoe
Three is a Tree
Four is a Door
Five is a Hive
Six is Sticks
Seven is Heaven
Eight is a Gate
Nine is a Line
Ten is a Hen
Next, a visual association is formed between these pegs and whatever is to be remembered. I used the system recently to remember a few items of shopping, and formed the following images:

- A jar of coffee growing out of a bun
- A shoe 'covered' in breakfast cereal
- A tree with yoghurt hanging as leaves
- A door upon which biscuits had been nailed
- Bees carrying crisps to a hive

As I do not normally use the system for shopping, I was surprised how durable it appeared to be, being easily able to recall the list a week later. Clearly, the example illustrated fails to utilise the full potential of the mnemonic, (ie., to facilitate serial order sequencing) but the items could have been sequenced to suit the layout of the store. The method does have its limitations:

a) The associative images used with previous pegs, may interfere with subsequent material.

b) As only ten pegs can act as cues, the learner must extend the number if there are not enough. This might be problematic, as appropriate rhyming words are cumbersome, (e.g., see Gruneberg, 1983). Morris, (1979) points out that the range of pegs can be greatly extended, illustrating that 'memory-men' use 52 pegs when memorising the serial location of playing-cards, (see also, Lorayne and Lucas, 1972).

c) Failure to recall a peg/s, may result in loss of recall for one or more item.

d) It takes a little time to form the interactive images, (e.g., Bugelski, 1962; Bugelski, Kidd and Segmen, 1968; Lea, 1975). Writing the items down might be more economical use of time.

Among the harsher critics of mnemonic systems, Hunter (1977) refers to Francis Bacon’s commentary about "location" mnemonics being "not dextrous to be applied to the serious use of business and occasions", and although Richardson, (1980) somewhat misconstrues Morris's, (1977) position, he does emphasise Hunter's (ibid.) misgivings:
The method has such a circumscribed range of utility that it is useless for all practical purposes of learning and remembering. Appropriate task conditions are essential. These task conditions rarely arise in real life." It is the writer's belief that many practical applications for the peg system can be found in schools. Take for example, mental checklists that might be used as a 'failsafe' system, complementing written information. Items required for visits or 'residentialss' could easily be remembered using the peg system.

Despite these more pessimistic views, there is "considerable empirical evidence" supporting the mnemonic's effectiveness, (e.g., Bugelski, 1968; Morris and Reid, 1970; Paivio, 1971; Baddeley and Lieberman, 1980) although there does appear to be a relationship between subject-imageability, (e.g., Divesta and Sunshine, 1974) the concreteness of the pegwords, (e.g., Delprato and Baker, (1974) and learning-time, (e.g., Bugelski, et al., 1968) and performance using the mnemonic.

Subjects of Bellezza and Reddy, (see Battig and Bellezza, 1979) using a "modified" peg-mnemonic, recalled 130 of the 150 target-words, [8] and, contrary to traditional belief, (e.g., Ad Herennium, (86-82 B.C.) and as memory-improvement systems suggest, "bizarre images do not lead to better recall than ordinary situations," (Morris, 1978,, p. 155). In another study, Morris and Stevens, (1974) tested subject's performance using lists of 24 concrete words in three experimental conditions: linking images, [9] single images, [10] and an uninstructed control. Linking images produced recall superior to that obtained by imaging individual items which in turn, proved less effective than the uninstructed control!

8 Using cued recall techniques
9 Instructed to link images in groups of three
10 Instructed to image each item separately
Concerned that "experiments may have failed to allow subjects sufficient time to form bizarre images," Morris, (1978) tested bizarre imagery effects "where subjects have been allowed enough time," for construction. In fact, ordinary images led to statistically insignificant, marginally superior recall, but as noted elsewhere, this relationship is prominent in cued, immediate re-test conditions whereas bizarreness can be a powerful learning facilitator in delayed free-recall conditions, (e.g., see Merry, 1978)

Conducive with the main body of research related to the bizarre-ordinary hypotheses, (see "Imagery," this study) it seems to matter little whether pegword cues are either bizarre or ordinary at immediate re-test. Nearly all studies show that loci-type methods produce learning superior to that produced when no mnemonic controls are used and although bizarre images take longer to construct than ordinary images, their efficacy over ordinary images only becomes apparent at delayed re-test.
THE KEYWORD MNEMONIC

"It is not premature to conclude that the keyword method is a highly effective strategy for remembering new vocabulary, as well as other factual information with an associative component.... This is true for subject populations of all kinds, ranging in age from preschoolers to adults." (McGivern and Levin, 1983)

Although research related to vocabulary instruction can be traced to the publication of work by Gray and Holmes, (1938) it is only more recently that the possibility of teaching foreign vocabulary, using mnemonics, has been effectively demonstrated, (e.g., Ott, et al., (1973).

The keyword mnemonic, originally proposed by Atkinson, (1975) has probably become the most rigorously investigated mnemonic type. The main principle of the mnemonic is to provide learners with associative cues in the form of interactive images [11].

Rosenheck, Levin and Levin, (1989) illustrate how the mnemonic is used:

"...to remember that the Spanish word for duck is pato, one could recode the Spanish word into a concrete English keyword that is acoustically similar, such as pot. The next step is to relate the keyword pot to the meaning, duck. This could be accomplished by picturing a duck inside a pot. In this way a retrieval path is formed that links the foreign word pato with its English meaning, duck".

The method has proved so successful in both laboratory, (e.g., Ott, et al., 1973) and applied studies, (e.g., Merry, 1980b) that its commercial potential is now being exploited in a plethora of D.I.Y. [12] language instruction courses, (e.g., A memory-improvement scheme offered by Paul Daniels/ Michael Pressley, in The People Newspaper, 25-2-90).

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11 Where a mental relationship or 'picture' is formed between two or more images
12 Do It Yourself
The keyword mnemonic, sometimes referred to as the Keyword "method", (e.g., Desrochers, et al., 1989) has now been extensively studied with a range of subjects, e.g., undergraduates, (e.g., Atkinson and Raugh, 1975; Rosenheck, Levin and Levin, 1989; McDaniel and Pressley, 1989;) learning disabled children, (e.g., Mastroplier, et al., 1985b; Condus, et al., 1986; Scruggs, et al., 1987) normal children, (e.g., Levin, et al., 1982; McGivern and Levin, 1983) and more able children, (e.g., McGivern and Levin, 1983) with encouraging results.

The keyword method has typically enabled mnemonically-instructed users to demonstrate "dramatic results" (Merry, 1980b). Learning improvements in excess of 50% superiority over non-user controls are not unknown, (e.g., Raugh and Atkinson, 1975) and a study by Pressley, (1977) demonstrated that children could achieve 189% superiority over non-users, when tested on Spanish-English word association.

Clearly, the acquisition of ...."complete vocabulary knowledge is complex,..." (McDaniel and Pressley, 1989) requiring a wide range of associative skills such as the interpretation and analysis of meanings, fluency in accessing appropriate meanings, and judgements of accuracy which are task-appropriately related to current needs, (e.g., Beck, et al., 1987; Elshout-Mohr and van Daalen- Kapteijns, 1987).

Claims for such involved processes are not made for the keyword, but used to promote the acquisition of foreign or native vocabulary. The keyword facilitates a "narrow" understanding of the type of context in which a previously unfamiliar word might be appropriate, (e.g., Kameenui, et al., 1987) and helps to establish a basic repertory of words for which at least some meaning is known, (e.g., Beck, et al., 1987).
Although not without its critics, (e.g., Sternberg, et al., 1983; Nagy, et al., 1985; Hall, et al., 1981; 1986) the keyword's efficacy has also been demonstrated over a variety of control conditions and alternative study methods, (e.g., Levin, et al., 1982. For reviews, see Mastropieri, et al., 1985a; McDaniel and Pressley, 1987; McKeown and Curtis, 1987). Further, its "flexibility" (Levin, et al., 1982) has been illustrated in a range of subject-areas, e.g.,: Science facts, (Mastropieri, Scruggs and Levin, 1985b) science classifications, (Mastropieri, et al., 1985b) natural history, (Veit, et al., 1986) botanical concepts, (Rosenheck, Levin and Levin, 1989) mineral categorisation, (Levin, et al., exp. 2, 1986) and German nouns, (e.g., Desrochers, et al., 1989).

Despite such positive results, confidence in the keyword method has not been universal. Hall and his associates, (e.g., Hall, et al., 1981; Hall, 1988) have expressed three important concerns about claims made for the mnemonic, related to:


13 Suggesting that disproportionate time is required for subjects to construct the mnemonic, resulting in greater time-on-task than that for alternative learning conditions.
KEYWORD DURABILITY

Although some experimental results suggest that experimenter-generated keywords lead to better, more durable learning, (e.g., McGivern and Levin, 1983 and see Gruneberg, 1983) there is some confusion about long-term keyword superiority, when compared with alternative learning methods such as the semantic context method, (see Nagy, Herman and Anderson, 1985 and Sweeney and Bellezza, 1982).

An explanation, which might account for these anomalies, relates to the number and quality of cues established during initial learning.

The keyword method, relies upon the formation of just one interactive link, (e.g., McDaniel, et al., (1987) whereas it is known that a "multitude of elaborations" (ibid.) offer a wider range of retrieval cues and improved access at both coding and recall stages, (e.g., Cuddy and Jacoby, 1982; Anderson and Reder, 1979). There is also evidence which suggests that uninstructed learners, free of the learning constraints that instruction imposes, intuitively form numerous semantic associations during learning, (e.g., Battig, 1965). These provide the learner with richer and more numerous semantic links, upon which to "hang" new learning material, (e.g., Clifton and Slowiaczek, 1981).

Because the keyword method relies upon just one interactive link, the possibility of cueing the correct information during recall, tends to be wholly reliant upon re-constructing the one interactive image.

This area of the keyword's potential weakness, might also be its main strength. Limiting the number of semantic associations at encoding, could contribute to the keyword's effectiveness by reducing the interference effects which would otherwise be caused through the simultaneous encoding of numerous semantic links.
TIME-ON-TASK AND SPEED OF PRESENTATION

Underwood, (1983) has extended the investigation relating to keyword research anomalies, by suggesting that the information initially acquired in each experimental condition is not "equivalent", an idea which Hall and his associates, (e.g., Hall and Fusson, 1986; Hall, Owens and Wilson, 1986) have explored from a somewhat different perspective.

Hall's view is that item-presentation speed, and the time-on-task allocated to alternative learning methods being tested, is inappropriately distributed. His argument, is that the time-offered alternative learning conditions with which the keyword is compared, tend to be of arbitrary duration, allocated as a result of convenience rather than appropriateness.

Hall and Fuson, (1986) note that although keyword experiments typically offered item-learning times of around 9-10 seconds, this amount of time artificially inhibited the effectiveness of alternative learning methods. They illustrated the point by demonstrating that subjects given short presentations of items, (e.g., 3 items, every 3 seconds) learned more than subjects in a 9-second single presentation condition, (Hall Owens and Wilson, 1986) an effect also noted by Bellezza, (1981).

Responding to Hall's comments, Pressley, (1987) questioned the keyword instructions offered by experimenters in Hall's team, suggesting this as the prima facie reason why the normal "keyword effect" was not replicated. Pressley, (ibid) concludes: .... "Hall and Fuson ignored the possibility that only their specific keyword-method instructions may not be adequate". (p.333).
Adopting a similar learning paradigm to Hall, but different keyword instructions, Pressley’s (ibid) subjects, [14] outperformed no-strategy-control learners in both 1 x 9s and 3 x 3s presentation conditions despite brief training on keyword use. This view is important and can be applied to the learning of all mnemonics, especially in those situations where attempts are being made to demonstrate the efficacy of a particular mnemonic against alternative learning methods.

Responding to Hall’s critique, Pressley (1987), suggests that a failure to provide sufficient time for subjects to use a selected keyword or appropriate instruction on how to utilise the keyword method, might seriously reduce the keyword’s effectiveness. Nonetheless, Pressley, (ibid.) concluded that fast rates of presentation were not conducive to learning via the keyword method.

Some studies, which incorporated delayed re-test, (e.g., Atkinson and Raugh, 1975; Merry, 1980a; Condus, et al., 1986) have demonstrated memory improvements over no-strategy controls, (e.g., Levin, et al., 1982) and also against taxonomic [15] learning conditions, (e.g., Rosenheck, Levin and Levin, 1989). A team led by McDaniel, (1987) tested college students’ recall of vocabulary paired-items, (learned using the keyword method one week earlier) against the semantic-context method. Although they observed facilitative keyword "effects" at immediate re-test, they concluded: "....there were no differences in long-term retention as a function of learning method". These findings are in sharp contrast to Rosenheck, et al., (1989) study, where it was concluded that the "keyword mnemonic superiority appears to increase with time".

14 university students
15 hierarchically organised lists
To test the hypothesis that at least some of the research anomalies were either due to the type of keyword instruction that subjects were offered, or to the suitability of the keywords selected for research, Hall, (1988) conducted two experiments. However, he was unable to discover any significant learning improvements using the keyword method unless keywords were selected upon the basis of mnemonicising suitability, e.g., "obvious keywords", (ibid). Indeed, "The keyword subjects scored significantly more poorly than control subjects on items not selected for keyword suitability."

McGivern and Levin, (1983) approached the problem from a different perspective by testing the "stimulus-transformation" [16] stage of keyword operation. Children with either high or low vocabulary knowledge were assigned to one of three keyword conditions, each graded in the degree of structure and support provided by the experimenter, against a control condition where no strategies were adopted. Whereas all the keyword conditions facilitated children's vocabulary learning, the degree of support offered was shown to be more crucial to the children with low vocabulary knowledge, who experienced "considerably more difficulty" (ibid) in manipulating the learning material.

Although it is known that children with memory deficits do not use mnemonic strategies very effectively, (e.g., Torgesen, 1980; see McLaughlin Cook, 1989) for a review) more recently, a series of studies have deliberately explored the possibility of using the keyword-method to facilitate the learning of learning-disabled children, (e.g., Mastropieri, et al., 1985a; Condus, et al., 1986; Scruggs, et al., 1987) with most encouraging results.

16 Where the foreign vocabulary word is linked to a corresponding English word
In the Condus study, 32 learning-disabled children identified with "low", and 32 with "high" receptive vocabularies, were randomly assigned to either keyword, or one of three different learning conditions, [7]. Not only did the keyword produce learning significantly superior to the other learning methods studied at immediate re-test, but "significantly" (ibid) more word meanings were recalled 10 weeks post-test. These results provided evidence supporting the earlier findings by Mastropieri, et al, (1985c) that the keyword technique is "extremely effective" (Scruggs, et al, 1987) as a mnemonic for assisting learning-disabled children.

THE KEYWORD METHOD: A FUTURE IN SCHOOLS?

".....the study of vocabulary learning under naturalistic conditions should be a high priority." (Pressley, 1987)

It is hard to envisage how such a useful, flexible and potent mnemonic form will ever penetrate educational practice.

Although there is little evidence to suggest that British language teachers have been alerted to the possible benefits the mnemonic might afford, a survey amongst a group of American teachers shows that they have expressed a keen interest, (e.g., Levin, et al., (1982) and were willing to "explore (the method) further in their classrooms." If such an undertaking has been explored in the U.K. it has, to the writer's knowledge, remained unreported. It should further be noted, that the keyword method has proved to be a flexible learning tool and is certainly not restricted to vocabulary instruction. Given the breadth of

7 Picture context, sentence-experience context, and uninstructed control.
potential applications for this mnemonic, it seems necessary to ask the question:

Why, after proving successful in so many applied studies, and in such a broad range of subject-areas, does the method remain virtually undiscussed and undisclosed in any of the main educational weekly papers, [18]? Indeed, "...the keyword method is often not recommended in vocabulary instruction programs...", (McDaniel and Pressley, 1989).

In the same way that advances in knowledge about developmental aspects of cognition only steadily filter into classroom practice, problems of communication at the intersection between knowledge sources [19] and teachers' access to this appear to lack co-ordination.

Levin's (ibid) concluding remarks would seem to be equally relevant today, when he wrote:

"...will the (keyword) method ever prove its worth to the point that it will be welcomed into the vocabulary learning of classroom teachers"?

At present it is difficult to envisage a time when teachers will have the opportunity to exploit the wealth of research which concerns their everyday activities. One wonders.... why?

18 e.g., The Times Educational Supplement
19 e.g., Educational periodicals, university, college and polytechnic libraries
SUMMARY OF SECTION 4

Under the more general heading of "First-letter mnemonics", *acrostics and acronyms* are described along with discussion related to their application. This is followed by a *review of the literature specifically related to first-letter mnemonics*.

Next is a discussion which attempts to account for the discrepancy between the popularity of the mnemonic and its poor performance during scientific investigations of its efficacy.

This is followed by discussion related to some theoretical and practical considerations related to *applying* first-letter mnemonics through a synthesis of the literature available and the writer's own experiences related to actual classroom practice. The results of a limited survey undertaken in seven secondary schools and related to the informal use of mnemonics are used to support a number of arguments relating to classroom practice and hitherto unaddressed.
"First letter mnemonics...may have considerable potential for assisting learners in college courses where there are many concrete facts to be learned." (McLaughlin Cook, 1989).

There are two principal types of first-letter mnemonics: acrostics and acronyms.

An acrostic, more commonly called a "first-letter mnemonic", (e.g., Nelson and Archer, 1972; Baddeley, 1985; McLaughlin Cook, 1989) is a "peg-type" mnemonic, (e.g., Bellezza, 1981) where the first letter of each word forming a learning sequence is elaborated in order to construct new words. Typically, these new words are reconstructed to form a meaningful sentence, statement or phrase. The type of material commonly reorganised in this way is often arbitrary in nature, with little interrelationship between the to-be-learned items or the items' semantic structure, (e.g., Higbee, 1977). Within this context, the purpose of acrostics is to provide the learner with more effectively organised and structured learning material containing stronger, more useful cues. This is achieved by generating "meaning, integration and cues where none (might) naturally exist", (Morris, 1979).

To decode the information contained in acrostics, the mnemonic is recalled, cueing the first letters of the original learning material. Acronyms also provide learners with first-letter cues, but the letters are not elaborated or embellished with additional meaning although the letters of the acronym might facilitate this effect, (e.g., N.U.T. [1]; N.A.L.G.O., [2] C.O.H.S.E. [3]).

1 National Union (of) Teachers
2 National And Local Government Officers' Association
3 Confederation Of Health Service Employees
An acrostic commonly illustrated in the literature, (e.g.,
Grunenberg, Monks and Sykes, 1977; Morris and Cook, 1978; Bellezza,
1981; Baddeley, 1986) is "R-ichard of Y-ork G-ave B-attle I-n V-ain", a
phrase used informally by teachers to help students remember the visible
spectrum in sequential order, i.e., R-ed, O-range, Y-yellow, G-green, B-
blue, I-indigo and Violet. An association between the acrostic and the
learning material is either formed during initial acquisition of the
material, or alternatively, at some point after the material has been
learned. There is no conclusive evidence suggesting that subjects who
engage first-letter mnemonics during initial learning, or at a later
stage, produce superior learning, although there does appear to be a
relationship between subjects’ prior-knowledge of the learning material
that is to be mnemonised, [4] and the subsequent effectiveness of a
mnemonic, (e.g., Morris and Cook, 1978; Battig and Bellezza, 1979).

In a variety of alternative learning situations, acrostics are used
by teachers on an informal basis, (e.g., see "Staff survey", pp.293–325
of this study) typically to help students learn material comprising
words or phrases which must be remembered and later recalled accurately,
often in serial order. For example, to help learn the colour-coding of
resistors, electronics students sometimes use the acrostic "Beyond
Brown’s Rose Orchard You Glimpse Blue Violets Growing Wild". Here, the
first letter of each word in the sentence, represents a colour in
specific sequence and is used in the same way as the "Richard Of
York....." acrostic. For further examples, see e.g., Nelson and Archer,
1972; or Dictionary of Mnemonics, 1972: Smith, for a fuller review).

4 Converting learning material into a mnemonic form
First-letter mnemonics have been shown to facilitate serial-order recall, (e.g., Nelson and Archer, 1972; Morris and Cook, 1978). They also help to structure and organise material, a factor known to improve learning, (e.g., Norman, 1976). Some acrostics incorporate rhyme. This further enhances the potential of the mnemonic by providing increased meaning and cueing power, whilst simultaneously limiting the range of possible alternatives. For example, students of physiological psychology use variations of the acrostic, "On Old Olympus Towering Tops A Fop And Glutton Vended Some Hops," to remember the cranial nerves (e.g., see Nelson and Archer, 1972). Since antiquity, rhyme has been known to be an important agent in learning and recall.

Rhyme reduces possible word-options by forcing the reader to anticipate phonetically similar words, (e.g., McGeoch, 1942; Bower and Bolton, 1969). For example, once it is known that the mnemonic "Thirty days hath September,...etc., for learning the length of calendar months, is set to a form of metrical rhyme, the month cued by "September" leaves only the options: December and November. In a similar way, acrostics which employ rhyme, might further improve the mnemonic’s facilitative potential by restricting the phonetic possibilities of some succeeding words, whilst simultaneously providing a further "hook" through its lyrical form. Rhyme is not an uncommon feature of acrostics, but it is less usually associated with acronyms. Acronyms are just one word, (e.g., N.A.T.O.) and because the sequence is to all intents fixed, the facilitative effects rhyme might afford do not exist.
At present, there is no evidence which suggests either rhyming or non-rhyming first-letter mnemonics are superior, but a study by Machida and Calson, (1984) using a rhyming-sentence mnemonic with 12 and 13 year-olds, found that mnemonics which incorporate rhyme did facilitate learning. Machida and Carlson's results are also interesting because actual curricular material (algebraic principles) was used as part of the learning programme, and also because when compared to a regular teaching-method control group, the mnemonic group were still able to demonstrate superior learning at a 2-week post-test.
ACRONYMS

In contrast an acronym, also classified by Bellezza, (1981) as a "peg-mnemonic", is a reduction mnemonic, comprising the minimum "critical criteria", (e.g., Norman, 1976) of each word forming the learning material. Typically, acronyms employ the first letter of each word comprising the learning material. These then act as cues or prompts at the time of attempted recall. For example, "SCUBA" is a term associated with underwater diving and forms an acronym for the information: S-elf C-ontained U-nderwater B-reathing A-pparatus. Probably a more familiar example might be the individual "P. I. N." number, (P-ersonal I-dentification N-umber) required to obtain cash at bank service-tills.

It is sometimes the case that the first letters of the words or information for which an acronym is an abbreviation, often fail to provide a coherent or cohesive statement or phrase, regardless of how they are organised. To overcome this problem, "filler-words" often have to be included as part of the acronym. Although filler-words can help in the generation of an intelligible and more memorable mnemonic, it has been noted that filler-words, at least in the case of acrostics, (e.g., see Lieury, 1980) may result in negating the mnemonic's facilitative effect.

To retrieve or remember the original unabbreviated material, the acronym is recalled, offering the learner the first letters or "critical items", (e.g., Norman, 1976) of each word as cues to prompt both the complete words and subsequent words comprising the acronym. Further examples might include: "R O Y G B I V", an alternative mnemonic to the acrostic "Richard Of York Gave Battle In Valn", used to teach the visible spectrum, (e.g., Nelson and Archer, 1972) and "H O M E S" a scheme for remembering the "five great lakes", (e.g., Higbee, 1977).
Acronyms have become so popular, that they appear to have emerged as part of the 'standard vocabulary' of contemporary culture. Indeed, it would not be inappropriate to suggest that they dominate a variety of literature related to education in general and educational initiatives in particular. So successfully are acronyms remembered, that the mnemonic itself often becomes the referent phrase.

For example, "L A S E R", is now such a commonplace word that few people would be able to elaborate the acronym in order to re-form the extended term, (e.g., Light Amplification by (filler-word) Stimulated Emission of Radiation).

For purposes of clarity, it is useful to distinguish between acrostics and acronyms, before proceeding to suggest the general framework within which first-letter mnemonics will be reviewed. Morris, (1979) offers a useful illustration, suggesting: "....of the two common mnemonics for the spaces and lines of the treble clef, FACE is an acronym while E-very G-oOd B-oY D-eserves F-avour is an acrostic."

FIRST-LETTER MNEMONICS REVIEW APPROACH

Although it is not completely satisfactory, I propose to follow McLaughlin Cook's (1989) approach in disseminating the evidence relating to first-letter mnemonics, by treating acrostics and acronyms together. This position is made somewhat more tenable in that an unpublished thesis by Mulvenna, (1982) testing and comparing the two mnemonic types, found no learning differences.
Although the evidence related to first-letter mnemonics is largely inconclusive, by adopting this combined approach of convenience, it is possible to make more meaningful generalisations than would be reasonable reviewing acrostics independently. Where evidence specifically related to acrostics is available and relevant, it will of course be included.
FIRST-LETTER MNEMONICS - A REVIEW OF RESEARCH

Evidence related to the efficacy of first-letter mnemonics as learning aids is confused. Although a number of studies have found positive effects, (e.g., Nelson and Archer, 1972; Pines and Blick, 1974; Grunberg, Monks and Sykes, 1977; Morris and Cook, 1978; Haring and Fry, 1980; Lieury, 1980) others have not, (e.g., Boltwood and Blick, 1970; Gruneberg, 1973; Waite, Blick and Boltwood, 1971; Perewiznyk and Blick, 1978). First-letter mnemonics have been demonstrated to be a favoured learning strategy of students, (e.g., Blick and Waite, 1971; Blick, Buonassissi and Boltwood, 1972) and are also used informally by teachers in the classroom, (see "Staff survey" of this study, pp.293-325).

Whereas there is very little evidence suggesting how widespread is the use of first-letter mnemonics in school environments, or how effective they are when used with children, evidence related to their use by student-populations is available. Roberts, (1968) found that 60% of his subjects grouped words by their first letters. This finding was subsequently extended by Boltwood and Blick, (1970) Blick and Waite, (1971) where 38% and 34% of subjects respectively, prioritised the first-letter mnemonic technique as their most popular aide memoire. A further study by Harris, (1980) confirms the popularity of the mnemonic, but although 47% of Harris's sample reported using the first-letter mnemonic, it was not used regularly, suggesting more specialised application such as examination preparation where it is not unusual for teachers to suggest mnemonic techniques as an aid to learning, (see "Staff survey" of this study. (Ibid)
Given its popularity, one might expect that the mnemonic would be at least a useful tool in examination revision and recall, but attempts to compare college students' use of first-letter mnemonics with the class of degree subsequently obtained by regular mnemonic users, (e.g., Grunberg, 1973) have found no facilitative effect of the mnemonic upon examination performance [5].

Studies have so far failed to account for two important observations:

1) Why is there such a distinct disparity between the popularity of acrostics and objective evidence supporting their efficacy over other learning methods?

2) Why do studies commonly report contradictory evidence about
   a) the mnemonic's efficacy in general
   and
   b) the origin [6] of the mnemonic?

Results of studies using E (experimenter) and S- (subject) generated first-letter mnemonic schemes conflict. Whereas Kibier and Blick, (1972) and Pines and Blick, (1974) supporting E-generated schemes suggest: "the source of the mnemonic was the crucial variable affecting recall," (ibid).

Other studies, e.g., Boltwood and Blick, (1970) and Gilchrist, (1981) failed to support this position. Further, Lieberman, Walters and Cox, (1968) examining mnemonic origination in a broader context, failed to support the efficacy of mnemonics in either E or S-generated conditions!

5 Clearly, examination performance, requires more of candidates than factual recall.
6 Subject or experimenter-designed.
Research investigating the particular relationship between origination and the mnemonic’s durability (e.g., sustained effect) is also confused. Kerst and Levin, (1973) demonstrated the mnemonic’s durability regardless of origin, which is in contrast to the earlier findings of Olton, (1969) who discovered indications that the initial benefits of E-generated schemes deteriorated over time.

The results of both Kerst and Levin and Olton’s studies, (ibid) need to be assessed carefully, as neither incorporated a standard control. First, Gilchrist, (1981) employing unrelated word-lists, found no differences between E-generated acronyms when compared with either E or S-generated sentences. Second, in a study comparing sentence and first-letter mnemonics in both E and S-generated conditions, Pines and Blick, (1974) found significant differences in favour of E-generated schemes, concluding that "the source of the mnemonic was the crucial variable affecting recall." (ibid.), and adding: E-generated schemes "suffered no significant losses" over two-day and six-week intervals. (ibid.). It is of course difficult to review origination as objectively as we might like to.

A number of awkward variables tend to confuse the issue:

What is a 'good' first-letter mnemonic?

Good in what context?

Good for what type of population?

How is the effectiveness of the mnemonic related to expended cognitive effort?

How is the effectiveness of the mnemonic related to the subject's motivation?
These findings support earlier conclusions by Rohwer, (1966) who suggested that E-supplied sentences improved learning because ".....meaningfulness and syntactic structure in combination are the properties of verbal strings which facilitate learning". Testing for origination superiority in acronyms, Manning and Bruning, (1975) compared acronyms in both concrete and abstract form against an S-generated sentence-mnemonic condition, in both immediate, and one-day re-test conditions. Manning and Bruning reported sentence-scheme superiority over both concrete and abstract acronym conditions, with no statistically significant differences between the two acronym-types at one day re-test.

Even if origination is disregarded, there still exists confusion as to how durable the effects of first-letter mnemonics are. Pash and Blick, (1970) Kibler and Blick, (1972) and Pines and Blick, (1974) offer support for the mnemonic's long-term efficacy whereas Boltwood and Blick, (1970) and Carlson, et al., (1981) failed to discover any appreciable long-term benefits even when the mnemonic condition was compared to a simple repetition control group.

In his review of verbal mnemonics, McLaughlin Cook, (1989) compares evidence of the efficacy relating to first-letter mnemonics with that of alternative mnemonic forms. Boltwood and Blick, (1970) assessed the efficacy of first-letter mnemonics against three different strategy-conditions: descriptive story, acronyms and clustering. Each of the techniques was compared with a repetition control group using S-generated material. Of the mnemonic techniques studied, only the descriptive story method was effective after eight weeks.
IDENTIFYING CAUSES FOR THE DEFICIT BETWEEN THE POPULARITY OF THE MNEMONIC AND SCIENTIFIC EVIDENCE

"It might very well be that the failures to find the first-letter mnemonic effective do not result from the fact that the first-letter mnemonic cannot work as a mnemonic device, but rather that it was not implemented correctly." (Bellezza, 1981)

If, as Carlson, Zimmer and Glover, (1981) report, first-letter mnemonics "don't aid memory", why are they used at all? Morris and Cook (1978) ask, "Surely so many people cannot be wrong?"

In accounting for this disparity, it seems reasonable to consider broader aspects of the mnemonic. It might be that under artificial or scientific conditions, one or more of the mnemonic's components have been inappropriately manipulated, resulting in negating the mnemonic's facilitative effect. It is also conceivable that there is some component of first-letter mnemonics which fails to transfer to the type of situations under which they have so far been investigated. This possibility is made more conspicuous in that some of the more prominent features of the mnemonic such as cueing, (e.g., Whittaker, McShane and Dunn, 1986) the organisation of learning material, (e.g., Ceci and Bronfenbrenner, 1985) and labelling, (e.g., Fabricus and Cavaller, 1989) have been investigated independently and each have been found to be important components of learning.

SUBJECTS

Nearly all of the evidence concerned with the mnemonic is related to studies using adult populations, typically psychology students participating in studies as part of the requirements or accreditation of psychology courses. Little or no serious work employing scientific methodology has been undertaken with schoolchildren, using normal curricular learning material, within a familiar learning environment.
If it is the case that first-letter mnemonics "don't aid (the) memory" of adult subjects, this position may not generalise across to pre-adolescent populations or, more importantly, to circumstances and subjects outside the university setting! Further, colleges and universities do not provide either balanced or representative samples from which generalisations to normal populations can be made, as students are amongst society's most academically able.

Given that teachers in schools do use mnemonics to help teach curricular information in their classrooms, it seems reasonable to assess how children might benefit from using mnemonics as a related but separate issue to that of how adults might benefit from them.
TIME-ON-TASK

Researchers, (e.g., Morris and Cook, 1978; Bellezza, 1981) have often expressed two important concerns related to: a) the time subjects take to learn and b) to apply first-letter mnemonics. First, it can be argued that studies allowing subjects more time to learn the mnemonic, merely demonstrate learning improvements as a function of the extra time-on-task. Subsequently, an important feature of studies demonstrating the mnemonic's efficacy, will be that of carefully time-matched alternative learning conditions. Second, extra time in any comparative experimental condition will inevitably offer the subjects in question more time to reflect upon, organise and disseminate ideas, factors known to facilitate learning, (Tobin, 1987). But, as Gruneberg, Monks and Sikes, (1977) remind us, "it is difficult to assess how much time should be allowed for (mnemonic) construction", when allocating matched learning time to each group comprising the experiment. For example, when testing first-letter mnemonics, Nelson and Archer, (1972) presented their subjects with one word every two seconds. Smith and Noble, (1965) working with pegword mnemonics and using Consonant-Vowel-Consonants, as learning material, used four-second presentations.

If the evidence which would enable researchers to provide appropriate presentation-time and mnemonic learning-time is so ambiguous for adult populations, far less evidence is available to assist in the design of applied experiments using schoolchildren as subjects. In the absence of available evidence suggesting appropriate material-presentation speed and also optimum mnemonic-learning-time, the need for carefully designed pilot studies becomes essential. Each first-letter mnemonic contains unique cues for specific factual information. As applied studies become more common, it will become more important to know how much time children need to process and apply first-letter
mnemonics of different item and word-lengths. If teachers can be convinced that the time taken to mnemonise material in the short-term is economical in terms of long-term retention, then it is for the teacher to seek out the many opportunities when acrostics will facilitate retention, (e.g., see also, Cox, 1991).

TIME OF RECALL
The failure of the first-letter mnemonic when compared with alternative learning methods (typically employing rote rehearsal or un instructed learning) in immediate re-test conditions, (e.g., Carlson, Zimmer and Glover, 1981) reflects similar findings using sentence mnemonics, where superiority over control groups became evident only after six weeks, (e.g., Pines and Blick, 1974) and eight weeks (Boltwood and Blick, 1970; Garten and Blick, 1974) respectively.

It seems inappropriate to expect subjects with the dual task of learning the mnemonic and the order of the learning material, to demonstrate immediate learning improvements. If my experiences are correct, few teachers teach a first-letter mnemonic with either the intention or expectation of the mnemonic becoming immediately purposeful! An acrostic is more generally taught as a means of helping children order and organise typically arbitrary learning material for long-term retention, (see "Staff survey" of this study, pp.293-325) with the additional benefit of providing the first-letter cues inherently supplied by the mnemonic.
THE SIZE OF THE MNEMONIC

The size of the mnemonic appears to be a key determinant of its success. This seems to be the case both for first-letter mnemonics, (e.g., Lleury, 1981) and sentence-mnemonics, (e.g., Bower and Clark, 1969). Such findings are reminiscent of Miller's (1956) notion of a restricted processing capacity in the immediate or short-term store, and strongly suggest limitations in the immediate processing capacity of cognition at the reception level. This effect has been demonstrated regardless of how information is "chunked" or grouped together and it is reasonable to hypothesise that the same restrictions apply to the learning of first-letter mnemonics! Using adult populations, studies have used both six words, (e.g., Gruneberg, et al., 1977; Nelson and Archer, 1972) and nine words, (e.g., Pash and Blick, 1970). Moreover, as Bellezza (1981) points out, many studies using the pegword mnemonic are limited to ten items due to the inherent characteristic of the mnemonic itself.

MOTIVATION AND NOVELTY

A study investigating other mnemonic forms, (e.g., Griffith, 1979), suggests that subjects engage greater cognitive effort or "expanded processing capacity" in applying their own as opposed to E-supplied mnemonics. Griffith's findings have implications for studies incorporating E-generated first-letter mnemonics in that attention and concentration are dependent variables for effective learning, (e.g., Torgesen and Licht, 1983 and see Baddeley, 1990, for a review). It is also known that incentives, (e.g., Booth, 1981) cognitive effort, (e.g., Weiner, 1985) interest, (e.g., Shirley and Reynolds, 1988) and motivation, (for a review, see Ames and Ames, 1984) play important roles in positively altering children's perception of learning, (e.g., Ames and Archer, 1988).
Nearly all of the research related to first-letter mnemonics to date has been directed towards adult populations, who have typically 'volunteered' their services as part of a course requirement, (see McLaughlin Cook, 1989 for a review). It seems at least conceivable, that the interests, motivation and incentives of adult populations to learn and apply mnemonic material, differ from that of child populations. For example, schoolchildren in the fourth and fifth years especially, have both intrinsic (e.g., skill-acquisition) and extrinsic (exam-preparation) reasons for engaging a mnemonic. Further, mature learners typically have more refined and developed learning skills and strategies, (e.g., Waters and Andreassen, 1983) and are more able to accurately identify the circumstances in which these are likely to be most effective. It may well be that college students do not regard participating in mnemonic research, with the same sort of enthusiasm as a child who is offered a new and novel learning skill, with extrinsically specific practical applications! Further, adult mnemonisers might feel there is a limited value in adopting a new "trick" when, typically unlike the child, they already possess an item-bank of learning strategies of which the first-letter mnemonic forms a small part. Further, subjects forming the control group of studies are more likely to spontaneously adopt sophisticated mnemonic strategies, having the effect of masking overall experimental results.
THE TYPE OF RESEARCH SETTING

It is often problematic to address affective components of particular learning-strategies, as these are notoriously difficult to specify, control and assess.

The body of research related to first-letter mnemonics appears to have been only minimally successful in addressing these important issues and consistent with mnemonic research in general. Little is known about children’s thinking related to the use of strategies. Given the results of "laboratory" tests on the mnemonic, common sense suggests that there is some important variable or element/s absent in this type of test.

Belezza, (1981) recognises this problem in suggesting that the mnemonic’s poor performance in experimental studies is somehow related to the circumstances in which first-letter mnemonics have so far been applied. To date, there has never been a strong case for transferring experimental results testing adult subjects and applying them to younger populations. Nonetheless, it is a concern that such a popular mnemonic can at the same time prove so ineffective in the preparation for examinations, even for those students who name the mnemonic as their favourite learning strategy!

There are numerous variables which might account for a range of attitudes towards using the mnemonic. Inevitably, some are similar to those found in any teaching situation and include: teaching-style, presentation, time-of-day, the gender of teacher and subjects, the resources available for instruction, the experience of the teacher, the
motivation of teacher and taught. Further, children or students may be less inclined or willing to learn a mnemonic if they:

a) Fall to appreciate the potential benefit the mnemonic might afford their learning

b) Are given insufficient instruction about how to use and apply the mnemonic

c) Find the mnemonising activity (in the case of S-generated mnemonics) too demanding to complete, or "badly" produced (in the case of E-generated mnemonics).

Adopting this hypothesis, it becomes clearer precisely *why* the first-letter mnemonic has been "ineffective" (e.g., Boltwood and Blick, 1970) when investigated by impersonal, detached and anonymous researchers under artificial (laboratory) conditions. It is difficult and highly improbable that environments and circumstances which are representative of empirical settings can be replicated in a clinical laboratory situation.

In the "real world", the quality of the relationship between teachers and their classes is known to affect learning outcomes. (see Stainthorp, 1991 for an excellent review) It appears that the laboratory work undertaken so far has failed to accommodate this important consideration. It is hypothesised that this has resulted in a reduction of the effort enthusiasm and inspiration to tap an acrostic's true potential which under more regular learning conditions makes an acrostic a powerful learning aid. (e.g., See the results of experiments in the "7-Series" of this study, pp.276-291 and also, Cox, 1991) A number of
teachers do use first-letter mnemonics to help teach specific topics. Are these staff wasting their time? Teachers place an important value upon potential classroom learning-time.

Common sense suggests that teachers are a discerning community. If this community had perceived first-letter mnemonics were ineffective learning-aids, might they not have abandoned them long ago - or at least hung them up along with the cane? Alternatively, if they are useful learning-aids, why is there not more obvious or formal provision for them within curricular-learning programs? These questions highlight the considerable need for applied experimental studies in schools.

THE CONSTRUCTION OF FIRST-LETTER MNEMONICS

The evidence now available strongly suggests that for mnemonics to have the optimum facilitative effect upon learning, they should ideally be related to an established framework of knowledge, (e.g., Bartlett, 1932; McDaniel and Pressley, 1984; Rosenheck, Levin and Levin, 1989). It has been demonstrated that well-organised, (e.g., Levin, 1972) and well-constructed mnemonics, (e.g., Lieury, 1980) provide subjects with the best opportunities to improve learning. In two related experiments, Morris and Cook, (1978) successfully demonstrated that prior knowledge of the learning material was an important factor both in successful encoding and retrieval. Whereas in experiment 1, neither concrete abstract words in either E or S-generated conditions facilitated recall, recall was facilitated in experiment 2, where days of the week were used as the learning material. In this condition, first-letter mnemonics "considerably improved recall," suggesting that first-letter mnemonics are effective learning-aids "when the items are known but their ordering presents problems." (ibid.) In recent papers, both the importance of "background knowledge" (e.g., Alexander and Judy, 1988) and the
necessity to present students with clear and unambiguous models and examples from which to build effective knowledge-bases are discussed. Mayer, (1989) argues that verbatim knowledge related to concepts does not in itself provide the subject with a sufficient repertoire from which to generalise and apply task-appropriate conceptual skills to novel situations, a position demonstrated by both Glaser, (1984) and Chi, (1987).

Further, the evidence at present available related to metacognition, suggests that academically successful children will be more effective in knowing both how to generate and when to apply a suitable first-letter mnemonic, (e.g., Leal, 1987; Kurtz and Weintr, 1989). Successful children will be more spontaneous in the freedom with which mnemonic strategies are applied, (e.g., McDaniel and Pressley, 1984) and more able to generalise these to a wider range of settings, (e.g., Cross and Paris, 1988).
A JUSTIFICATION FOR TEACHING CHILDREN TO USE FIRST-LETTER
MNEMONICS

It has been repeatedly demonstrated that children acquire cognitive
learning strategies and skills incrementally. That is, the acquisition
of learning strategies is more specifically related to their current
cognitive maturation, than to their chronological age. This has been
shown to generalise across a range of developmental settings, and has
been demonstrated for:

Memory strategies in general, (e.g., Kail and Hagen, 1977;
Ornstein and Baker-Ward, 1983; Waters and Andressen, 1983;
Borkowski, et al., 1988)

Metacognition, (e.g., Cross and Paris, 1988; see Brown and DeLoache,
1983 for a review)

Metamemory, (e.g., Campione and Brown, 1978; Byrd and Gholson, 1985 and
Andreassen and Waters, 1989)

and

Rehearsal, (e.g., Flavell, et al., 1966; Hagen and Kingsley, 1968;

Researchers have also suggested that subjects with a broader range of
metacognitive skills are more effective at manipulating and
disseminating knowledge, and applying task-appropriate strategies,
(e.g., Brown, (ibid.); Shuell, 1986 and Waters and Andreassen, 1983).
Additionally, metacognition has been found to play an important role in
strategy-generalisation per se, (e.g., Pressley, Borkowski and
O'Sullivan, 1985; Borkowski, 1985) and some authorities hypothesise that
metacognition itself in some way regulates all thinking, acting as an
"executive control" responsible for both aware and unaware cognitive
activities.
These observations tend to support Bransford, et al’s. (1979) assumption, that the knowledge people have about their own cognitive functions is directly related to learning and recall-performance, (e.g., tip-of-the-tongue and feeling of knowing). Material which is known once-to-have-been-learned and present within memory, does not always guarantee its availability, but learners who have acquired more efficient metacognitive and metamemory processing possess the requisite cognitive "tools" to organise, integrate and manipulate information for effective processing, (e.g., Mandier, 1967; Craik, 1972). Organised material is both easier to code and access than that which is unrelated, to the extent that if disorganised material is presented to learners, they will organise the material in order to make processing more efficient, (e.g., Mandier, 1972) as organisation provides more salient retrieval cues, (e.g., Morris, 1979; Gruneberg, 1983).

Given the positive interrelationship between the organisation of learning material, strategy-acquisition and learning-performance, it seems reasonable to consider opportunities which might promote children to gain access to a wider range of strategies.

Unlike older children and adults, young children and learning-disabled children tend not to employ grouping or organizational strategies spontaneously, (e.g., Torgesen, 1980; Borkowski, Wehying and Carr, 1988). But in cases of rehearsal, (e.g., Flavell, Beach and Chinsky, 1966; Mechan, 1980) and metacognition, (e.g., Lodico, et al., 1983; Pressley, et al., 1985; Cross and Paris, 1988; Andreassen and Waters, 1989) interventional instruction has been shown to lead to substantial improvements in learning, (e.g., Andreassen and Waters, 1989).
For many decades, psychologists have highlighted the need to extend laboratory and theoretical research to real empirical settings, (e.g., Bartlett, 1932; Richardson, 1980) with a view to developing practical applications which will help children to learn more effectively, (e.g., McLaughlin Cook, 1989). Although this has already commenced, the area of study has been in the somewhat specialised domain of vocabulary instruction, (e.g., Merry, 1980b; Levin, et al., 1982; McGivern and Levin, 1983). Further, the specific type of mnemonic employed has been the so-called "keyword" method, (e.g., Atkinson, 1975), (discussed pp. 127-135 in this paper) a visual imagery technique suited to word-associations. In stark contrast, following a flurry of research activity in the late 1970s, interest in classroom applications of first-letter mnemonics appears to have all but dissolved. Amongst the reasons for this decline in interest, might be the poor performance and confusing evidence of the mnemonic in laboratory trials. Given that the keyword mnemonic's 'laboratory success' (e.g., Ott, et al., 1973) suggested immediate practical learning applications, the attention of those working within the field of learning strategies tended to be diverted away from the study of first-letter mnemonics to more financially lucrative topics.

Recent reviews of verbal mnemonics have been more favourable and the need for applied studies related to first-letter mnemonics has been requested, (e.g., McLaughlin Cook, 1989) and the methodological framework for studying first-letter mnemonics proposed, (e.g., Bellezza, 1981).
There is limited evidence relating to the use of mnemonics in schools and "no study has examined the spontaneous use of verbal mnemonics in schoolchildren", (McLaughlin Cook, 1989). This seems strange, as schools appear to be the 'womb' of this particular learning strategy! (e.g., see "Staff survey", in this paper, pp.293-325). In addition, Leal, (1987) has focused upon the particular relationship between children's adoption and use of learning strategies and academic success, highlighting the importance of children's acquiring a repertoire of task-appropriate strategies. Such acquisition offers learners a more flexible response in a variety of formal and informal learning situations.

FIRST-LETTER MNEMONICS IN THE CLASSROOM

Research has indicated that it is often insufficient merely to instruct children how and when to use a particular mnemonic strategy, (e.g., see Kail, 1979 for a review); the child must keep alive the knowledge of how to use and apply mnemonics until their utility becomes a spontaneous aspect of problem-solving behaviour. This can be achieved either through maintenance-rehearsal (frequent silent or audible revision of the process or cognitive activity involved) or by learning a mnemonic technique to criterion through regular use.

The process of teaching children how to use a mnemonic strategy is, in itself, a less formidable task than monitoring the child's persistent correct use of that strategy. Further, there are practical implications for ensuring that around thirty children in each teaching group are able to regulate the application of a particular mnemonic.
Just like any cognitive skill, the ability of the child to spontaneously seek out opportunities where a mnemonic could aid learning, might involve a number of specialised associated cognitive skills outside the child’s current intellectual capabilities.

Opportunities to apply first-letter mnemonics to learning material in the classroom can be found in most (if not all) subject syllabuses.

For example, some years ago, I noticed that children in my third-year C.D.T. (Craft, Design and Technology) groups were experiencing problems in recalling important factual information in serial order, less than 50% failing to recall the information accurately, one week post-test [7]. Although only six words were involved, these formed important sub-headings from which a more thorough evaluation might be generated. The information was to be remembered in serial order and was as follows:

P-erformance
F-unction
V-alue-for-money
C-onstruction
A-esthetics
S-afty

7 Elapsed time after initial recall test
The children learning this list of arbitrary material found it somewhat difficult to recall both the words and particularly the serial-order of the words in the list. After limited instruction of around two or three minutes, on how to design and apply first-letter mnemonics, the group I was teaching quickly suggested the following idea:

- P-elicans
- F-ind
- V-indaloo
- C-urry
- A-wfully
- S-satisfying

After a maximum of one or two minutes of rehearsing the mnemonic, the topic was left. The next week, I tested the group informally with a view to finding out how successful or otherwise the mnemonic had been. After a few moments of recollection, almost 85% were able to recall the six word-headings in correct serial order! Such observations are supported by the findings of Senter and Hauser, (1968) but in sharp contrast to a study by Perewiznyk and Blick, (1978) where E-generated first-letter mnemonics, previously identified as superior to those generated by subjects, (e.g., Pines and Blick, 1974) performed poorly even against a simple-repetition control. Further, children in my C.D.T. group who were initially unsuccessful in recalling all of the words in correct serial order, later either recalled the list correctly, or, by minimal prompting through the mnemonic, recalled to criterion [8]! It is worth stressing that mnemonics do not teach the meaning of words but they do help organise and structure to-be-learned material in such a way as to make it almost unforgettable, (see results of this study and collaborative work, e.g., Cox, 1991).

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8 Complete competence
Such encouraging observations bring into question the host of negative findings related to the mnemonic, whilst also suggesting, that it might be prudent to add an additional category to mnemonising procedures, that of *group-generated mnemonics*. Undoubtedly, mnemonics conceived in this way, will rely upon the input of a few (more academically able?) members of the class/group. I have found this does not necessarily detract from a common feeling of *ownership*. Clearly, this is a point that needs to be explored using more *scientific* methodology.
SUMMARY OF SECTION 5

This begins with a description identifying the choice of approach used in this study. This is followed by discussion related to the methodology employed and an analysis of the experimental materials used.

Next, the main pilot experiment and the subsequent modifications that were implemented prior to the main experiments are described and reviewed.
In the interest of brevity, references in this section will be limited to those which are either felt appropriate or which support evidence which does not appear elsewhere in this study.

The information presented in this study was obtained through:

a) Thirty individual experiments, each designed to compare the efficacy of first-letter mnemonics, with uninstructed and instructed rote-learning conditions. Performance differences between two age-groups were also assessed in each of the three experimental conditions.

b) A survey of teaching staff from randomly-assigned secondary schools within the authority.

c) A survey related to the individual learning methods of each child in the study.

d) Selective interviews with children from experimental-conditions in both year-groups.
GENERAL PREPARATION FOR THE EXPERIMENTS:

1) Interview with Northamptonshire Education Authority's Senior Education Officer, requesting permission to undertake research and distribute questionnaires to secondary schools. Approval received.

2) Headmaster and senior management of the study-school approached three months prior to the experiments. Support and approval obtained.

3) Registration teachers informed (informal discussion and written notification) two months in advance of commencing the experiments, (including pilot) and again reminded three days prior to the pilot. Written reminders were also placed in registers on the morning of the pilot and also of each experiment. This was subsequently reinforced by a verbal reminder as respective staff moved to register their forms.

4) Experiment room (school cinema) booked for the projected period of the experiments, (including pilot) as were all audio/visual aids that were required.

5) Recorded information and instructions for pilot and each subsequent experiment, pre-tested in experiment room, prior to each experiment, to ensure reproduction quality and experiment-room clarity.

6) The preparation for the pilot and all subsequent experiments included arranging seating as near to external examination requirements as was practicable. Each subject's place was provided with a work-board and also, the learning sheets appropriate for the experiment taking place. Maximum totals were catered for and additional writing equipment made available.

7) During the pilot experiment, and also subsequent initial experiments, a video-camera was used to record events. This was used to elicit unforeseen faults in experimental design and administration with a view to re-appraising the experimental approach where appropriate. A technician was available to record events.

8) Three students were available during the preparation and administration of each experiment. Their assistance was invaluable. Their tasks included:

   a) Assisting in setting-up the experiment room on each morning there was to be an experiment.

   b) Checking that respective children had, or were in the process of leaving for each of the thirty experiments

   c) Collecting and issuing relevant learning or answering-sheets during each experiment.
9) All research materials designed and tested prior to each aspect of empirical work. These materials included:

a) The staff questionnaire - circulated to 6 schools

b) Learning and answering sheets produced in sequence for each of the thirty experiments.

c) The audio-tapes used in each experiment.

THE EXPERIMENTAL DESIGN

An applied experimental study was chosen as the main source of information for the following reasons:

1) Studies addressing issues related to first-letter mnemonics have so far been conducted in artificial settings and with a narrow range of subjects, typically, college students. The mixed and confused findings of these studies, have tended to discredit first-letter mnemonics as an aide-memoire, despite their known popularity amongst learners, (e.g., Gruneberg, 1973). Clearly there is a need to explore the mnemonic's efficacy in more regular learning situations with different age-groups and with normal learning materials.

2) Common sense suggests that first-letter mnemonics are used in schools, albeit on an informal basis and at the discretion of the teacher. Little is known about the efficacy of the mnemonic when it is used with children or whether older children are more adept at using the mnemonic than younger children. This type of comparison suggested an experimental design which would allow comparisons to be made between children of different ages. Further, testing the efficacy of the first-letter mnemonic in isolation of alternative learning methods, seemed in itself somewhat artificial, as comparisons of performance could not be made. These considerations are pursued further below, (see "age of subjects").

3) Psychologists have repeatedly requested that research is more directly related to real learning situations, using actual curricular material, in a regular context. Attempts to satisfy these requests, often require researchers to compromise between meeting the requirements of scientific objectivity, whilst attempting to preserve the essential features of the testing context. As in most, if not in all applied studies, this has been the case here.
4) For scientific reasons, it was decided to standardise the format of each experiment. This was clearly a compromise between experiment and the children’s regular learning environment as during normal learning, children encounter a variety of teaching styles and types of presentation, (e.g., see the Oracle Project, Leicester University). Whereas few teachers are likely to present learning material, or test their children’s learning using an audio tape, this method of presentation offered the most consistent objective and reliable means of communicating information to the children. Not all of the information could be communicated to the children via an audio recorder. That which could not, was delivered verbatim via pre-prepared scripts, each carefully matched for inter-script format, consistency, and length.

AGE OF SUBJECTS

Research related to learning strategies in general and to the use of mnemonics in particular, has highlighted age-related performance differences, (discussed in the section marked "metamemory" of this study, pp.69-74). Three main features have been identified:

1) There is a direct relationship between strategy-use and cognitive maturation. This relationship is prominent between pre and post adolescent children but has been observed in the years approaching adolescence.

2) Younger children have an undeveloped repertory of learning strategies, are less planful and deliberate in matching learning needs with appropriate strategies.

3) Young children can be successfully instructed in the use of learning strategies and mnemonics with beneficial effects upon learning. Learning benefits of two kinds have been demonstrated:

   a) Learning performance that is superior to that of rote or uninstructed learners at immediate re-test [1]

   b) Learning performance that is superior to that of rote or uninstructed learners at delayed re-test, [2].

1 A test conducted very soon after initial learning has taken place.
2 Typically around seven days (variable) after learning the initial information.
Using children as subjects, certain mnemonic forms have now been extensively and successfully studied in a wide range of learning contexts, in particular, learning using the *keyword* mnemonic. Impressive results, obtained in artificial settings, have more recently given way to a number of studies applied to more regular learning situations. These, too, have replicated the results of earlier findings leading to a search for further applications of the mnemonic.

Other popular mnemonics have also been studied in laboratory settings with confusing and conflicting results. In particular, the favoured learning method of examination candidates, the *first-letter* mnemonic, was found to be an unreliable and poor learning facilitator in some studies, whilst proving effective in others.

There is little evidence relating to how the mnemonic can benefit children in the classroom, using regular learning material - a familiar setting for the mnemonic. Further, it is not known if maturation affects how the mnemonic is used, or whether it has a bearing upon its effectiveness. Additionally, it is not known if children can be successfully taught to use first-letter mnemonics in conjunction with regular learning material, or how effective the mnemonic is in promoting the long-term retention of this material.
To illuminate these areas of uncertainty, it was decided to involve two year-groups in the study. The rationale behind the choice of years was as follows:

It was preferable to target first-year children as one of the study groups for the following reasons:

a) They offered the youngest sample available with which to make maturational/developmental comparisons.

b) If there were to be any effect on subsequent schooling as a result of this study, damage occurring in the first year might be less traumatic.

c) Whereas the second year were involved in residential activities during the course of the experiments, (making them unavailable for variable periods of time) the first year were not.

Providing an additional year-group with which to make maturational comparisons of the mnemonic's performance was found to be difficult for both moral and practical reasons.

During the relatively extensive period in which it was proposed to conduct the research, (nearly three months) students in the fifth year were actively preparing for external examinations. This effectively precluded them as potential experimental candidates. For similar reasons, fourth-year students were omitted from the study as it is a vital preparatory year for the fifth-year external examinations. Additionally, several schemes [3] are provided for the fourth-year students at around the time the research was targeted. To include this year-group would have resulted in a number of awkward administrative complications rendering the timing and organisation of the proposed experimental design impracticable. This left the possibility of using second and third-years, as potential targets.

3 For example, "Work experience" and "Enhancement Week".
The second-years were effectively precluded because they were all involved in residential-experience during the time the school had granted permission for the undertaking of the research. Fortunately, third-year students were found to be unaffected by any foreseeable constraints.

**ALLOCATION OF EXPERIMENTAL GROUPS**

The natural division between all first and third-year pupils into one of three school "houses", (three to each year) provided a convenient dichotomy of each year-group supplying three matched groups.

Because of timetabling and other administrative differences, it was decided to maintain the three groups intact. One of the groups would provide the mnemonic condition, whilst children in the other two groups could be assigned to comparative learning conditions. There is a scientific tradition amongst applied psychologists to compare an experimental learning (strategy) condition with children who are asked to learn in their regular manner. This provides an objective yardstick with which to compare the efficacy or otherwise of the strategy. Children in both years comprising these groups were called "control group", and were uninstructed about how to learn material throughout the experiments.

It is known that higher achievers and older children adopt more sophisticated strategies, whereas less able and younger children tend to rely upon the deliberate repetition of material to facilitate learning, (see pp.61-64 of this study). But rote-learning has been shown to be a more effective learning mediator than a read, or hear-and-learn approach alone, especially with younger children who have, as yet, undeveloped and unstrategic mnemonic capability. Because of its proven facilitative effect on learning, (see rehearsal, pp.64-68
of this study) an instructed rote-learning condition in both year-groups was incorporated into the experimental design.

Having established the nature of the alternative learning conditions, a decision had to be made about how the three school houses in each year-group might be allocated to particular experimental-conditions. Further, it was unclear if each of the three houses was acceptably matched.

Although the school made extensive efforts to balance the three houses accurately for aptitude, this was no guarantee of balanced performance of the three houses on memory and recall tasks.

In a series of six independent experiments, (later referred to as the "matching experiment", experiment 1) tests were made to determine the comparability of the three groups on a short-term memory task. The three groups in each year, were asked to learn information relating to a practical real-world situation. Had there emerged statistically unacceptable intra-year [4] group learning-performance differences, the composition of the various groups would have had to be reviewed. In the event, intra-year differences were found to be acceptable, (see results for Experiment 1).

It was further decided to assign the group with the poorest score in each year-group to the experimental (first-letter mnemonic) condition. This would have the effect of making any advantage of mnemonic instruction more pronounced.

4 Differences between groups in each year.
The composition of the experimental groups was as follows:

CONTROL - (subsequently referred to as "C.-group", "control-group" or "uninstructed-learners").

REPRESENTED BY ONE THIRD OF ALL FIRST AND THIRD-YEAR CHILDREN, RANDOMLY SELECTED.

ROTE - (subsequently referred to as "R.-group", "rote-group" or "rote-learners").

REPRESENTED BY ONE THIRD OF ALL FIRST AND THIRD-YEAR CHILDREN, RANDOMLY SELECTED.

EXPERIMENT - (subsequently referred to as "E.-group", "experiment-group" or "mnemonic group").

REPRESENTED BY ONE THIRD OF ALL FIRST AND THIRD-YEAR CHILDREN, RANDOMLY SELECTED.

PILOT EXPERIMENTS

Although the experimental framework (e.g., experiment v control v rote) provides an established and accepted experimental research structure, the particular format of individual experiments was closely reviewed.

In an effort to obtain a consistent approach throughout the experiments, it was decided:

1) To use real curricular material where applicable
2) To minimise the number of independent variables
3) To adopt an experiment format which was consistent
Because each of the experiments had similar structure but different content, it was decided to focus upon developing a practical and functional experimental design. This was primarily achieved through a full-scale pilot study, using children unrelated to the main study, (second-year children). The pilot reflected the following aspects of the main experiment format:

1) Administrative procedures required to inform and obtain appropriate children
2) Time-of-day
3) Learning procedure, (via audio-tape)
4) Answering procedure, (via audio-tape)
5) Experiment presentation
6) Group size
7) Identity of experimenter

Following the main pilot, various administrative and methodological components were reviewed and modified. Further, prior to each of the experiments, (eight designs in all) a small group of children, (typically twelve) unconnected with the main experiments, participated in individual pilots to ensure:

a) Audio-tape-clarity and continuity
b) The appropriateness of learning and answer-sheets, (and questionnaires where relevant)
c) The timing of both learning and answering aspects of each experiment

Both the main pilot, prior to experiment 1, and subsequent pilots, typically comprised second-year children, (mean between the two target-year-groups).
Because all the main experiments were linked in some way, (e.g., testing the long-term effects of learning methods, using previously learned material with children familiar with that material), the statistical result of each pilot was not particularly relevant. Although all pilot results are available, they are not reported here. A full description of the main pilot, including discussion of results, can be found under the heading of "Pilot for Experiment 1", pp.179-187 of this study.

THE SELECTION OF MATERIALS FOR THE MAIN EXPERIMENTS
Psychologists have repeatedly requested that applied experiments should be as "real" as possible, reflecting as accurately as is practicable the context, circumstances and materials used during regular learning, (e.g., see Richardson, 1980). In a recent review of verbal mnemonics, McLaughlin Cook, (1989) urges that "...laboratory findings" should be "tested more systematically against the needs of real-life learning situations."

Various attempts were made to comply with these requests. Although it could be argued that the experiments should have been conducted by an experimenter unknown to the children, this would have been unrepresentative of real classroom practice. Further, if the main argument against someone familiar administering the experiments is that a "hawthorn-effect" [5] is created, given the format of these experiments, it is difficult to see how the effect can be applied to any one group more than others. A valid criticism that might be applied to this study, is that an experimenter known to the children might generate a hawthorn-effect throughout samples, making a replication of the study difficult.

5 e.g., where an experimenter's intervention stimulates unrepresentative or artificial performance.
In order to achieve empirical research in naturalistic settings, this type of 'sacrifice' has to be accommodated.

Even if inter-school comparisons are invalidated by the procedures adopted here, if the experimental design that has been adopted is considered both a reliable and valid intra-group [6] and inter-group [7] measure and performance indicator, there is still a strong justification for this study.

GENERAL CONSIDERATIONS

In selecting learning material for this study, one of the main aims was to align the experimental learning as closely as possible with subject-material that would normally be covered in each year-group's syllabus. To this end, the syllabus of both first and third-year children was scrutinised with a view to extracting material fulfilling the following requirements:

1) The learning material had to be in the form of a list of items. This is the type of material which typically favours learning using the first-letter mnemonic.

2) Lists between six and nine-item sets or sub-sets were given priority. The writer has found that a nine-item list is the optimum length for learning using first-letter mnemonics.

3) The learning material had to comprise an important constituent of a subject's knowledge-base, e.g., a set of material which, once learned, permitted the child to make more informed and accurate comprehensive judgements, analysis and synthesis relating to the subject-area.

4) Both year-groups should find the learning material unfamiliar.

6 Comparisons made between the experimental groups of this and other studies.
7 Comparisons made between each of the experimental groups comprising this study.
"Artificial" learning-material was deliberately avoided, as this might be a factor contributing to the mnemonic's poor performance in laboratory studies.

Research has repeatedly demonstrated that meaning and the relevance of learning-material plays an important role in successful learning. Using regular, factual curricular material which the children would normally be required to learn, would hopefully provide this opportunity.

The staff-survey completed by staff in secondary schools, (see "Staff survey" in this study, pp.293-325) also suggested that item-lengths within this specific range were typical of the more popular mnemonics. It seemed reasonable to test items of this length rather than material of an arbitrary length.

PILOT STUDIES
Because each experiment in the main study was linked in some way, the statistics associated with individual pilots in isolation, are not relevant, and are therefore unreported.
PILOT FOR EXPERIMENT 1
The sample comprised of forty-two, randomly assigned second-year students; sixteen girls and twenty-six boys (mean age, c. twelve years).

METHOD:
Subjects were unbriefed about the nature of the experiment. Upon arrival, they were seated, as far as practicable, according to examination requirements. Before starting the pre-recorded tape containing the directions, information and questions comprising the experiment, the children were informed that their performance "no matter how good or poor" would not affect their school-career.

Subjects were requested to listen to the tape which would provide them with all the information necessary to proceed with the minimum of further 'live' instruction.

START TAPE:
"In front of you, there is a card. Turn it over now. On the card there is a story, which I am going to read through twice. After I have read the story through twice, you will be asked to answer some questions about the story when you can no longer see the card. When I have finished reading the story, you will have a further two minutes to read the story through quietly to yourself".

FIVE SECOND PAUSE......

(All scoring-items appear in italics)
"On the night of Monday, January 16th, a robbery took place at the Midland Bank in Barton. Earlier in the evening, two men had been seen outside the bank. One was tall and about thirty years old, the other, a smaller man in his early twenties. The tall man was wearing light-coloured, red check trousers and a navy blue overcoat. The smaller man was thought to be wearing a grey raincoat and a yellow hat.

At around 7-20pm, they were seen running from the bank towards a green Ford Cortina. The number of the car is believed to be GMS 629A. The car sped off in the direction of Hecton Road and was later found abandoned at Minster. If you saw anything suspicious yourself, you are asked to contact the local police, phone number: Barton 57883"
"You have been given a sheet of paper, turn it over now. On the sheet there are some questions which I want you to answer. I will read each question through twice and give you an extra ten seconds answering time, after I have finished reading each question. But you can answer the questions whenever you like."
PILOT QUESTIONS:

"Question one,
On what day of the week did the robbery take place?

Question two,
In what month did the robbery take place?

Question three,
On what date did the robbery take place?

Question four,
What was the name of the bank that was robbed?

Question five,
In what town did the robbery take place?

Question six,
About how old was the tall man?

Question seven,
About how old was the smaller man?

Question eight,
What sort of trousers was the tall man wearing?

Question nine,
What colour was the tall man's coat?

Question ten,
What was grey that the smaller man was wearing?

Question eleven,
What colour was the smaller man's hat?

Question twelve,
At around what time were they seen running from the bank?

Question thirteen,
What colour was their getaway car?

Question fourteen,
What particular make was their getaway car?

Question fifteen,
What was the number of their getaway car?

Question sixteen,
The car sped off in the direction of which road?

Question seventeen,
Where was the car found abandoned?

Question eighteen,
What phone number are you asked to ring?"
"PLEASE STOP WRITING NOW".

CHILDREN THANKED 'LIVE'.

EXPERIMENT 1, PILOT RESULTS:

<table>
<thead>
<tr>
<th>GENDER</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>26</td>
<td>452</td>
<td>17.384</td>
<td>4.089</td>
</tr>
<tr>
<td>GIRLS</td>
<td>16</td>
<td>274</td>
<td>17.125</td>
<td>2.778</td>
</tr>
<tr>
<td>ALL</td>
<td>42</td>
<td>726</td>
<td>17.285</td>
<td>2.597</td>
</tr>
</tbody>
</table>

The maximum score possible was 22. Scores were distributed as follows:

<table>
<thead>
<tr>
<th>FULL SAMPLE</th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 @ 22</td>
<td>2 @ 22</td>
<td></td>
</tr>
<tr>
<td>4 @ 21</td>
<td>1 @ 21</td>
<td>3 @ 21</td>
</tr>
<tr>
<td>1 @ 20</td>
<td>1 @ 20</td>
<td></td>
</tr>
<tr>
<td>7 @ 19</td>
<td>4 @ 19</td>
<td>3 @ 19</td>
</tr>
<tr>
<td>9 @ 18</td>
<td>7 @ 18</td>
<td>2 @ 18</td>
</tr>
<tr>
<td>3 @ 17</td>
<td>3 @ 17</td>
<td></td>
</tr>
<tr>
<td>5 @ 16</td>
<td>1 @ 16</td>
<td>4 @ 16</td>
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<td>1 @ 15</td>
<td>1 @ 15</td>
<td></td>
</tr>
<tr>
<td>7 @ 14</td>
<td>5 @ 14</td>
<td>2 @ 14</td>
</tr>
<tr>
<td>3 @ 13</td>
<td>1 @ 13</td>
<td>2 @ 13</td>
</tr>
</tbody>
</table>
GENERAL OBSERVATIONS

NEGATIVE FINDINGS

1) Despite substantial efforts to ensure subjects would arrive at the prescribed venue and time, some arrived ten minutes late, delaying the experiment. Some subjects (who never did arrive!) were sent to the wrong location.

2) Inevitably the pilot overran. This resulted in lesson-start noise outside the experiment room which was unsatisfactory.

3) It was necessary to apologise to some forgiving staff for the inconvenience the overrun might have caused.

4) In view of the somewhat high mean score, resulting in a 'ceiling effect' [8] a second recorded reading of the story was thought unnecessary. (NB. Two readings of the story were incorporated into the pilot in order to accommodate children who might otherwise be penalised on the test due to their poor reading ability).

POSITIVE FINDINGS

1) After the unfortunate late start, the experiment proceeded according to plan.

2) All technical equipment functioned as hoped and the continuity of the pre-recorded tape was appropriate.

3) The mean for groups in each year was high, suggesting that the comprehension of audio-tape content was adequate. Further, subjects were able to respond to audio-tape continuity.

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8 A situation where the overall score is so high, that it fails to discriminate between conditions of learning or performance, e.g., everyone does well.
In addition to the modifications described above, the following changes were also made:

1) Two minutes of silent reading seemed unnecessary as many of the subjects were demonstrating signs of task-completion after the first minute. One minute of silent reading was subsequently allocated in experiment 1.

2) The term "light-coloured" was considered unnecessarily ambiguous and was replaced by "red check".

4) Two types of "coat" are mentioned in the script. This is avoidable. One was replaced by "jacket".

5) The two names "Barton" and "Hecton" are phonetically similar and might be confused. This is avoidable. "Hecton Road" was therefore replaced by "Highway Road".

6) Some children offered one-word answers to those items which required two. This could have been a result of forgetting, but might be because subjects thought that only one response was necessary. In view of this, split answer-lines will be provided for questions fourteen and fifteen.

7) Question 14, asked "What particular make was their getaway car"? It seems reasonable to answer "Ford". For this reason, the split-line answer was coupled with the modified question: "What type of car was their getaway car"? to prompt the required response: "Ford Cortina".

OTHER CHANGES

1) It was necessary to design notification slips to remind staff to send students to the experiment room.

2) At least two other assistants (total three) were required to help assemble the furniture and assist during the experiments. These were later to prove invaluable in chasing up forgetful teachers.

REVISED STORY (Scoring items appear in italics) POSSIBLE SCORE = 22
AMENDED STORY READS

"On the night of Monday, January 16th, a robbery took place at the Midland Bank in Barton. Earlier in the evening, two men had been seen outside the bank. One was tall and about thirty years old, the other, a smaller man in his early twenties. The tall man was wearing red check trousers and a navy blue jacket. The smaller man was thought to be wearing a grey raincoat and a yellow hat.

At around 7-20pm, they were seen running from the bank towards a green Ford Cortina. The number of the car is believed to be GMS 629A. The car sped off in the direction of Highway Road and was later found abandoned at Minster. If you saw anything suspicious yourself, you are asked to contact the local police, phone number: Barton 57883."
AMENDED QUESTIONS

"Question one,
   On what day of the week did the robbery take place?

Question two,
   In what month did the robbery take place?

Question three,
   On what date did the robbery take place?

Question four,
   What was the name of the bank that was robbed?

Question five,
   In what town did the robbery take place?

Question six,
   About how old was the taller man?

Question seven,
   About how old was the smaller man?

Question eight,
   What sort of trousers was the taller man wearing?

Question nine,
   What colour was the taller man's jacket?

Question ten,
   What was grey that the smaller man was wearing?

Question eleven,
   What colour was the smaller man's hat?

Question twelve,
   At around what time were they seen running from the bank?

Question thirteen,
   What colour was their getaway car?

Question fourteen,
   What type of car was their getaway car?

Question fifteen,
   What was the getaway car's registration number?

Question sixteen,
   The car sped off in the direction of which road?

Question seventeen,
   Where was the car found abandoned?

Question eighteen,
   What phone number are you asked to ring?"
PREPARATION FOR MAIN EXPERIMENTS

1) School's senior management consulted about the experiments. Approval received.

2) Registration teachers approached to obtain approval to release children during registration period. Approval received.

3) Experiment dates circulated to registration teachers and other appropriate staff.

4) Tape with experiment content pre-tested in pilot experiment together with experiment materials.

5) Registration teachers reminded to send appropriate subjects to experiment room before registration on the day of each experiment.

6) Reminder-slips placed in registration teachers' registers on the day of each experiment.

7) Three 'runners' available for visiting registration rooms to check appropriate subjects had left for the experiment on time.

8) Seating and experiment material organised in the experiment room prior to the experiment.

EXPERIMENT 1 (matching experiment, target-years: 1 and 3)
Methodology and rationale discussed above.

EXPERIMENT 2 (planets, target-year: 1)

*Material to be mnemonised:* Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.

This material forms part of the first-year Geography syllabus.

Mnemonising this material proved difficult. It was thought that the names of each of the planets might be familiar to the children. If the names were already known, a first-letter mnemonic would provide the appropriate cues for the children to place the names of the planets in the correct order.
Among the options considered was a simple first-letter mnemonic which employed the first letter of each planet-name. This idea was rejected. Whereas such a mnemonic would be easy to construct, if the learning material was to reflect real classroom practice, the Sun would normally appear in any diagrammatic learning material, [9].

Such an inclusion might present problems for the mnemonically instructed sample, as it is known that first-letter cueing is confused when one cue-letter is shared by more than one learning item. A simple first-letter mnemonic would therefore be inappropriate for this material, as both the Sun and Saturn, and Mercury and Mars, share identical first letters. Because of these problems, it was decided to construct an acrostic which would offer the learner at least the first two letters of each word of the learning-material.

It was further thought that a rhyming acrostic might be more effective as the rhyme would help cue the latter part of a somewhat long list of arbitrary or inherently unrelated words, (Machida and Carlson, 1984; also see Bower and Bolton, 1969).

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9 e.g., see the learning sheet for experiment 2, in the "Appendix" of this study.
MNEMONISING PROCEDURE

For brevity, this is reported in some detail here but a fuller
description can be found pp.345-356. Reference will be made to this
procedure in subsequent experiments (where appropriate).

1) An item-bank of words was collected, a set for each letter
being mnemonised.

2) From this, eight words were extracted, one representing the
Sun, the others, a planet each.

3) Given the original brief that the mnemonic should embody at
least the first two letters of each item comprising the
learning material, and form a rhyme, a suitable mnemonic for
Uranus and Pluto could not be identified.

4) The effect of this mnemonic on the learning of children
unconnected with the experiments was encouraging. The writer
had some doubts about the "UR" component of the mnemonic, but
when it was mentioned that this is how one might write the
term in a "love-letter", "UR" was never again a problem.
The term "plunk" was also a concern in that it is known that
meaningful material is generally more readily learned than
material lacking in meaning. It was stressed that "plunk" was
just a "fun" word which rhymed with "junk". The point was
readily accepted by the children.

5) The outcome of this activity was the sentence: "Six Mer-ry
Ve-getables Ea-ting Mars Ju-nk, Satur-day UR Ne-ver
Plu-nk".

The acrostic actually extended beyond the original design-brief, by
cueing three letters of two planets, (Mercury and Pluto) four and five
in the cases of Mars and Saturn respectively.

EXPERIMENT 3 (Design-process, target-year: 3)

Material to be mnemonised: Situation, Brief, Investigation,
Solutions, Best-solution, Model, Working-drawing, Realisation,
Appraisal.

This material forms part of the third-year Technology syllabus.
Much has been written about the effect that the origination or ownership of mnemonic material has on the recall of adults, (e.g., see either "First-letter mnemonics" or "The keyword mnemonic" in this study, pp. 144-157, and 127-135 respectively.

Little is known about origination effects connected with first-letter mnemonics, especially in the classroom context, with child-learners. Interest in how children respond to mnemonising requests has been expressed for some time, (e.g., Rohwer, 1966; Lieury, 1980) with requests that "...future research could attempt to ascertain how much training is needed to construct mnemonics of various types". (McLaughlin Cook, 1989). This study offers no formal evidence addressing the issue of training, but researchers in the field of verbal mnemonics, and especially that of acrostics, might be encouraged by the following information.

BACKGROUND
On numerous occasions, with different learning materials, and groups of different ages, the writer has encouraged groups of children to design their own first-letter mnemonics, to assist specific learning needs. This is a device typical of those used to facilitate the learning of arbitrary facts, names or lists, which need to be learned as part of a subject's knowledge-base.

The acrostic used in this experiment was the response of a third-year C.D.T. group, to the learning of a list of words describing "The design process". This list, provides children with a sequential order of important stages through which designs are conceived, investigated, made and evaluated. The arbitrary nature of this material tended to create natural difficulties for children. Once the meaning of the
words describing the design process had been learned, children often had to be prompted considerably before they could recall even most of the items in the correct order.

*Without* the mnemonic, even the most able candidates were noted to display difficulty in recalling more than three or four of the items at informal immediate re-test. The performance of less able candidates was normally poorer. In all ability-ranges, it was noticed that candidates found it problematic to recall the list in the correct order - this being the *object* of the list.

Two years previously, I asked a group to design a solution to the problem. The group were familiar with the mechanics of how to apply first-letter mnemonics. This was their solution:

"S-tupid Br-ickies Inve-nted So-mee B-ricks M-ade W-ith Re-d A-spirins."

It can be seen that, although the learning material contains two words beginning with the letter "s", the students responded by incorporating a second cue-letter in the fourth mnemonic item, "some". Similarly, the word "brickies" also provides first and second letter cues for the word "brief", thus reducing the possibility of confusing the learning items, "brief" and "best-solution," e.g.,

(s-itution) (br-ief) (inve-stigation) (so-lution) (b-est solution) (m-odel) (w-orking-drawing) (re-alisation) (a-ppraisal).

Despite these problems, in a matter of two minutes or so, the group had learned how to associate the mnemonic with the learning material. Serial recall at immediate (informal) post-test was impressive. All but one of a group of 16 could recall each list item in its correct serial position. On an informal basis, the mnemonic also proved an
effective aid at one and three week intervals, with learning at the three-week stage, showing little deterioration.

Children, in each of the three experimental conditions, had not yet encountered the learning-material during lessons. This presented an opportunity to make the learning phase of this experiment as real as practicable, thereby reflecting the manner in which the material might normally be taught.

The acrostic was also tested in a small-scale pilot using children unassociated with the study. These tests suggested the acrostic was of an appropriate design.

EXPERIMENT 4 (historical periods, target-year: 1)

*Material to be mnemonised:* Tudor, Stuart, Georgian, Regency, Victorian, Edwardian.

This material forms part of the first-year History syllabus.

Using the methods for constructing an acrostic described in experiment 2, a range of acrostics was considered. From a range of possibilities, the chosen mnemonic was:

"T-en S-wans G-et R-ed V-ests E-as y".

The first-years had not yet covered the learning material as part of their history course, which was convenient. All subjects were aware however, that various periods in history were given names such as the Iron-age or the Bronze-age. In this sense, the learning material for experiment 4 had context. Given that it formed a future part of the first-year course, it also had purpose and meaningfulness.
The acrostic was tested using a small-scale pilot, with children unassociated with the study. These tests suggested the acrostic was of an appropriate design.

EXPERIMENT 5 (assessment-scale, target-year: 3)

Material to be mnemonised: Performance, Function,
Value-for-money, Construction, Aesthetics, Safety.

This material forms part of the third-year, Craft, Design and Technology syllabus.

It was decided to use a group-generated acrostic, constructed by a previous year's third-year group, of which E.-group had no knowledge. This particular mnemonic had proved so successful when used informally, that it seemed reasonable to test it under experimental conditions.

The group who collectively designed the mnemonic did so as a response to awkwardness of this particular learning-material which contains arbitrary information which must be remembered in serial-order. Given the problem, it took the group only a minute or so, to design the memorable:

"P-elicans F-ind V-indaloo C-urry A-wfully S-atisfying"

The acrostic was tested using a small-scale pilot, with children unassociated with the study. These tests also suggested the acrostic was of an appropriate design.
EXPERIMENT 6 (delivery company, target-years: 1 and 3)


Unlike other experiments in this study, experiment 6 was not designed to test either immediate or long-term strategy efficiency. Experiments 2,3,4,5 and the 7-series were designed for this purpose. This experiment was designed to discover:

1) The exact learning method used by each child involved in the study.

2) Why children, instructed to adopt a specific strategy, failed to do so.

3) Whether mnemonically instructed children of two age-groups (11.5 mode v 13.5 mode) would be able to spontaneously mnemonise novel learning material. If so, would any differences in ability between the two age-groups be apparent?

To obtain this information, two additional approaches were used: a brief questionnaire which was completed by each child immediately following the recall phase, and selective follow-up interviews with first and third-year E.-groups.

Because experiment 6 was designed to elicit the exact learning method of each child, it was inappropriate to use standard curricular-material. Curricular-material appropriate to one year-group would have been inappropriate to another. It was therefore decided to design learning-material which would have some relevance to children of both age-groups, and similar to that used successfully in the matching-experiment ("Crimewatch" story; experiment 1).

Although the crimewatch material could have been re-worked to provide a more familiar but new scenario, it was decided that a fresh learning task might be both more challenging and more stimulating.
RATIONALE
Common sense suggests that children enjoy taking part in activities which permit them to display a degree of responsibility in their decision-making. (e.g., Doise, 1985) Teachers and parents note evidence of this from an early age, but as children mature, it is typically manifested in role-playing activities, where the child seeks to gain some understanding of life as an adult, (e.g., Grusec and Abramovitch, 1982).

This situation was used in developing the learning material for this experiment.

LEARNING MATERIAL
In six separate experiments, all children were asked to imagine they were drivers for a delivery company. The day’s task was to make deliveries to six places, but to conserve both fuel and time, the deliveries were to be made in a specific order. Just in case the list was lost, it was suggested that the order of the place-names was committed to memory.

Children in the uninstructed control group were asked to learn the place-names in the way they felt best. The rote group were asked to memorise the material through repetition and the mnemonic group were asked to design their own first-letter mnemonic.

Obscure places and those with similar first letters or phonetic similarity were not considered. Attempts were made to ensure the route designed was realistic, and linked the delivery towns and cities together using the shortest/fastest route.
Previous experiments had suggested that six-item list-learning was normally completed in about one-and-a-quarter minutes, [10]. This amount of learning time was again used in this experiment.

The choice of design for the pupil-questionnaire was largely dictated by the time available as it was impracticable to move the experiment to another day or time. Given that experiment 6 was longer than the other experiments, it was considered appropriate to ask children in each of the three experimental conditions a maximum of three questions. Brief as the questionnaire was, it provided essential evidence of each child's learning in each of the conditions. A detailed discussion relating to format and results of the interviews, can be found on pp.266-275 of this study.

The material was tested using a small-scale pilot, with children unassociated with the study. These suggested the material was of an appropriate design.

EXPERIMENTS IN THE 7 SERIES
In the four experiments in this series, the long-term retention of material learned in experiments 2,3,4 and 5 was tested.

It was considered inappropriate to test the children’s retention of both the learning material, (e.g., names) and the material’s serial order, given that in some cases eight weeks had expired between learning and subsequent recall.

It was therefore decided to adopt the policy throughout experiments in the 7-series, of supplying names or terms originally learned, but in a random order.

10 e.g., the majority of children in the uninstructed control group had normally completed the learning task after this period.
This effectively precluded comparisons of long-term word recall between the different learning conditions, whilst emphasising any effects related to serial-order recall. Had children in each condition been required to recall both the names and order of the information learned earlier, recall of the uninstructed and rote conditions would have probably been around the level of "chance", (e.g., see the "results" of experiments in the 7 series).

The range of possible alternatives appeared at the head of each long-term recall answer sheet. The method of organising these was as follows:

1) Items occupying the same serial position as those during original learning were avoided.

2) Adjoining items forming the original learning material were separated wherever possible.

LEARNING BETWEEN INITIAL LEARNING AND LONG-TERM RECALL

The interval separating learning and long-term recall varied between experiments, but not between experimental groups. As test-re-test intervals were consistent, no group benefitted from time as a function of learning.

In an attempt to make learning as real as was practicable, at each encounter between the experimenter and the groups, the material learned on previous occasions was mentioned. Typically, this took a few seconds and was in the following form:
Just before children in each condition were dismissed following an experiment, the experimenter would say: "Do you remember the information you learned the last time we met? The children responded, and information was prompted or corrected as necessary. This activity was designed to reflect the amount of time a teacher might spend in just checking that a concept or list learned during the previous week's lesson was still "alive". Great care was taken to distribute this learning time fairly, so that no condition received a disproportionate amount of time.

A typical example for one of the E.-groups would be: "Do you remember the information you learned the last time (or a named previous time) we met? (Experimenter reinforces response). Do you remember that little silly-sentence I taught you to help you remember this? (Children tended to spontaneously recite the appropriate first-letter mnemonic). Typical time taken, around thirty seconds.

The allocation of answer time for each set of material was distributed as a result of both individual pilot studies and also, the knowledge gleaned from earlier experiments.

THE STAFF SURVEY

It was felt more appropriate to discuss the methodology and rationale of the staff survey along with the items chosen and the results. These can be found in the section called "Staff survey" of this study, pp.293-325.
SUMMARY OF SECTION 6

The precise content of each experiment is examined in turn, followed by an individual analysis of results. The results are displayed in tabular form, and reveal inter-group, intra-group and gender performance differences. Standard statistical terminology has been followed. Graphs relating to the more important results can be found in the section marked "Appendix" of this study.

Two other empirical aspects of this study are also reviewed: The pupil questionnaire undertaken as part of experiment 6, and the interviews designed to elaborate the information gleaned from the questionnaires. For reasons described, only a limited number of subjects from the experiment group were interviewed.
THE EXPERIMENTS:

COPIES OF THE AUDIO-TAPES USED IN EACH OF THE EXPERIMENTS ARE AVAILABLE FROM THE AUTHOR UPON REQUEST. ADDITIONALLY, EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE APPENDIX OF THIS STUDY.

IN THE INTEREST OF BREVITY, DURING THE DISCUSSION OF EMPIRICAL DATA, REFERENCES WILL BE INCLUDED ONLY IN SITUATIONS WHERE SUPPORTING EVIDENCE DOES NOT APPEAR ELSEWHERE IN THIS STUDY.

THE MAIN MEASURE USED TO IDENTIFY SIGNIFICANT RESULTS THROUGHOUT THIS REPORT, IS \( p < 0.05 \).

VARIABLES

The following variables were held constant throughout the experiments:

1) The Experiment-room
2) The content of the learning material
3) The format of the learning material
4) The continuity of the learning material
5) The delivery of the learning material
6) The time-of-day of the experiments
7) The identity of the experimenter

The following abbreviations are used in this section:

\[ v \] = (versus) compared with
\[ p \] = probability
\[ s.d. \] = standard deviation
\[ t \] = t-test
\[ F \] = Fisher F ratio
\[ df \] = degrees of freedom
\[ Yr. \] = year
\[ c. \] = (circa) around
\[ \sim \] relates to the above

Although I realise the most powerful test to adopt would have been a paired t-test, because the identities of the children were masked, it was not possible to pair the data. A two sample paired t-test and a one way analysis of variance have been employed. Graphic representation of the analysis of variance for each experiment may be found in the section marked "Appendix" of this study. Further information relating to the statistical analysis of results may be found in Gravetter and Wallnau, (1985) 'Statistics for the Behavioural Sciences'. West Publishing Company: New York.
EXPERIMENT 1 (matching experiment)

PURPOSE: a) To establish if each of the three first and third-year groups are reliably matched.

b) To discover any significant inter or intra-group gender differences.

c) To discover any significant inter and intra-group performance-differences, especially year 1 v year 3.

d) To establish criteria which would assign the intact groups in each year-group to one of three conditions:

   C.-GROUP, (CONTROL)
   R.-GROUP, (ROTE)
   E.-GROUP, (MNEMONICS).

N.B. Experiment 1 is different from the other experiments in that children are not requested to learn material in any specific way. It is used to obtain an approximate idea of children's short-term recall in each of the six experimental groups, (e.g., three first-year and three third-year groups).

MATERIAL: A "crimewatch"-type story.

Target groups: Year 1, x 3 groups; mean age, 11.5yrs.
              Year 3, x 3 groups; mean age, 13.5yrs.

DELIVERY:

The learning material was delivered by an audio-tape recorder and consisted of a "crimewatch"-type story, in which a fictitious robbery is described. Eighteen questions relating to information contained in the story text were used to establish each group's mean ability on a common learning task.
Following the presentation of the story, further recorded
instructions advise children how to respond to the questions. The
question sheets were situated face-down under childrens' chairs and
answered after a brief interpolated task [1].

Before commencing each experiment in this series, (6 in all)
children were told that their performance either on the day of the
experiment, or during subsequent experiments, would in no way
influence their school career. Further, they were told that they would
not be asked to mark their answer-sheets with their name or
other identification.

METHOD:

On six separate occasions, each group in both year-groups (e.g., year
1, x 3, year 3, x 3) heard an identical pre-recorded audio tape which
contained the following information:

AUDIO-TAPE CONTENT:

"In front of you, there is a card. Turn it over now. On the card
there is a story, which I am going to read through once. After I have
read the story though once, you will be asked to answer some questions
about the story, when you can no longer see the card. When I have
finished reading the story through, you will have a further minute to
read the story through quietly on your own."

1 Distributing of answer-sheets. Time-taken: c. two minutes.
STORY

"On the night of Monday, January 16th, a robbery took place at the Midland Bank in Barton. Earlier in the evening, two men had been seen outside the bank. One was tall and about thirty years old, the other, a smaller man in his early twenties. The tall man was wearing red check trousers and a navy blue jacket. The smaller man was thought to be wearing a grey raincoat and a yellow hat.

At around 7-20pm, they were seen running from the bank towards a green Ford Cortina. The number of the car is believed to be GMS 629A. The car sped off in the direction of Highway road, and was later found abandoned at Minster. If you saw anything suspicious yourself, you are asked to contact the local police, phone number: Barton 57883.

Minute for silent reading (tape running, no commentary)

Siren sounds time-up.

AUDIO TAPE STOPPED: Children instructed to exchange story cards with question sheets, placing story cards face-down at the side of their chairs. (Three supervisors in addition to the experimenter, check that children are following correct procedure).

AUDIO-TAPE RE-STARTED

"You have been given a sheet of paper. Turn it over now. On the sheet, there are some questions which I want you to answer. I will read each question through twice and give you an extra ten seconds answering time after I have finished reading each question, but you can answer the questions whenever you like."
Q1. On what day of the week did the robbery take place?
Q2. In what month did the robbery take place?
Q3. On what date did the robbery take place?
Q4. What was the name of the bank that was robbed?
Q5. In what town did the robbery take place?
Q6. About how old was the taller man?
Q7. About how old was the smaller man?
Q8. What sort of trousers was the taller man wearing?
Q9. What colour was the taller man’s jacket?
Q10. What was grey that the smaller man was wearing?
Q11. What colour was the smaller man’s hat?
Q12. At around what time were they seen running from the bank?
Q13. What colour was their getaway car?
Q14. What type of car was their getaway car?
Q15. What was the getaway car’s registration number?
Q16. The car sped off in the direction of which road?
Q17. Where was the car found abandoned?
Q18. What phone number are you asked to ring?

TOTAL TAPE-TIME = 11 MINUTES, SIXTEEN SECONDS
FIRST AND THIRD YEAR GROUPS COMPARED

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Yr.</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP 1</td>
<td>1</td>
<td>41</td>
<td>569</td>
<td>13.878</td>
<td>3.401</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>40</td>
<td>595</td>
<td>14.875</td>
<td>3.059</td>
</tr>
<tr>
<td>GROUP 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>44</td>
<td>612</td>
<td>13.909</td>
<td>3.381</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>3</td>
<td>42</td>
<td>701</td>
<td>16.682</td>
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</tr>
<tr>
<td>GROUP 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>34</td>
<td>449</td>
<td>13.205</td>
<td>6.137</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>43</td>
<td>631</td>
<td>14.674</td>
<td>2.993</td>
</tr>
</tbody>
</table>

DISCUSSION:

Although the scores of groups 1 and 2 are not significant, at the level of \( p < 0.05 \) (\( t < 1.671 \)), Group 2's intra-group score is highly significant. On a common short-term memory task, the older children in each group performed better than younger children. In one case only however, (e.g., group 2) did this become significant. Intra-group first-year scores fail to reach a level of significance.
FIRST-YEAR GROUPS COMPARED

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
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</thead>
<tbody>
<tr>
<td>GROUP 1</td>
<td>41</td>
<td>569</td>
<td>13.878</td>
<td>3.401</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>44</td>
<td>612</td>
<td>13.909</td>
<td>3.381</td>
</tr>
<tr>
<td>GROUP 3</td>
<td>34</td>
<td>449</td>
<td>13.205</td>
<td>6.137</td>
</tr>
</tbody>
</table>

\[ F = 6.27 / p = 0.003 \]

**t SCORES**

| GROUP 1 v GROUP 2 | 0.042 | --- df | 83 |
| GROUP 2 v GROUP 3 | 0.645 | --- df | 76 |
| GROUP 3 v GROUP 1 | 0.600 | --- df | 73 |

**DISCUSSION**

Assuming a level of statistical significance of \( p < 0.05 \), \((t < 1.671)\) there were no significant differences. On a one way analysis of variance, this result was significant.
**FIRST-YEAR GENDER DIFFERENCES**

<table>
<thead>
<tr>
<th>GROUP 1</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>19</td>
<td>266</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>GIRLS</td>
<td>22</td>
<td>303</td>
<td>13.772</td>
<td>2.778</td>
</tr>
<tr>
<td>$^t$ 0.214</td>
<td>$df$ 39</td>
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<table>
<thead>
<tr>
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<th>MEAN</th>
<th>S.D.</th>
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<td>2.854</td>
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<tr>
<td>GIRLS</td>
<td>22</td>
<td>303</td>
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<td>3.617</td>
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<tr>
<td>$^t$ 1.657</td>
<td>$df$ 40</td>
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<table>
<thead>
<tr>
<th>GROUP 3</th>
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<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>17</td>
<td>226</td>
<td>13.294</td>
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<tr>
<td>GIRLS</td>
<td>17</td>
<td>223</td>
<td>13.117</td>
<td>4.535</td>
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<tr>
<td>$^t$ 0.122</td>
<td>$df$ 32</td>
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</table>

**DISCUSSION OF FIRST-YEAR GENDER-DIFFERENCES**

The results of the first-year matching experiment suggested an acceptable distribution of recall ability between the three intact groups.  
Somewhat unpredictably, [2] boys performed slightly better than girls, but the difference was insignificant and largely attributable to the relatively high boys’ score in R.-group.

---

2 Re: Girls’ earlier maturation and cognitive development, (see Stainthorp, 1989 for discussion).
THIRD YEAR GROUPS COMPARED

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP 1</td>
<td>40</td>
<td>595</td>
<td>14.875</td>
<td>3.059</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>42</td>
<td>701</td>
<td>16.261</td>
<td>3.464</td>
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<tr>
<td>GROUP 3</td>
<td>43</td>
<td>631</td>
<td>14.674</td>
<td>2.993</td>
</tr>
</tbody>
</table>

\[ F \, 3.88 / p \, 0.023 \]

\textit{t} SCORES

GROUP 1 \textit{v} GROUP 2 ..... \( 1.917 \) \textit{df} 80

GROUP 2 \textit{v} GROUP 3 ..... \( 2.262 \) \textit{df} 83

GROUP 3 \textit{v} GROUP 1 ..... \( 0.302 \) \textit{df} 81

DISCUSSION OF THIRD-YEAR RESULTS

Given that considerable effort is made to match the first-year intake for academic ability, it is perhaps surprising that group 2, (later termed rote-group) performed better than the other two groups. The high score of group 2 however, was exclusively attributable to the girls' result, (high mean of 17.523). Using the measure of \( p > 0.05 \) (\( t < 1.671 \)) however, inter-group differences were considered acceptable although data relating to subsequent experiments should be interpreted with this anomaly in mind.
THIRD-YEAR GENDER-DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP 1</th>
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<th>S.D.</th>
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<td>GIRLS</td>
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^t 0.052 ---- df 38

<table>
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<tr>
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<th>MEAN</th>
<th>S.D.</th>
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</thead>
<tbody>
<tr>
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<td>15</td>
<td>3.625</td>
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<tr>
<td>GIRLS</td>
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<td>17.523</td>
<td>2.770</td>
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</table>

^t 2.534 ---- df 40

<table>
<thead>
<tr>
<th>GROUP 3</th>
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<th>MEAN</th>
<th>S.D.</th>
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<td>342</td>
<td>14.25</td>
<td>3.204</td>
</tr>
</tbody>
</table>

^t 1.057 ---- df 41

DISCUSSION:

As noted previously, girls in group 2 (later called R.-group) were responsible for raising group 2's overall score. Inter-group scores are affected by this result and subsequent data should be interpreted with this anomaly in mind.

For scientific purposes, the lowest-scoring group in each year-group was assigned to the experimental condition.
The three groups in each year were subsequently assigned to the following conditions:

GROUP 1 = (C) CONTROL (UNINSTRUCTED LEARNERS)

GROUP 2 = (R) ROTE (INSTRUCTED ROTE-LEARNERS)

GROUP 3 = (E) EXPERIMENT (INSTRUCTED FIRST-LETTER MNEMONIC USERS)

GENERAL DISCUSSION

FIRST YEAR

The range of mean scores of all first-year groups fall between 13.117 (GROUP 3 GIRLS) and 15.45. (GROUP 2 BOYS). When boys' and girls' scores in each group are amalgamated, there are no significant differences at the \( p < 0.05 \) level. An acceptable match of the three intact groups was noted.

THIRD YEAR

As previously noted, group 2's higher score (e.g., mean = 16.261 v Group 1, mean = 14.875 v group 3, mean = 14.674) at \( p < 0.05 \) (\( t < 1.671 \)) resulted in a statistically significant result attributable almost entirely to the girls high score. Given that the scores of groups 1 and 3 were remarkably similar, it was decided to retain the intact character of the groups rather than reorganising the children for a purer match. To do so would lead to a number of administrative problems given the overall sample-size.
EXPERIMENT 2 (planets experiment)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX".

PURPOSE: The short-term aim was to test an experimenter-generated, nine-item, first-letter mnemonic in immediate-recall against rote-instructed and uninstructed learners. The long-term aim was to re-test each group at a two-weeks post-test in order to identify any long-term facilitative effects of the first-letter mnemonic over other learning conditions.

Target Year: 1 (mean age 11.5 yrs)

Target-groups: C.-group (uninstructed)
R.-group (instructed to rote-learn material)
E.-group (instructed to use experimenter-generated first-letter mnemonics).

EACH GROUP TESTED SEPARATELY ON CONSECUTIVE DAYS:
E.-group..... Wednesday 10th May
R.-group..... Thursday 11th May
C.-group..... Friday 12th May

CURRICULAR/SUBJECT AREA: Geography

MATERIAL: The planets comprising the solar-system.

SEQUENTIAL ORDER? Yes

MATERIAL TO BE MNEMONISED: SUN, MERCURY, VENUS, EARTH,
MARS, JUPITER, SATURN, URANUS, NEPTUNE, PLUTO.

SAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP:</td>
<td>17</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>R.-GROUP:</td>
<td>20</td>
<td>22</td>
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</tr>
<tr>
<td>E.-GROUP:</td>
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<td>38</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>55</td>
<td>65</td>
<td>120</td>
</tr>
</tbody>
</table>
CONDITIONS:

Each group hears a common pre-recorded tape which provides information about procedure and also subject-material to be remembered. At the departure-point [1] the learning of each group is manipulated in the following ways:

C.-Group given identical T.O.T., (time-on-task) but merely asked to remember the learning material in the way they felt best. Post-departure-point instructions delivered 'live', faithfully related to prepared script.

R.-group given identical T.O.T. but asked to rehearse (rote-learn) the learning material initially overtly (aloud, with experimenter) and then covertly (silently, alone) for the prescribed learning period.

E.-group given identical T.O.T. but instructed to use an experimenter-generated first-letter mnemonic.

N.B. Although considerable effort was made to match the actual time-on-task for each condition throughout the experiments the mnemonic group unavoidably required a small amount of extra discussion time in order to receive mnemonic instructions.

METHOD:

Children enter experiment room. They are welcomed and reminded that their progress at school will in no way be affected by the results of these experiments. Learning cards are distributed face-down on children's work-boards.

---

1 Place in the experiment where each condition is instructed to operate a different time-matched learning strategy.
"In front of you there is a card. Turn it over now. On the card is a picture of the Sun and the planets which make up our Solar-System [2]. You might have seen this picture before as it is a topic first-years cover in Geography. I want you to look at the order of the planets very carefully for half-a-minute. Try to remember the names of the planets and the order the planets are in".

SIREN SOUNDS WHEN TIME UP.

** DEPARTURE-POINT ** [3]

All post-departure-point scripts are delivered verbally, by the experimenter and are faithfully related to pre-prepared scripts, one for each experimental condition.

C.-GROUP SCRIPT: (Delivery time = 35 seconds)

"You might have found it difficult to remember both the names and order of the planets. There was a lot to remember in quite a short time.

To help you with this problem, I want you to look at the sheet again. This time, I will give you just over one minute more to learn the information. Don’t forget, you have to learn and remember the names of the planets and the order they are in.

START NOW."

CHILDREN STOPPED AFTER PRESCRIBED TIME.

TOTAL T.O.T. (time-on-task) = 1 MINUTE 45 SECONDS
R.-GROUP SCRIPT: (delivery time = 1 minute)

"You might have found it difficult to remember both the names and the
order of the planets. There was a lot to remember in quite a short
time.

One way in which you can improve your chances of being able to
remember this information, is by saying it over and over again in your
mind quietly. I will give you an example of what I mean, but instead
of saying it quietly to myself, as I want you to do, I will say it
aloud."

EXPERIMENTER READS ALOUD TWICE:
"Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus,
Neptune, Pluto."

"Now, I want you to say the order of the planets over and over quietly
to yourself, for the next three-quarters of a minute.

START NOW."

CHILDREN STOPPED AFTER PRESCRIBED TIME.

TOTAL T.O.T. = 1 MINUTE 45 SECONDS
E.-GROUP SCRIPT: (delivery-time = 1 minute, 15 seconds)

"You might have found it difficult to remember the names and order of the planets. Don't worry, I'm going to show you an easy way to remember them.

You have been given a new sheet of paper, turn it over now. On the card, there is a funny sentence. I am going to read it through once, and then I want us all to read it through together aloud twice.

S-ix M-erry V- egetables E-at ing M-ars J-unk;
S-at urday UR N-ever P-lunk”!

N.B. Six (Sun), Mer- ry (Mercury), Ve-getables (Venus), Ea- ting (Earth), Mars (Mars), Ju-nk (Jupiter), Satur-day (Saturn), UR (Uranus), Ne-ver (Neptune), Plu-nk (Pluto).

"One of the first things you will notice about the funny sentence is that it's a rhyme and if you look carefully at the picture below, you will also notice that the first two letters of each word in the rhyme are also the first two letters of a planet.

SIX .......... SUN
MER-RY .......... MER-CURY
VE-GETABLES .... VE-NUS
EA-TING ....... EA-RTH
MARS .......... MARS
JU-NK .......... JU-PITER
SATUR-DAY ...... SATUR-N
UR ............. UR-ANUS
NE-VER .......... NE-PTUNE
PLU-NK .......... PLU-TO
Just remember that U-R is not spelt YOU ARE but how you might write it in a love letter!

Take half a minute to learn the rhyme by saying it *quietly* over and over to yourself.

**START NOW.**

CHILDREN STOPPED AFTER PRESCRIBED TIME.

**TOTAL T.O.T. = 1 MINUTE 45 SECONDS**

IMMEDIATELY FOLLOWING EACH GROUP'S LEARNING ACTIVITY, LEARNING-SHEETS ARE PLACED FACE-DOWN UNDER SUBJECTS' CHAIRS

**AUDIO-TAPE RE-STARTED:**

**QUESTIONS COMMON TO ALL GROUPS:**

"Under your seat there is another sheet. Pick it up now. Don’t write anything on the sheet until you are told. At the top of the sheet is the Sun. There are nine spaces below this, numbered one to nine, one space for each planet. I want you to try to remember the names of all the planets in their correct order. If you can’t, don’t worry, just do your best. I will give you one minute to do this. **START NOW.**

**AUDIO-TAPE STILL RUNNING.....**

SIREN SOUNDS AFTER ONE MINUTE

**AUDIO-TAPE ENDS**

SCRIPTS COLLECTED IN SILENCE

CHILDREN THANKED 'LIVE' FROM THE FLOOR

END.
RESULTS:

For inter-group measures, \( n = 40 \), \( p < 0.05 \) \((t > 1.671)\) is used and for intra-group measures, \( n = 20 \), \( p < 0.05 \) \((t > 1.684)\).

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP</td>
<td>40</td>
<td>284</td>
<td>7.1</td>
<td>2.211</td>
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<tr>
<td>R.-GROUP</td>
<td>42</td>
<td>282</td>
<td>6.714</td>
<td>2.490</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>38</td>
<td>272</td>
<td>7.157</td>
<td>2.134</td>
</tr>
</tbody>
</table>

\( F \) 0.14 / \( p \) 0.869

\( t \) SCORES

CONTROL v ROTE \( ........ \) 0.741 -- \( df \) 80

ROTE V EXPERIMENT \( ....... \) 0.850 -- \( df \) 78

EXPERIMENT V CONTROL \( .. \) 0.116 -- \( df \) 76

DISCUSSION:

On a one way analysis of variance, this result is significant. Given that one of the main concerns about the use of first-letter mnemonics is related to the time it takes subjects to learn and use them in relation to other learning methods, it is interesting to note that E.-group, who were assigned to this condition as the poorest learners, demonstrate slightly superior, but not statistically significant recall on the set learning task. Further, this is achieved in a matched-for-time situation although this result was not significant for the experiment group.

Additionally, it appears that the eleven-year-olds forming E.-group, were able to use the first-letter mnemonic under instruction. This contrasts with some experimental evidence which suggests more elaborate learning strategies (mnemonics) are largely beyond the scope of pre-adolescent learners.

Performance-differences between C (un instructed) and R (rote-learners) groups were not significant, suggesting possibly that the uninstructed learners in C.-group were employing some learning methods as effective as rote-learning.
**GENDER DIFFERENCES**

<table>
<thead>
<tr>
<th>Group</th>
<th>Scripts</th>
<th>Score</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C.-GROUP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>17</td>
<td>129</td>
<td>7.588</td>
<td>2.197</td>
</tr>
<tr>
<td>Girls</td>
<td>23</td>
<td>155</td>
<td>6.739</td>
<td>2.151</td>
</tr>
</tbody>
</table>

^ t 1.223 -- df 38

| **R.-GROUP** | | | | |
| Boys | 20 | 148 | 7.4 | 1.984 |
| Girls | 22 | 134 | 6.090 | 2.478 |

^ t 1.879 -- df 40

| **E.-GROUP** | | | | |
| Boys | 18 | 129 | 7.166 | 1.979 |
| Girls | 20 | 143 | 7.15 | 2.264 |

^ t 0.023 -- df 36

**DISCUSSION:**

Conducive with the "matching-experiment" results, and somewhat contrary to developmental theory, the boys had a slight tendency to out-perform the girls. The result for R.-group was significant. It may be remembered that the boys in R.-group displayed recall superiority over the girls in the initial matching experiment, (experiment 1).
EXPERIMENT 3  (design-process experiment)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX".

PURPOSE: The short-term aim was to test the effectiveness of a group-generated nine-item, first-letter mnemonic in immediate-recall against rote-instructed and uninstructed learners. The long-term aim was to re-test each group at a two-weeks post-test in order to identify any long-term facilitative effects of the first-letter mnemonic over other learning conditions.

Target Year: 3 (mean age 13.5 yrs)

Target-groups: C.-group (uninstructed)

R.-group (told to rote-learn material)

E.-group (told to use a group-generated first-letter mnemonic)

EACH GROUP TESTED SEPARATELY ON CONSECUTIVE DAYS:

E.-group .... Wednesday 17th May
R.-group .... Thursday 18th May
C.-group .... Friday 19th May

CURRICULAR/SUBJECT AREA: Craft, Design & Technology.

MATERIAL: The design Process.

IS SEQUENTIAL ORDER REQUIRED? Yes.

MATERIAL TO BE MNEMONISED: SITUATION, BRIEF, INVESTIGATION, SOLUTIONS, BEST-SOLUTION, MODEL, WORKING-DRAWING, REALISATION, APPRAISAL.
SAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP:</td>
<td>18</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>R.-GROUP:</td>
<td>22</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>E.-GROUP:</td>
<td>19</td>
<td>22</td>
<td>41</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>59</td>
<td>56</td>
<td>115</td>
</tr>
</tbody>
</table>

CONDITIONS:

Each group hear a common pre-recorded tape which provides information about procedure and also subject-material to be remembered. At the departure-point the learning of each group is manipulated in the following ways:

- C.-Group given identical T.O.T., (time-on-task) but merely asked to remember the learning material in the way they felt best. Post-departure-point instructions delivered 'live' but faithfully related to prepared script.

- R.-group given Identical T.O.T. but asked to rehearse (rote-learn) the learning material initially overtly (aloud) and then covertly (silently) for the prescribed learning period.

- E.-group given identical T.O.T. but told to use a group-generated first-letter mnemonic.

METHOD:

Subjects enter experiment room, are welcomed and reminded that their performance in these experiments will in no way affect their school career. Learning cards, pre-distributed face-down upon work boards.
AUDIO-TAPE STARTED.

"In front of you there is a card. Turn it over now. On the card there is some information you may have seen before in one of the design areas. If you haven’t don’t worry, I will explain it to you now. Look at the card and follow it through with me carefully as I explain.

Before products like shoes, cars, clothes and furniture are made, the designer's ideas develop stage-by-stage through what is called the DESIGN PROCESS.

The start of this process is identifying the SITUATION where there is a need for a product. This is followed by the design BRIEF or the problem. Then, research takes place: this is called INVESTIGATION. Next, various SOLUTIONS or ideas are thought out. One will be the BEST SOLUTION.

Now, a MODEL of the newly designed product might be made, followed by a technical or WORKING DRAWING. Next, comes the making of the product: this is called the REALISATION.

Finally, the product is carefully assessed to see if it could have been made better or better designed. The name for this is APPRAISAL.

You won’t be asked today to explain what the words written in capitals mean, but I do want you to remember these words and especially the order they are In.

To make this job easier for you, look at the list below.
The learning card reads:

1) SITUATION
2) BRIEF
3) INVESTIGATION
4) SOLUTIONS
5) BEST-SOLUTION
6) MODEL
7) WORKING-DRAWING
8) REALISATION
9) APPRAISAL

Look at the list very carefully for one minute. Try to remember the names and the order of the names. START NOW."

SIREN SOUNDS WHEN TIME UP

TAPE-TIME TO HERE: 4 MINUTES 45 SECONDS

**DEPARTURE-POINT**

All post-departure-point scripts are delivered verbally by the experimenter, and are faithfully related to pre-prepared scripts, one for each experimental condition.

C.-GROUP SCRIPT  (delivery time = 30 SECONDS)

"You might have found it difficult to remember all the words and the order of the words that you have just been asked to learn. There was a lot to learn in a short amount of time. To help you with this problem, I want you to look at the sheet again. This time, I will give you just under two minutes more time to learn and remember the names of the various stages in the design process and their correct order, in whatever way you feel is best. START NOW." (time one minute, forty-five-seconds)

WHEN TIME IS UP....... 

EXPERIMENTER SAYS: "PLEASE STOP WRITING NOW."

TOTAL LEARNING TIME = 2 MINUTES, 15 SECONDS.
R.-GROUP SCRIPT  (delivery time = 1 minute, 15 seconds)

"You might have found it difficult to remember all the words and the order of the words that you have just been asked to learn. There was a lot to learn in a short amount of time. One way in which you can improve your chances of being able to remember this information, is by saying what you want to remember over and over again, quietly, in your mind. I will give you an example of what I mean."

EXPERIMENTER SAYS ALOUD TWICE:

"SITUATION, BRIEF, INVESTIGATION, SOLUTIONS, BEST-SOLUTION, MODEL, WORKING-DRAWING, REALISATION, APPRAISAL."

"Now, I want you to say the names of the design process over and over to yourself BUT QUIETLY as you have just been shown for the next three-quarters-of-a-minute. START NOW."

WHEN TIME IS UP........

EXPERIMENTER SAYS: "PLEASE STOP WRITING NOW."

TOTAL LEARNING TIME = 2 MINUTES

E.-GROUP SCRIPT  (delivery time = 2 MINUTES)

"You might have found it difficult to remember the correct order of the various stages in the design process. Don’t worry, I am going to show you an easy way of doing this. Under your seat is another sheet, pick it up now."

PAUSE

"On the sheet is a silly-sentence. I am going to read it through once, and then I want us all to read it through together aloud twice."

"STUPID BRICKIES INVENTED SOME BRICKS MADE WITH RED ASPIRINS."

"Now, I want you learn the silly sentence by saying it quietly over and over to yourself. I will give you half a minute to do this."
"Now, look at the list below. You will notice that the first letter of each silly-sentence word is also the first letter of one of the stages in the design process. If you can remember the silly-sentence, you will almost certainly be able to remember the stages of the design process in the correct order.

S-TUPID ....... S-ITUATION
B-RICKIES ..... B-RIEF
I-NVENTED ..... I-NVESTIGATION
S-OME .......... S-OLUTIONS
B-RICKS ....... B-EST SOLUTION
M-ADE .......... M-ODEL
W-ITH .......... W-ORKING-DRAWING
R-ED ........... R-EALISATION
A-SPIRINS ..... A-PPRAISAL

Just remember that there are two S's and the SITUATION is the FIRST stage in the process."

TOTAL LEARNING TIME = 2 MINUTES

QUESTIONS COMMON TO ALL GROUPS:

The instructions which immediately follow, were delivered 'live' to each group.

"Under your chair is another sheet. Only when you are told, exchange your present sheet with the new sheet. Make sure no one can see the print on either sheet as you do this."

ALL GROUPS PROCEEDED THROUGH THE ANSWERING-PHASE, HEARING THE FOLLOWING RECORDING.....
RE-START TAPE

"You have a new sheet of paper. Turn it over now. On the sheet, you will see nine spaces numbered one to nine. Don't write anything yet. Only when I tell you, I want you to write in these spaces the various stages of the DESIGN PROCESS you have just learned in the correct order. If you have difficulty, don't worry, just do your best. I will give you one minute to do this. START NOW."

SIREN SOUNDS WHEN TIME-UP

SCRIPTS COLLECTED IN SILENCE

END.
RESULTS:

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP</td>
<td>32</td>
<td>196</td>
<td>6.125</td>
<td>2.814</td>
</tr>
<tr>
<td>R.-GROUP</td>
<td>42</td>
<td>296</td>
<td>7.047</td>
<td>2.339</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>41</td>
<td>199</td>
<td>4.853</td>
<td>2.278</td>
</tr>
</tbody>
</table>

\[
F = 12.28 \quad / \quad p = 0.000
\]

t SCORES

- CONTROL v ROTE ........ 1.538 -- df 72
- ROTE v EXPERIMENT ..... 4.328 -- df 81
- EXPERIMENT v CONTROL .. 2.135 -- df 71

DISCUSSION:
On an analysis of variance, this result is significant. At level of significance adopted two results are significant, R v E and E v C. The children instructed to use the nine-item first-letter mnemonic appear to have been handicapped by having to remember the learning material and the mnemonic in the time-matched condition. It was hypothesised that one of the following factors might be responsible for this result:

First, because of the additional learning load, first-letter mnemonics do not provide learners with immediate benefits when compared with alternative learning conditions, (e.g., see experiments in the 7 series of this study and also see Cox, 1991).

Second, the mnemonic was too difficult for the children to manipulate in the time allocated.

Third, the mnemonic was too complex or ambiguous for the children to use effectively.

Fourth, children comprising the mnemonic group were unfamiliar with the mnemonising process.

This particular mnemonic was the result of collaborative design by one of my previous C.D.T. groups (introduced to these children for the first time) and proved an immediate, effective aid to recall.

It seems reasonable to assume that there is an important link between ownership and understanding of the mnemonic and its immediate effectiveness. Clearly, the activity of spontaneously designing a first-letter mnemonic engages the children’s cognition in a problem-solving mode. This activity might have an effect similar to the mnemonic itself, by attaching additional meaning to the learning material through semantic relationships.

C v R group’s score was not statistically significant, but does suggest that the uninstructed group were adopting some form of cognitive or mnemonic learning strategy approaching the efficiency of rote rehearsal, (assuming that the rote group were following instructions).
GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
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<tbody>
<tr>
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<td>5.388</td>
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<td>GIRLS</td>
<td>14</td>
<td>99</td>
<td>7.071</td>
<td>2.520</td>
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<tr>
<td></td>
<td>( t )</td>
<td>1.757</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( df )</td>
<td>30</td>
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<th>MEAN</th>
<th>S.D.</th>
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<tbody>
<tr>
<td>BOYS</td>
<td>22</td>
<td>157</td>
<td>7.136</td>
<td>2.201</td>
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<tr>
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<td>139</td>
<td>6.95</td>
<td>2.479</td>
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<tr>
<td></td>
<td>( t )</td>
<td>0.258</td>
<td>—</td>
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<tr>
<td></td>
<td>( df )</td>
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<th>S.D.</th>
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<tr>
<td></td>
<td>( t )</td>
<td>0.168</td>
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<tr>
<td></td>
<td>( df )</td>
<td>39</td>
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</table>

DISCUSSION:

Assuming a level of significance at \( p < 0.05 \)
\( (t > 1.684) \) There is a significant C.-group gender difference. It is hypothesised that this is due to the girls' ability to employ superior cognitive strategies due to maturational factors.
EXPERIMENT 4  (historical periods)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX".

PURPOSE: The short-term aim was to test the effectiveness of an experimenter-generated six-item, first-letter mnemonic in immediate-recall against rote-instructed and uninstructed learners. The long-term aim, was to re-test each group at a two-weeks post-test in order to identify any long-term facilitative effects of the first-letter mnemonic over other learning conditions.

Target Year: 1 (mean age 11.5 yrs)

Target-groups: C.-group (uninstructed)

R.-group (told to rote-learn material)

E.-group (told to use experimenter-generated first-letter mnemonics)

EACH GROUP TESTED SEPARATELY ON CONSECUTIVE DAYS:

C.-group..... Wednesday 7th June
R.-group..... Thursday 8th June
E.-group..... Friday 9th June

CURRICULAR/SUBJECT AREA: History

MATERIAL: The periods of the Modern age.

IS SEQUENTIAL ORDER REQUIRED? Yes.

MATERIAL TO BE MNEMONISED:

TUDOR, STUART, GEORGIAN, REGENCY, VICTORIAN, EDWARDIAN.

SAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP:</td>
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<td>R.-GROUP:</td>
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<td>E.-GROUP:</td>
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</tr>
<tr>
<td>TOTALS:</td>
<td>49</td>
<td>59</td>
<td>118</td>
</tr>
</tbody>
</table>
CONDITIONS:
Each group hear a common pre-recorded tape which provides information about procedure and also subject-material to be remembered. At the departure-point, the learning of each group is manipulated in the following ways:

C.-Group given identical T.O.T., (time-on-task) but merely asked to remember the learning material in the way they felt best. Post-departure-point instructions delivered 'live' but faithfully related to prepared script.

R.-group given identical T.O.T. but asked to rehearse (rote-learn) the learning material initially overtly (aloud) and then covertly (silently) for the prescribed learning period.

E.-group given identical T.O.T. but told to use an experimenter-generated first-letter mnemonic.

METHOD:
Subjects enter experiment room, are welcomed and reminded that their performance in these experiments will in no way affect their school career.

AUDIO-TAPE STARTED......

"In front of you, there is a card. Turn it over now. On the card there is some information which you may have seen before. It is part of the first-year History course. If you haven't, don't worry, I will explain it to you now."
On the card is an historical chart which gives dates and information about historical ages and periods. Look at the chart carefully as I explain it to you now. As you can see, man's history is divided up into four main ages: The Classical Age, The Dark Ages, The Middle Ages and The Modern Age. These four main ages are further divided into various periods; starting with Greek, then Roman, Anglo-Saxon and so on, right up to the Edwardian period.

At the side of these periods are some dates. These tell us at what time in the past each period took place.

What I want you to learn today is the names of the six periods which make up the Modern Age, and the particular order of these periods. I will give you half a minute to learn the names and the order of the periods of the Modern Age. START NOW."

SIREN SOUNDS WHEN TIME UP

TAPE-TIME TO HERE: 2 MINUTES 35 SECONDS

**DEPARTURE-POINT**

All post-departure-point scripts are delivered verbally by the experimenter, and are faithfully related to pre-prepared scripts, one for each experimental condition.

C-GROUP SCRIPT: (delivery time = 35 seconds)

"You might have found it difficult to remember all the names and the order of the names that you have just been asked to learn. There was a lot to learn in a short amount of time.

To help you with this problem, I want you to look at the sheet again. This time, I will give you just under one-and-a-half minutes' extra time to learn and remember the names and the particular order of the periods of the Modern Age in whatever way you feel is best. START NOW."

WHEN TIME IS UP......

EXPERIMENTER SAYS: "PLEASE STOP NOW."
TOTAL LEARNING TIME = 2 MINUTES

R.-GROUP SCRIPT: (delivery time = 1 minute, 15 seconds)

"You might have found it difficult to remember all the names and the order of the names that you have just been asked to learn. There was a lot to learn in a short amount of time.

One way in which you can improve your chances of being able to remember this information, is by saying what you want to remember over and over again quietly, in your mind. I will give you an example of what I mean:

EXPERIMENTER SAYS ALOUD TWICE:

"TUDOR, STUART, GEORGIAN, REGENCY, VICTORIAN, EDWARDIAN."

"Now, I want you to say the names of the periods in the Modern Age over and over to yourself, but QUIETLY as you have just been shown for the next three quarters of a minute. START NOW."

WHEN TIME IS UP......

EXPERIMENTER SAYS: "PLEASE STOP NOW."

TOTAL LEARNING TIME = 2 MINUTES

E.-GROUP SCRIPT: (delivery time = 1 minute, 30 seconds)

"Sometimes we can help ourselves to remember lists. Often, once we can remember the first letter of a word, the word just 'pops' into our minds. You will notice that the first letter of each silly-sentence word is also the first letter of a period in the Modern Age. This silly-sentence; 'Ten Swans Get Red Vests Easy', also helps you to remember the periods in their correct order. I will give you half a minute to learn the silly-sentence by saying it quietly over and over to yourself. START NOW.

WHEN TIME-UP......
"Now, just to check that you know how to use this sentence to help you remember the periods, what does the 'T' in ten help you remember? (wait for response; correct, advise or praise) The 'S' in swans?..etc.

QUESTIONS COMMON TO ALL FIRST-YEAR GROUPS:
TOTAL TAPE TIME: 2 minutes, 16 seconds
ANSWERING TIME: 1 minute, 15 seconds

AUDIO-TAPE RE-STARTED......
"You have been given a new sheet. Turn it over now. Don’t write anything until you are told. On the sheet, there are six spaces; one for each of the periods which make up the Modern Age.

When I tell you, I want you to write down the six periods which you have just learned, which make up the Modern Age. Remember, that it is important to write these periods down in their correct order. If you find this difficult, don’t worry, just do your best. I will give you one-and-a-quarter minutes to do this. START NOW."

AUDIO-TAPE STILL RUNNING......
SIREN SOUNDS AFTER ONE-AND-A-QUARTER MINUTES
"PLEASE STOP WRITING NOW."
AUDIO TAPE ENDS.
SCRIPTS COLLECTED IN SILENCE, CHILDREN THANKED.

END.
RESULTS:

For inter-group (c.40) scores, \( p < 0.05 \) (\( t > 1.671 \)) is used as the measure of significance. For intra-group scores, the measure used is: \( p < 0.05 \) (\( t > 1.684 \)).

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
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<tbody>
<tr>
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<td>119</td>
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<td>37</td>
<td>177</td>
<td>4.783</td>
<td>1.579</td>
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</tbody>
</table>

\( F \ 10.00 / p \ 0.000 \)

\( t \) SCORES

CONTROL v ROTE ........ 1.887 -- df 69
ROTE V EXPERIMENT ..... 1.066 -- df 73
EXPERIMENT V CONTROL .. 2.798 -- df 68

DISCUSSION:

On an analysis of variance, this result is significant. An interesting result is the poor performance of the control group. During the matching experiment, (experiment 1) where all groups were set a learning task without learning instructions, there were no significant differences between the three experimental conditions. The poor showing of the un instructed learners in this experiment suggests that:

a) Children in the instructed rote-learning condition (R.-group) were complying with instructions to rote-learn. Evidence from other research supports the hypothesis that rehearsal is a valuable learning aid. It is also known that spontaneous rehearsal [1] is not engaged by younger and inexperienced learners. Given these facts, it seems reasonable to suggest that at least some members of the un instructed group were failing to adopt more sophisticated learning strategies such as rote learning as an aide-memoire.

b) Although the mnemonic group's score was not significant (\( t \ > 2.660 \)) vis-a-vis the R v E result, the E v C result is significant. It is hypothesised that this suggests E.-group immediately benefitted from using a smaller mnemonic containing only six items, whereas they found the nine-item mnemonic difficult to manipulate in the time available.

c) Eleven-year-olds are able to utilise a provided first-letter mnemonic and produce learning superior to that produced by children with similar recall under time-matched conditions.

[1] Rehearsal engaged intuitively by the child, without prior instruction.
d) Even at the level of immediate recall, acrostics produce learning superior to that achieved in an uninstructed learning condition.

GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
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<tbody>
<tr>
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<tr>
<td>GIRLS</td>
<td>20</td>
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\[ t \text{ } 0.389 \quad -- \quad df \text{ } 31 \]

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<th>S.D.</th>
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<td>GIRLS</td>
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\[ t \text{ } 0.772 \quad -- \quad df \text{ } 36 \]

<table>
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<td>GIRLS</td>
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</tbody>
</table>

\[ t \text{ } 0.187 \quad -- \quad df \text{ } 35 \]

DISCUSSION:

At the \( p < 0.05 \) level of significance, (e.g., \( t \quad 1.684 \)) there were no significant gender differences to report.
EXPERIMENT 5 (assessment-scale experiment)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX".

PURPOSE: The short-term aim was to test the effectiveness of a group-generated six-item, first-letter mnemonic in immediate-recall against rote-instructed and uninstructed learners. The long-term aim, was to re-test each group at a two-weeks post-test in order to identify any long-term facilitative effects of the first-letter mnemonic over other learning conditions.

Target Year: 3 (mean age 13.5 yrs)

Target-groups: C.-group (uninstructed)

R.-group (told to rote-learn material)

E.-group (told to use a student-generated first-letter mnemonics)

EACH GROUP TESTED SEPARATELY ON CONSECUTIVE DAYS:

C.-group..... Wednesday 14th June
R.-group..... Thursday 15th June
E.-group..... Friday 16th June

CURRICULAR/SUBJECT AREA: Craft, Design and Technology.

MATERIAL: A six-point assessment scale.

IS SEQUENTIAL ORDER REQUIRED? Yes.

MATERIAL TO BE MNEMONISED:

PERFORMANCE, FUNCTION, VALUE-FOR-MONEY, CONSTRUCTION, AESTHETICS, SAFETY.

SAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP:</td>
<td>21</td>
<td>18</td>
<td>39</td>
</tr>
<tr>
<td>R.-GROUP:</td>
<td>14</td>
<td>18</td>
<td>32</td>
</tr>
<tr>
<td>E.-GROUP:</td>
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<td>24</td>
<td>42</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>53</td>
<td>60</td>
<td>113</td>
</tr>
</tbody>
</table>
CONDITIONS:
Each group hear a common pre-recorded tape which provides information about procedure and also subject-material to be remembered. At the departure-point the learning material is manipulated in the following ways:

C.-Group given identical T.O.T., (time-on-task) but asked to remember the learning material in the way they felt best. Post-departure-point instructions delivered 'live' but faithfully related to prepared script.

R.-group given identical T.O.T. but asked to rehearse (rote-learn) the learning material initially overtly (aloud) and then covertly (silently) for the prescribed learning period.

E.-group given identical T.O.T. but told to use an experimenter-generated first-letter mnemonic.

METHOD:
Subjects enter experiment room, are welcomed and reminded that their progress at school will in no way be affected by the results of these experiments. Learning-cards are pre-distributed face-down upon work boards.

AUDIO-TAPE STARTED......
"In front of you, there is a card. Turn it over now. On the card, there is some information you may have seen before in one of the design areas. If you haven't, don't worry, I will explain it to you now.

Look at the card and follow it through with me carefully as I explain. After products like shoes, cars, clothes and furniture have been made, companies must assess or check their products for quality. If their products are of poor quality, the public will buy from someone else!
Below, you will see six headings under which products can be assessed. This is called an assessment scale. Some of the words look difficult and complicated, but they are not really. I will explain what they mean.

* PERFORMANCE means; how well a product works or performs during regular use. For example, a car’s engine shouldn’t need repairs for the first few years of its life.

* FUNCTION means; does the product do what the maker claims it should do? For example, if Ford say a car in their Fiesta range should do more than forty miles to the gallon, then it should!

* VALUE-FOR-MONEY means; is the product good value for the money spent?

* CONSTRUCTION means; is the product well constructed and strongly made?

* AESTHETICS, is the designer’s word for appearance or looks.

* SAFETY, is the product safe when in regular use?

"You won’t be asked today what the starred words mean, but I do want you to learn and remember the words that are starred and the particular order of the names. I will give you half a minute to do this. START NOW."

SIREN SOUND WHEN TIME-UP.

LEARNING TIME TO HERE: 2 minutes, 35 seconds
**DEPARTURE-POINT**

All post-departure-point scripts are delivered verbally, by the experimenter, and are faithfully related to pre-prepared scripts, one for each experimental condition.

C.-GROUP SCRIPT: (delivery time = 35 seconds)

"You might have found it difficult to remember all the words and the order of the words that you have just been asked to learn. There was a lot to learn in a short amount of time.

To help you with this problem, I want you to look at the sheet again. This time, I will give you just under two minutes more time, to learn and remember the names and the particular order of the names in the Assessment Scale, in whatever way you feel is best. START NOW."

WHEN TIME IS UP......

EXPERIMENTER SAYS: "PLEASE STOP NOW."

TOTAL LEARNING TIME = 2 MINUTES

R.-GROUP SCRIPT: (delivery time = 1 minute, 15 seconds)

"You might have found it difficult to remember all the words and the order of the words that you have just been asked to learn. There was a lot to learn in a short amount of time.

One way in which you can improve your chances of being able to remember this information, is by saying what you want to remember over and over again, quietly in your mind. I will give you an example of what I mean:

EXPERIMENTER SAYS ALOUD TWICE:

"PERFORMANCE, FUNCTION, VALUE-FOR-MONEY, CONSTRUCTION, AESTHETICS, SAFETY."

Now, I want us all to say these words through together aloud twice:

PERFORMANCE, FUNCTION, VALUE-FOR-MONEY, CONSTRUCTION, AESTHETICS, SAFETY."

"Now, I want you to say the names of the Assessment Scale over and over to yourself but quietly as you have just been shown, for the next three-quarters of a minute. START NOW."

WHEN TIME IS UP......

EXPERIMENTER SAYS: "PLEASE STOP NOW."
TOTAL LEARNING TIME = 2 MINUTES

E.-GROUP SCRIPT: (delivery time: = 1 minute, 30 seconds)
"Turn your new sheets over now. Sometimes, we can help ourselves
remember lists. Often, once we can remember the first letter of a
word, the word just 'pops' into our minds! Look at the silly-sentence
below:

PELICANS FIND VINDALOO CURRY AWFULLY SATISFYING.

You will see that the first letter of each word in the silly-sentence,
is also the first letter of a word in the Assessment Scale.

I will read the sentence through aloud once, then, I want you to
learn it by saying it over and over quietly to yourself for half-a-
minute."

EXPERIMENTER SAYS TWICE:
"Pelicans find vindaloo curry awfully satisfying."

'LIVE' PROMPT: "Now, learn it yourself."

TIME HALF-A-MINUTE
WHEN TIME HAS EXPIRED, EXPERIMENTER SAYS:

"Now, just to check that you know how to use this sentence, what does the 'C' in Curry help you to remember? (wait for response; correct, advise or praise) The 'V' in Vindaloo? ....etc.

Now, let's say the sentence over together a final time just to get it into our minds:

Pelicans Find Vindaloo Curry Awfully Satisfying."

TOTAL LEARNING TIME = 2 MINUTES

QUESTIONS COMMON TO ALL FIRST-YEAR GROUPS:
TOTAL TAPE TIME: 2 minutes, 22 seconds
ANSWERING TIME: 1 minute, 15 seconds

AUDIO-TAPE RE-STARTED......
"You have been given a new sheet. Turn it over now.

Don't write anything until you are told. On the sheet, there are six spaces; one, for each stage of the Assessment Scale you have just learned. Only when I tell you, I want you to write down the six stages in the Assessment Scale in the correct order. If you have difficulty doing this, don't worry, just do your best. I will give you one-and-a-quarter minutes to do this. START NOW."

AUDIO-TAPE STILL RUNNING......

SIREN SOUNDS AFTER ONE-AND-A-QUARTER MINUTES.
"PLEASE STOP WRITING NOW."

AUDIO TAPE ENDS.

SCRIPTS COLLECTED IN SILENCE, CHILDREN THANKED.
END.
RESULTS:

For inter-group (c.40) scores, $p < 0.05$ ($t > 1.671$) is used as the measure of significance. For intra-group scores, the measure used is: $p < 0.05$ ($t > 1.684$).

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<th>SCORE</th>
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<th>S.D.</th>
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</thead>
<tbody>
<tr>
<td>C.-Group</td>
<td>39</td>
<td>185</td>
<td>4.743</td>
<td>1.675</td>
</tr>
<tr>
<td>R.-GROUP</td>
<td>32</td>
<td>164</td>
<td>5.125</td>
<td>1.316</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>42</td>
<td>198</td>
<td>4.714</td>
<td>1.722</td>
</tr>
</tbody>
</table>

$F$ 0.97 / $p$ 0.384

$t$ SCORES

CONTROL v ROTE ....... 1.051 -- df 69

ROTE v EXPERIMENT ..... 1.123 -- df 72

EXPERIMENT v CONTROL .. 0.077 -- df 79

DISCUSSION:

On an analysis of variance, this result is significant. Although results did not reach levels of significance on the $t$-tests, ($t < 1.671$) it is worth noting, that R.-group’s slightly better performance was also reported in the "matching experiment" (experiment 1) discussion.

It is therefore, perhaps not surprising, that this is also reflected in R.-group's score here.

GENDER DIFFERENCES

<table>
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<td>BOYS</td>
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<td>GIRLS</td>
<td>18</td>
<td>93</td>
<td>5.166</td>
<td>1.536</td>
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$t$ 1.503 -- df 37
### Discussion:

Using the measure, \( p < 0.05 \ (t > 1.684) \) R.-group's score was significant. The trend for boys in this group to learn more than the girls also featured in previous experiments.
EXPERIMENT 6  (Delivery company experiment)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX."

EXPERIMENT FORMAT

Experiment 6 comprised of three interrelated components:

1) A learning phase under timed test conditions

2) A questionnaire completed by all subjects identifying each child's specific learning method. (see "pupil questionnaire" pp.258-265)

3) Selected follow-up interviews with both E.-groups designed to extend the range of information obtained from the questionnaires. (see "pupil interviews" pp.266-275)

PURPOSE:

1) To establish how many of the mnemonically-instructed children (e.g., E.-Groups in years one and three) would be able to apply their knowledge of mnemonising to:
   a) A novel situation using factual learning material within a meaningful context,
   b) A novel situation under the pressure of a time constraint.

2) To obtain direct feedback from mnemonically-Instructed children about:
   a) The actual first-letter mnemonic used to remember information (if any).
   b) Alternative learning strategies adopted by mnemonically-instructed children, used in preference to first-letter mnemonics.
   c) Both E.-groups’ rating of first-letter mnemonics as learning aids.
3) To obtain direct feedback from rote-instructed groups related to:
   a) Alternative strategies adopted by the rote-instructed groups (if any).
   b) Their understanding of the usefulness of rote-rehearsal in facilitating recall in this and previous experiments.
   c) Their performance comparative to C. (uninstructed) and E. (first-letter mnemonic instructed) groups.

4) To obtain direct feedback from the uninstructed groups related to:
   a) The methods they spontaneously adopted to learn material throughout this study.
   b) Their performance comparative to R. (Rote-instructed) and E. (first-letter mnemonic-instructed) groups.

5) To assess quantitative differences (if any) in first-letter mnemonic mnemonising ability between first (mean age, 11.5 years) and third year (mean age, 13.5 years) subjects.

6) To assess qualitative mnemonising differences (if any) between first and third-year subjects.

Target Years:

1, (mean age: 11.5 yrs and 3, mean age 13.5 yrs)

Target-groups: C.-group (uninstructed)
   R.-group (instructed to rote-learn material)
   E.-group (instructed to use first-letter mnemonics)
DATES OF TEST AND SAMPLE USED:

FIRST-YEAR SAMPLE

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THIRD-YEAR SAMPLE

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<td>C.-group...</td>
<td>17</td>
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<td>R.-group...</td>
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<tr>
<td>C.-group.....</td>
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<td>21</td>
<td>42</td>
</tr>
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</table>

DESCRIPTION OF EXPERIMENT AND METHOD

Unlike the previous experiments, (e.g., 2 - 5) the learning task in experiment 6, was not designed to differentiate between the quality of learning methods but to enable children in each experimental condition sufficient opportunity to use the instructed learning methods.

The learning phase was immediately followed by a brief questionnaire designed to probe the specific learning-strategies of each child in each experimental condition.

Further, if a different learning-strategy was used by individuals on previous occasions, children had an opportunity to specify the nature of this alternative. For a more detailed account of the choice of approach and materials both for this experiment and the questionnaire, see the section "Research methodology", (pp.166-174).
MATERIAL TO BE RECALLED

For the learning material to be relevant to both of the target year-groups, a practical, albeit hypothetical situation was used. Children were asked to imagine they were drivers for a delivery company, requested to deliver products to a variety of locations in a specific order, thereby economising on both fuel and time. The names and order of the venues are as follows:

Bedford - Luton - Aylesbury - Oxford - Stratford - Rugby

For further discussion see "Choice of materials" in the "Research Methodology" section; pp.166-174.

CONDITIONS:

Both C.-Groups given identical time-on-task as other conditions, but (as on previous occasions) and instructed to remember the names and the order of names of towns in whatever way they felt best.

Both R.-Groups given identical time-on-task as other conditions, but (as on previous occasions) instructed to rote-learn the sequential order of the town names.

Both E.-Groups given identical time-on-task as other conditions but instructed to mnemonise the sequential order of the town names, by applying their knowledge of this process gained during two previous trials.

EXPERIMENT FORMAT

The format of experiment 6 differs from that of previous experiments in that information instructing each group how to proceed with learning names and information were delivered before the learning phase.
METHOD:

Children enter experiment room and are reassured that their performance will in no way affect their school career. They are also told that on this occasion, they will be required to initial their scripts and add the number of their "family" (registration group). They were told that this was to make it easy for the experimenter to follow-up results should this be desired.

The following scripts were delivered 'live' to each group immediately prior to the learning phase. In each case, the learning phase was delivered via an audio-recording. Each script was read verbatim.

C.-GROUP SCRIPT: (delivery time 46 seconds approx.)

"In the past, when I have asked you to remember names or information for me, I have asked you to do this in whatever way you feel is best. You have been asked to remember names or information for me three times now, and you will have probably tried out more than one way of remembering names in their correct order.

In a few moments, once again I am going to ask you to remember some names and information in the correct order. Remember how you have done this in the past and choose whatever you think is the best way to help you do this."

R.-GROUP SCRIPT: (delivery time 46 seconds approx.)

"In the past, when I have asked you to remember names or information for me, I have told you to say what you want to remember over-and-over quietly to yourself. You have been asked to remember names or information for me three times now, and although you might normally use this method to remember things, you might still have found it useful.

In a few moments, once again I am going to ask you to remember some names and information in the correct order. Just learn the information as I have shown you before, by repeating it over-and-over, quietly to yourself."
E.-GROUP SCRIPT: (delivery time 46 seconds approx.)

"In the past, when I have asked you to remember names or information for me, I have given you a silly-sentence to help you. The first letter of each silly-sentence word was the same as the first letter of a name that you had to remember.

Today, I want you to make up a silly-sentence of your own when you are asked to learn some names in their correct order. Keep your silly-sentence very simple. Choose words for your silly-sentence that begin with the same letter as the words you have to remember. You will not have a lot of time, so make one up quickly."

Each group, after hearing the 'live' instructions related to their experiment-condition, heard a common pre-recorded audio tape.

TAPE CONTENT:

"In front of you, there is a card. Turn it over now. On the card is some information which I will read through to you. Follow it through with me carefully.

I want you to imagine that you are a driver for a delivery company. On your first day at work, you have been asked to make six deliveries in the Midlands area. In order to save time and petrol, your company has told you to make your deliveries to various places in a particular order which should also help you to get back without being late.

Here are the names of the places which you have to deliver to in the correct order:

1) BEDFORD
2) LUTON
3) AYLESBURY
4) OXFORD
5) STRATFORD
6) RUGBY
Just in case you lose this list, it might be best to put the place-names and the particular order of them into your memory. I will give you one-and-a-quarter minutes to do this. START NOW.

WHEN TIME-UP SIREN SOUNDS.

THE FOLLOWING INFORMATION IS DELIVERED LIVE:

"Please turn your cards over and put them face-down at the side of your chair."

When task completed:

RE-START TAPE......

"Under your chair is a new sheet. Pick it up now. On the sheet, you will see the names of all the six towns that you have been asked to make deliveries to, but they are not in the right order. Only when I tell you, I want you to write these place names in the six spaces numbered one to six in the order that the deliveries are to be made. I will give you one minute to do this. START NOW."

WHEN TIME-UP, SIREN SOUNDS.

DELIVER LIVE:

"PLEASE STOP WRITING NOW. SCRIPTS COLLECTED BY ASSISTANTS AND QUESTIONNAIRES ISSUED TO EACH SUBJECT."
**DEPARTURE-POINT**

C.-GROUP'S 'LIVE' SCRIPT:

"The last thing I want you to do today, is to answer this very brief questionnaire. Take as long as you need to answer each of the questions. Start with question 1.

Please can you explain to me exactly how you tried to remember the names of the delivery places in the correct order? Question repeated. (when subjects had finished writing)

Now, can we move to question 2? Try to think back to how you remembered names and information for me before. If you used a different way of remembering when you learned things for me before, try to remember what it was."

ALL SUBJECTS THANKED 'LIVE' FROM THE FLOOR

END.

R.-GROUP'S 'LIVE' SCRIPT:

"The last thing I want you to do today, is to answer this very brief questionnaire. Don't worry if you didn't remember things exactly the way I asked you to. It doesn't matter, just answer honestly. Take as long as you need to answer each of the questions. Start with question 1.

Did you say the names of the delivery places over and over again in order to remember them in the correct order or not? (repeat question and wait for subjects to complete)

Now, move on to the next question. If you did not, how did you remember them? (repeat question and wait for children to complete)

Now, move on to question 2. You have been taught to remember names and information twice before by saying what you need to remember quietly over-and-over again in your mind. did you find this: not very helpful, fairly helpful, helpful or very helpful? Just tick which bracket you think is right for you."

ALL SUBJECTS THANKED 'LIVE' FROM THE FLOOR

END.
E.-GROUP’S ‘LIVE’ SCRIPT:

The last thing I want you to do today, is to answer this very brief questionnaire. Don’t worry if you didn’t remember things exactly the way I asked you to. It doesn’t matter, just answer honestly. Take as long as you need to answer each of the questions.

Start with question 1. Did you use a silly-sentence to help you remember the names? Please tick either yes or no (repeat question and wait for subjects to complete). If you did use a silly-sentence, write in the space exactly what it was. (repeat question and wait for subjects to complete).

If you used another way of remembering the names in the correct order, write here briefly what you did. (repeat question and wait for subjects to complete). Now move on to question 2. You have been taught to remember names or information twice before using a silly-sentence to help you. Did you find using a silly-sentence to help you remember, either... Not very helpful, fairly helpful, helpful or very helpful? Just tick whichever you think is right for you.” (repeat question and wait for subjects to complete).

ALL SUBJECTS THANKED LIVE FROM THE FLOOR.

END.
RESULTS:

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Yr. SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>37</td>
<td>201</td>
<td>5.432</td>
</tr>
</tbody>
</table>

C.-GROUPS

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>42</th>
<th>238</th>
<th>5.666</th>
<th>0.890</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>0.960</td>
<td>D.F. 77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R.-GROUPS

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>39</th>
<th>220</th>
<th>5.641</th>
<th>0.999</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>1.411</td>
<td>D.F. 76</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E.-GROUPS

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>34</th>
<th>186</th>
<th>5.470</th>
<th>1.368</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>2.003</td>
<td>D.F. 73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|       | 3           | 41    | 243   | 5.926| 0.462|

DISCUSSION:

As predicted, deliberately imposed 'ceiling effects' produced high scores for subjects in each year and experimental condition. Using the measure of significance previously established, E.-groups' score is significant. It is hypothesised that this result reflects the older children's ability to incorporate newly learned cognitive strategies into their regular learning schemes.
FIRST-YEAR GROUPS COMPARED

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-Group</td>
<td>37</td>
<td>201</td>
<td>5.432</td>
<td>1.263</td>
</tr>
<tr>
<td>R.-GROUP</td>
<td>39</td>
<td>207</td>
<td>5.307</td>
<td>1.089</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>34</td>
<td>186</td>
<td>5.470</td>
<td>1.368</td>
</tr>
</tbody>
</table>

\[F \text{ 2.07} / p \text{ 0.131}\]

\[t \text{ scores}\]

CONTROL v ROTE ....... 0.463 -- D.F. 74
ROTE v EXPERIMENT ..... 0.566 -- D.F. 71
EXPERIMENT v CONTROL .. 0.122 -- D.F. 69

DISCUSSION:
As above.
FIRST-YEAR GENDER-DIFFERENCES

<table>
<thead>
<tr>
<th>C.-GROUP SCRIPTS SCORE MEAN S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS 16 85  5.312  1.529</td>
</tr>
<tr>
<td>GIRLS 21 116  5.523  1.005</td>
</tr>
</tbody>
</table>

^ T 0.506 -- D.F. 35

<table>
<thead>
<tr>
<th>R.-GROUP SCRIPTS SCORE MEAN S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS 16 90  5.625  1.053</td>
</tr>
<tr>
<td>GIRLS 23 117  5.086  1.059</td>
</tr>
</tbody>
</table>

^ T 1.567 -- D.F. 37

<table>
<thead>
<tr>
<th>E.-GROUP SCRIPTS SCORE MEAN S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS 19 105  5.526  0.818</td>
</tr>
<tr>
<td>GIRLS 16 81  5.062  1.784</td>
</tr>
</tbody>
</table>

^ T 1.016 -- D.F. 33

DISCUSSION OF FIRST-YEAR GENDER-DIFFERENCES

Although C.-groups' score failed to show any gender-differences of significance, it is interesting to note a small but significant difference in the scores of R. and E. groups. In both cases, the boys outperform the girls when their strategy options are restricted. This could be interpreted to suggest that predicted maturation effects, favouring girls' learning were removed by specifying which learning-strategies they were to adopt. A different explanation may simply be that the boys found the learning material more meaningful or relevant, resulting in their better performance.
THIRD-YEAR GROUPS COMPARED

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP</td>
<td>42</td>
<td>238</td>
<td>5.666</td>
<td>0.890</td>
</tr>
<tr>
<td>R.-GROUP</td>
<td>39</td>
<td>220</td>
<td>5.641</td>
<td>0.999</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>41</td>
<td>243</td>
<td>5.926</td>
<td>0.462</td>
</tr>
</tbody>
</table>

$F$ \(3.11 / p \ 0.048\)

$t$ SCOR ES

CONTROL v ROTE ....... \(0.119 \) -- D.F. \(79\)

ROTE v EXPERIMENT ..... \(1.651 \) -- D.F. \(78\)

EXPERIMENT v CONTROL .. \(1.664 \) -- D.F. \(81\)

DISCUSSION OF THIRD-YEAR RESULTS

As predicted, deliberately imposed 'ceiling effects' produced high scores for subjects in each year and experimental condition.
THIRD-YEAR GENDER-DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>21</td>
<td>119</td>
<td>5.666</td>
<td>0.942</td>
</tr>
<tr>
<td>GIRLS</td>
<td>21</td>
<td>119</td>
<td>5.666</td>
<td>0.835</td>
</tr>
</tbody>
</table>

\[ T = 0.000 \text{ -- D.F. 40} \]

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>18</td>
<td>100</td>
<td>5.555</td>
<td>1.065</td>
</tr>
<tr>
<td>GIRLS</td>
<td>21</td>
<td>120</td>
<td>5.714</td>
<td>0.933</td>
</tr>
</tbody>
</table>

\[ T = 0.497 \text{ -- D.F. 37} \]

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>17</td>
<td>99</td>
<td>5.823</td>
<td>0.705</td>
</tr>
<tr>
<td>GIRLS</td>
<td>24</td>
<td>144</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ T = 1.237 \text{ -- D.F. 39} \]

DISCUSSION OF THIRD-YEAR GENDER-DIFFERENCES

As with the first-year C.-group results, gender scores are remarkably similar and are not statistically significant. Unlike first-year scores however, third-year R. and E. groups fail to show performance differences favouring the boys. In fact, the converse is true, but the scores were not statistically significant. The older children seem less affected by the prescription of the strategy to use. Whereas the manipulation of learning material using strategies, benefited the younger boys more than the younger girls, maturation effects at the older age had levelled off. Conversely, the result could suggest that the older girls found the learning task more relevant or realistic than the younger sample.
PUPIL QUESTIONNAIRE

Although inter-group [1] performances were assessed at immediate re-test following each experiment, (e.g., expts: 1, 2, 3, 4 and 5) and at long-term re-test, during the 7-series, (e.g., expts: 7a, 7b, 7c and 7d) certain features of intra-group [2] recall remained unexamined. Whilst the test performances, provided comparative information relating to the three learning-conditions, (e.g., un instructed, rote and mnemonic) these failed to provide more specific evidence indicating:

a) The precise learning-methods both un instructed groups were adopting.

b) Whether groups in instructed conditions (e.g., rote and mnemonic) were following instructions to adopt the specifically requested learning-strategy.

c) That previously instructed first-letter mnemonic users could construct their own mnemonics after training.

Immediately following the "delivery company" experiment, (e.g., experiment 6, 6 separate experiments) all children were asked to complete a brief questionnaire. On this occasion, by agreement with all children, it was decided to break the previous convention of anonymity, by coding each child's answer-sheet and questionnaire. The questionnaires were designed to elicit the following information:

C.-GROUP  (un instructed learners)

1) The exact method each child used to learn the place names.

2) The method/s used by each child on previous learning occasions, if different from 1.

1 Performance differences between experimental conditions.
2 Performance differences between children within a specific experimental group.
R.-GROUP  (instructed rote-learners)

1) Whether rote-instructed children adhered to their instructions.
2) Any alternative methods used other than rote-learning.
3) A user-rating for the rote-method (four-point scale).

E.-GROUP  (instructed to construct and apply a first-letter mnemonic)

1) The precise form of the first-letter mnemonic constructed.
2) The precise learning-method employed if it was other than a first-letter mnemonic.
3) A user-rating for first-letter mnemonics (four-point scale).
RESULTS:

C.-GROUP, YEAR 1 (UNINSTRUCTED LEARNERS)

The various learning-methods employed by the children fell roughly into one of the five categories listed below. For convenience, percentage totals are taken to one decimal place. The results were as follows:

key: b = boys  
g = girls  
n = total sample

<table>
<thead>
<tr>
<th>Method</th>
<th>b</th>
<th>g</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehearsal</td>
<td>7</td>
<td>9</td>
<td>16</td>
<td>43.2</td>
</tr>
<tr>
<td>Using first-letters as cues</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>29.7</td>
</tr>
<tr>
<td>&quot;Picturing&quot; or mental imaging</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>10.8</td>
</tr>
<tr>
<td>Grouping strategy</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>10.8</td>
</tr>
<tr>
<td>A more formal type of mnemonic</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>5.4</td>
</tr>
<tr>
<td>---------------------------------------</td>
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<td>---</td>
<td>---</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>21</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION:

As expected, the younger uninstructed learners (mode 11.5 years) favoured rehearsal as the principal means of learning. There were no significant gender-differences.

The second most popular list-learning-method was to use first-letter cueing. This result is interesting as it demonstrates two important points:

First, at least some eleven-year-olds realise the necessity and value of engaging a more reliable form of learning-strategy than rehearsal alone.

Second, eleven-year-olds' are able to make an appropriate response to this particular type of learning situation.

Developmentalists have argued that the more complex mnemonic forms (e.g., interactive imaging or first-letter mnemonics) emerge as spontaneous responses to learning only in older children and adults. Observations related to this experiment however, tend to support the metacognitive approach, where the child's repertory of learning-strategies is seen to be incrementally acquired and only loosely linked to children's maturation.

Although there are gender-differences in favour of the girls, the main sample-size prevents the inference of either reliable or valid generalisations, although it is consistent with developmental views of gender-cognitive maturation, identifying the earlier maturation of girls.
C.-GROUP YEAR 3 (UNINSTRUCTED LEARNERS)

key: b = boys
g = girls
n = total sample

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>g</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehearsal</td>
<td>9</td>
<td>11</td>
<td>20</td>
<td>47.6</td>
</tr>
<tr>
<td>Using first letters as cues</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>19.0</td>
</tr>
<tr>
<td>&quot;Picturing&quot; or mental imaging</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>7.1</td>
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<tr>
<td>Grouping strategy</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7.1</td>
</tr>
<tr>
<td>A more formal type of mnemonic</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>19.0</td>
</tr>
<tr>
<td>------------------------------</td>
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<td>----</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>21</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION:

Again, when requested to learn items of arbitrary information, the dominant learning-strategy adopted by the older uninstructed group was rehearsal.

As in the case of the younger uninstructed learners, gender-differences were not significant, but of particular interest, is the relationship between age-differences and the choice of more complex mnemonic forms other than the popular first-letter cueing used by the younger children.

Again, the size of the sample prevents statistical generalisations to be made, but what is worthy of note, is the relationship between more sophisticated learning-strategies [3] and gender. Given a matched sample, the boys were three times as likely to engage more formal learning-strategies (some type of mnemonic) than the girls. This result is difficult to explain and contrary to normal predictions of the relationship between gender-cognitive development and strategy deployment which would favour the performance of girls. This discrepancy might be a useful subject of subsequent research.

---

3 eg., acronyms, acrostics, etc.
THE RESPONSE OF THE MNEMONIC GROUPS

It was hypothesised that a number of the children in both of the mnemonic-instructed groups would, for some reason, fail to mnemonise the material as requested. The questionnaire for E.-group, was therefore designed to discover the exact mnemonic constructed by mnemonic-users in this particular experiment and, additionally, the learning-methods used by non-mnemonisers. The responses of non-mnemonisers, fell broadly into one of three categories:

Rote-repetition, (rehearsal)
First-letter cueing and
"picturing" or imaging the learning material.

It will be recalled that the working definition for the term "mnemonics" in this paper is a broad one, but it seems appropriate to distinguish between alternative learning-methods for both the younger and older E.-groups, in order to discover any effects mnemonic instruction might have had in influencing learning-methods.

In addition, both mnemonic-instructed groups were also asked to rate the efficacy of first-letter mnemonics as an aid to learning. This exercise was completed by asking the children to choose from a four-point scale. This avoided "average" responses often associated with surveys including mid-point responses.

STRATEGIES USED:

E.-GROUP, YEAR 1 (INSTRUCTED TO USE A SELF-GENERATED FIRST-LETTER MNEMONIC)

key: b = boys
g = girls
n = total sample

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>g</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRST-LETTER MNEMONIC OR OTHER</td>
<td>10</td>
<td>8</td>
<td>18</td>
<td>51.4</td>
</tr>
<tr>
<td>Rehearsal</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>22.8</td>
</tr>
<tr>
<td>Using first letters as cues</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>20.0</td>
</tr>
<tr>
<td>&quot;Picturing&quot; or mental imaging</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>5.7</td>
</tr>
</tbody>
</table>

19 16 35

Below, figures in the "b" and "g" columns, are percentages of their respective gender totals, whereas percentages in the "total sample" column are combined "b" and "g" totals representing an overall percentage. For convenience, percentage totals are taken to one decimal place.
SURVEY

Question: Have you found silly-sentences........

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>g</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT VERY HELPFUL</td>
<td>5.2</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>FAIRLY HELPFUL</td>
<td>15.7</td>
<td>25.0</td>
<td>20.0</td>
</tr>
<tr>
<td>HELPFUL</td>
<td>63.1</td>
<td>31.2</td>
<td>48.5</td>
</tr>
<tr>
<td>VERY HELPFUL</td>
<td>15.7</td>
<td>43.7</td>
<td>28.5</td>
</tr>
</tbody>
</table>

DISCUSSION:

Taken together, these results demonstrate two important findings which, to the writer's knowledge, have not been demonstrated elsewhere.

First, after limited instruction on how to mnemonise arbitrary material in the form of lists, over 50% of the younger mnemonic group, (n = 35, containing children with an age of mode 11.5 years) were able to mnemonise the learning-material.

Second, they were able to mnemonise the learning-material within a prescribed learning-time. The time allowed for mnemonising, would not be considered incompatible with the amount of time that teachers might offer their classes to learn similar curricular-information. These findings have important implications which will be discussed later, [4].

There was a third important finding:

Those children who either failed or were unable to mnemonise the learning-material, were more likely to employ another strategy such as first-letter cueing or imaging instead of rehearsal. The difference is not of intra-group significance, but is dissimilar to the uninstructed group's strategy-response and may well be the result of a the mnemonic-group's more mnemonically 'educated' metacognition. Certainly the initial matching trials did not suggest that E.-group were more able learners - in fact the contrary!

The survey also produced important information. Over 70% of the younger mnemonic group found first-letter mnemonic instruction either helpful or very helpful. This tends to suggest that they found mnemonic instruction a useful addition to their normal learning skills. In retrospect, it would have been useful to know if these and the children in other groups were previously aware of how to design and apply acrostics. This point was subsequently followed up during a series of selected interviews with members of both mnemonic groups.

4 Under the heading of "Conclusions and discussion", pp.327-330
E.-GROUP, YEAR 3

(INSTRUCTED TO USE A SELF-GENERATED FIRST-LETTER MNEMONIC)

key: b = boys
g = girls
n = total sample

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>g</th>
<th>n</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>FIRST-LETTER MNEMONIC OR OTHER</td>
<td>7</td>
<td>7</td>
<td>14</td>
<td>34.1</td>
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<tr>
<td>Rehearsal</td>
<td>5</td>
<td>9</td>
<td>14</td>
<td>34.1</td>
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<tr>
<td>Using first-letters as cues</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>26.8</td>
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<tr>
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<td>1</td>
<td>2</td>
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<tr>
<td></td>
<td>17</td>
<td>24</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

The mnemonic-group were also asked to rate the utility of first-letter mnemonics on a four-point scale. The results are given as percentage for each gender except in the "total sample" column, where the totals of both genders are combined.

SURVEY

Question: Have you found silly sentences........

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>g</th>
<th>all</th>
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</thead>
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<tr>
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<td>9.7</td>
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<td>VERY HELPFUL</td>
<td>0</td>
<td>20.8</td>
<td>12.1</td>
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DISCUSSION:

The third-year findings are far less conclusive. Although around one third of the total sample, (n = 41) successfully mnemonised the learning-material as requested, an identical number adopted rehearsal to learn the material, (14 v 14).

The number employing first-letter cueing, a more sophisticated strategy than rehearsal, was just under one third, and as expected, slightly higher than the younger group. Accounting for these strategy-
differences between the younger and older children was investigated through the use of structured interviews with representative samples.

Although the results of this discussion are given elsewhere, [5] it appears that the older mnemonic-group seem less reliant upon the use of provided learning-strategies, and have both the ability and the knowledge to engage and apply their own task-appropriate learning-methods, relevant to learning requirements.

Although it might be concluded that this response to learning-demands was somewhat naive, (given the general highly significant results in favour of mnemonics provided by this study) the fact that the younger mnemonic-group adhered to mnemonic-instructions and the older group often considered alternative strategies, suggests that the older children had considerably more autonomy and discretion relating to the choice and intuitive application of learning-strategies.

R.-GROUP YEAR 1 (INSTRUCTED TO ROTE-LEARN)

DISCUSSION:

Asked if they adopted rehearsal as a learning-strategy, all of the younger rote-instructed group said they had adhered to instructions to rote-learn the material as requested.

This group were also asked to identify (from a four-point scale) whether instructions to rote-rehearse had assisted their learning. In retrospect, this instruction was ambiguous and might have been misinterpreted by the children. These details are available, but will not be discussed.

R.-GROUP YEAR 3 (INSTRUCTED TO ROTE-LEARN)

DISCUSSION:

All except two (one boy and one girl) of the older rote-instructed group conformed to using the learning-strategy requested, (n = 39). For similar reasons as those given above, the responses to the four-point scale will not be reviewed.

---

5 Under the heading of "Pupil questionnaire", pp.258-265
INTERVIEWS

These interviews were designed to extend the information obtained from the questionnaires related to experiment 6, (delivery company experiment) and additionally, obtain more complete information about both mnemonic groups' attitudes towards the efficacy of first-letter mnemonics.

To achieve a balanced sample, children in both of the mnemonic groups were randomly assigned to one of two groups:

1) Mnemonic instructed non-users (N)

2) Mnemonic instructed users (U)

The purpose of these interviews was primarily to establish:

a) How difficult the children rated constructing a first-letter mnemonic.

b) Why children instructed in the use of first-letter mnemonics, failed to construct and apply a mnemonic to aid the learning of novel material.

c) How long it took mnemonically-instructed users to construct and apply their own first-letter mnemonic.

In an ideal situation, it would have been valuable to interview all the children from each experimental condition (c.300), but given the limited resources of the experimenter and the fact that this aspect of the study was forced to be completed near the end of the summer term, it was necessary to make the interviews more selective.

Interviewing a very small group of children representing each condition, in each year-group (e.g., c.6), was considered and rejected. Although this approach would have provided a rich source of information relating to the learning strategies of specific children, it was thought that a very small sample would seriously restrict the possibility of meaningful generalisations being made.

The final decision was to focus attention on both the experimental groups in years 1 and 3. This approach would offer a more representative insight into the actual mnemonic procedure adopted by all children instructed how to use first-letter mnemonics, information which is at present unavailable.
METHODOLOGY

Three types of interview were considered:

Unstructured [1], semi-structured [2] and structured.

The chosen methodology was a structured approach. This method was a compromise between informal and formal approaches, and was adopted for the following reasons:

a) It would provide a clear direction to each interview and be less intimidating to the less articulate children.

b) It would obtain the maximum amount of information relating to specific questions in the shortest amount of time.

c) The information obtained from structured interviews is more readily coded and disseminated.

Although the interviews for each target-group were related to key questions, there was freedom for either the investigator or the child, to pursue other details of mutual interest.

The key questions for first-letter mnemonic users in both year-groups were:

1) How long did it take you to think of the silly-sentence?

2) Did you find it difficult to think of a silly-sentence?

A question relating to the child’s questionnaire-rating of first-letter mnemonics:

3) Could you make up and use a silly-sentence on your own now, without being shown how?

The key questions for the mnemonic-instructed non-users in each year-group were:

1) Please can you tell me why you weren’t able to use a silly sentence to help you learn the place names?

A question relating to the child’s questionnaire-rating of first-letter mnemonics.

2) If a teacher asks you to remember a list of names or words during a lesson, how do you normally go about it?

Twenty-four candidates were originally selected, twelve from each year-group, six mnemonic-instructed non-users and six mnemonic-instructed users respectively. Of those originally chosen for

---

1 Where interviewees control the direction of discussion interchangeably with the investigator.
2 Where only a rough framework of questions is provided.
interview, absence and unavailability of some third-years forced a minor modification to the intended sample, (see below).

IDENTIFICATION

To facilitate identification, each of the children interviewed has been given a code. This immediately follows the child's initial.

For example, "B1U3", represents the initial of a child (B) in a first-year group (1) who used a self-constructed first-letter mnemonic, (U-ser) to learn the delivery company (experiment 6) place names, referenced as child number 3.

"M3N1" represents the initial of a child (M) in a third-year group, (3) who has for some reason, failed to employ a first-letter mnemonic as instructed, (N-on user) referenced as child number 1.
SAMPLE

FIRST-YEAR  \( n = 12 \)

USERS

CODE

K1U1
L1U2
B1U3
J1U4
C1U5
M1U6

NON-USERS

R1N1
C1N2
M1N3
W1N4
M1N5
N1N6

THIRD-YEAR  \( n = 12 \)

USERS

CODE

T3U1
M3U2
F3U3
N3U4
J3U5

NON-USERS

M3N1
D3N2
A3N3
T3N4
C3N5
R3N6
S3N7

In the interests of brevity four interviews are reported here, one mnemonic-user and one who did not use a mnemonic in each year-group. The other transcripts may be found in the section of this study marked "Appendix".
FOUR INTERVIEW RESPONSES

B1U3

Q.: B., (referring to original script) when I asked you to remember these place names, you made up the silly sentence; "Breakfast Loonies Ask Orrible Stupid Riddles." I gave you a minute-and-a-quarter to make up this silly sentence. Do you remember whether it took you a long while to make up? Were you struggling for time?

A.: Well, I thought of Bedford; I used to live near there, and I thought of breakfast things. Then I thought of breakfast lollipops. Then I thought that wouldn't go very nice! So I said, Breakfast Loonies etc., and it took me about a minute.

Q.: So you needed the full time to actually do it?

A.: Well, round about, yes.

Q.: You put down here (referring to original script) you found the silly sentences "helpful" in helping you to remember things. Can you explain why?

A.: Well, I found them a bit helpful, I could remember Bedford, Luton and Aylesbury, but then I had to go to the riddle.

Q.: So what did the riddle or silly-sentence do? Did it help put the words in the right order?

A.: Yes, it helped me put them in the right order as well, as I could remember the first three.

Q.: Do you use silly sentences or might you use silly-sentences at all to help you remember other things at school?

A.: No.

Q.: Do you think they would be useful in examinations, to help you remember things in the right order?

A.: Yes, probably, if I had to remember something like the order of the numbers on it or something; it would help me there.
M1N3

Q.: M., a little while ago, (referring to original script) I asked you to remember some place names in the correct order, and to help you do that, I said you could make up a silly-sentence of your own in the same sort of way I had shown you in the past. When I gave you the chance to make up a silly-sentence of your own, you didn't in fact do it. That doesn't matter, but can you explain why you didn't?

A.: Because I could remember it in my mind.

Q.: You answered the first three letters of the words "stuck in my mind". What do you mean?

A.: From the letters, the words stayed in my mind.

Q.: You said that you found the silly-sentences I'd given you in the past "helpful". Can you just develop that a little bit further?

A.: It could help you remember the letters of what the words might be.

Q.: If you were asked to remember names, facts, information or a list of something for a subject in school, say, before we did this sort of thing, how would you normally do it?

A.: Read through it and try and remember what it is; cover the sheet by putting my hand over it.

Q.: Who taught you to do this?

A.: My sister.
T3U1

Q.: T., (referring to original script) a little while ago, I asked you to remember some place names, and asked you to imagine that you were working for a delivery company. You were to make up a silly-sentence of your own to help you remember the place names in the correct order. You made up quite a nice one; "Big Lilly And Olive Started Running". I gave you a minute and a quarter to do this. About how long within that time did it take you?

A.: About half a minute.

Q.: Did you find it difficult to make up a silly-sentence or did it come fairly easily?

A.: It came easy.

Q.: When you were asked (referring to the questionnaire) whether you found the silly-sentences in the past very helpful, helpful, fairly helpful or not very helpful, you answered "helpful". Can you explain what you mean by this please - Why did you find them helpful?

A.: Because the first letters, you can just put them down and you can remember the rest of the words from them.

Q.: So you put down the first letters and then you could remember the rest of the words from the silly-sentence first letters?

A.: Yes.

Q.: If a teacher in school asked you to remember a list of things or some names in a certain order, how would you go about doing this, T.?

A.: Just put the first letters down of whatever you want to remember and then you can remember the rest of the words from it.

Q.: But you wouldn't make up a silly-sentence?

A.: I don't know. It depends.

Q.: If you wanted to make up a silly-sentence to remember some information or a list, would you now know how to do it? Would you be able to go about it fairly easily?

A.: Yes.

Q.: Do you think you might be able to make up a silly-sentence to help you with examination work?

A.: Yes.
Q.: M., (referring directly to original script) on your sheet, you said you didn’t use a silly sentence. Can you tell me why that is, please?

A.: At the time, I couldn’t think of one. I thought it would be easier to look at the letters.

Q.: So, you needed more time to actually work one (first-letter mnemonic) out?

A.: Yes, I couldn’t think of one.

Q.: Do you remember getting any of the words for a silly-sentence, or couldn’t you get any at all?

A.: Well, I thought of something for 'B' but I couldn’t get it following on to 'L'.

Q.: You answered you found silly-sentences "fairly helpful"?

A.: It’s easier for me to look at the letters; it’s easier than remembering the sentence. Sometimes it’s helpful, if you’ve already got one, but it’s harder to think of one.

Q.: So, if a teacher gave you one, you think you’d be okay?

A.: Yes.

Q.: How do you remember lists normally? Do you have a particular way of remembering lists?

A.: I just go over it (the lists) in my mind.
RESULTS

Interesting as these responses are, they are to be interpreted with caution for the following reasons:

1) The sample size is small. It is therefore inappropriate to use these particular results for any more than a guide for hypotheses. The responses are therefore discussed in broad terms and no specific recommendations are made.

2) Because the interviewer was known to the children there is a probability that the answers the children have given are distorted by their own involvement. Clearly this can increase suggestibility, but valid arguments for a familiar interviewer might include a more relaxed atmosphere and less feeling of intimidation.

3) Discussed in the section on "metacognition" in this study, are some of the problems children experience when asked to introspect their own memory activities. It would be prudent to interpret the children's responses in the light of the natural difficulties children may have in expressing what is essentially abstract terminology.

**Mnemonic instructed users:**

The older children had a tendency to make up a mnemonic with more ease and speed, (e.g., 3U1; 3U3; 3U4). Children from both groups said they would be able to construct a mnemonic themselves in future but few gave the impression that this would be their preferred response to list or fact learning, (e.g., 1U2; 1U3; 1U5) although some referred to first-letter cueing, (e.g., 1U5; 3U1) and rehearsal, (e.g., 3U2; 3U3; 3U4). Perhaps not surprisingly, the mnemonic users responded favourably towards the use of first-letter mnemonics, both in the questionnaire and the interview. Again, perhaps not surprisingly, more able children were predominantly represented amongst the mnemonic users. This is conducive with evidence in the literature which suggests a positive relationship between cognitive maturation and strategy-acquisition.
Mnemonic-instructed non-users:

The main reasons offered for not using a self-generated mnemonic fell into two broad categories:

a) Insufficient time for mnemonic construction, (e.g., 1N1; 1N2; 1N4; 1N5; 1N6; 3N1; 3N2);

b) Adoption of a more preferred learning method, (e.g., 1N3; 3N3; 3N4; 3N5; 3N6; 3N7).

The predominance of younger children represented in category 'a' above, again reflects the important relationship between maturation and strategy acquisition. The older children who reported not using a mnemonic were far more likely to do so as a result of adopting a different form of learning-strategy. Perhaps not surprisingly, mnemonic-instructed non-users had a tendency to respond negatively towards mnemonics in both the questionnaires and also these interviews. Asked why this was, typical responses were: "I got muddled up by them", (1N1; 1N5; 1N6; ) or, "I'd forget them", (1N2; 3N7).

Asked how they would go about remembering a list of names that a teacher had asked them to learn, most reported rehearsal as their favoured choice, (e.g., 1N1; 1N2; 1N5; 3N3; 3N4; 3N5; 3N6 and 3N7) although a few mentioned first-letter cueing, (e.g., 1N4; 1N6; 3N1; 3N2). This contrasts with most mnemonic users in both year-groups, who favoured more complex strategies, such as first-letter cueing. There appears to be a clear relationship between children in the mnemonically-instructed groups who did use an acrostic as requested and those who did not. Typically, children who failed to construct a mnemonic either found the exercise "too hard" or irrelevant, in view of more favoured regular alternatives. Non-users tended to be represented by a larger number of lower achievers. Children who constructed a mnemonic as requested were represented by a larger number of higher achievers. Such observations are consistent with the literature, (e.g., see Kail, 1979).

No objective criteria was used to establish these trends other than the researcher's personal knowledge of the children's ability.
EXPERIMENTS 7a and 7b (Planets 2 and historical periods 2)

EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX"

PURPOSE: To test the long term efficacy of nine (planets) and six-item, (historical periods) experimenter-generated first-letter mnemonics, on a recognition test at 2 retention intervals, against rote and un instructed learning conditions. Graphs displaying a comparison between immediate and long-term recall for each condition can be found on page 290.

Target Year: 1 (mean age 11.5 yrs)

Target-groups: C.-group (uninstructed)

R.-group (told to recall rote-learned material)

E.-group (told to recall mnemonic material)

N.B. Unlike all previous experiments experiments in the 7 series involved recognition in addition to recall.

DATES OF TEST AND SUBJECTS USED:

EXPERIMENT 7a (planets 2) boys girls

-------------------------------
E.-group,... Wednesday 5th July 8 17 20
-------------------------------
R.-group,... Thursday 6th July 8 16 19
-------------------------------
C.-group,... Wednesday 7th July 8 17 19
-------------------------------
No. WEEKS RE-TEST
EXPERIMENT 7b  (historical periods 2) boys girls

E.-group..... Wednesday 5th July  4  17  20
R.-group..... Thursday 6th July  4  18  19
C.-group..... Friday 7th July  4  17  19

No. WEEKS RE-TEST

MATERIAL TO BE RECALLED:

1) The order of the planets comprising our solar system (LEARNED IN EXPERIMENT 2)

2) The historical periods which comprise the Modern Age (LEARNED IN EXPERIMENT 4)

PROCEDURE:

Each first-year group heard an identical audio-tape which contained instructions about how to respond to the two answer sheets provided.

METHOD:

Subjects enter experiment room, are welcomed and reminded that their performance on the test will in no way affect their school career.

AUDIO-TAPE STARTED......

"In front of you, there is a card. Turn it over now. Do not write anything until you are told.

The second time you learned information for me, I asked you to learn the names of the planets which make up our solar system, and also, the particular order of the planets. Near the top of the card, you will see the names of all the planets in our solar system, BUT THEY ARE NOT IN THE CORRECT ORDER.

Below these names, there are nine spaces. At the top of these spaces, the "Sun" has been written. ONLY WHEN I TELL YOU, I want you to write the names of the planets, in their correct order from the Sun. I will give you one minute to do this. START NOW."

TAPE RUNNING......

SIREN SOUNDS WHEN TIME UP
EXPERIMENTER SAYS:

"At the bottom of this sheet, where it says "house", circle either B, D or R. Where it says "sex", circle either "B" or "G". Where it says "family", (form) put your family number, and where it says "initials", put the first letter of your Christian and surnames.

Now I want you to change this sheet with the one under your chair, making sure to put the new sheet face-down on to your work board. Now please listen to the tape again."

RE-START TAPE........

"In front of you, there is a card. Turn it over now. Do not write anything until you are told.

The third time you learned information for me, I asked you to learn the periods which make up the Modern Age. On the card, you will see the names of all the periods which make up the Modern Age, BUT THEY ARE NOT IN THE CORRECT ORDER.

Below these names, there are six spaces, one for each period of the Modern Age. Only when I tell you, I want you to write the names of these periods in their correct order. I will give you one minute to do this. START NOW."

TAPE STILL RUNNING........

SIREN SOUNDS WHEN TIME UP

AUDIO-TAPE ENDS

Experimenter repeats instructions about the identification of scripts, (see above).

SCRIPTS COLLECTED IN SILENCE, CHILDREN THANKED

END.
RESULTS OF PLANETS RE-TEST (experiment 7a)

<table>
<thead>
<tr>
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<th>MEAN</th>
<th>S.D.</th>
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<td>R.-Group</td>
<td>35</td>
<td>109</td>
<td>3.114</td>
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<td>E.-Group</td>
<td>37</td>
<td>299</td>
<td>8.081</td>
<td>2.097</td>
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</tbody>
</table>

\[ F \quad 74.32 / \quad p \quad 0.000 \]

\[ t \text{ SCORES} \]

CONTROL v ROTE ........ 0.341 -- \( df \) 69

ROTE V EXPERIMENT ..... 8.913 -- \( df \) 70

EXPERIMENT v CONTROL .. 9.729 -- \( df \) 71

DISCUSSION

On an analysis of variance, this result is highly significant. Using the measure of \( p < 0.05 \) (\( t > 1.671 \)), there are two highly significant results to report: R v E and E v C. These results are interpreted to suggest the following:

1) On a long-term recognition task, children instructed how to use first-letter mnemonics, demonstrated considerably better performance than either children instructed to learn material in their regular manner or children instructed to rote-rehearse material.

2) Although mnemonically instructed children have difficulty in demonstrating immediate learning benefits [1] using a more sophisticated acrostic, (e.g., of nine items, as opposed to six) on a long-term recognition task, acrostics can considerably facilitate recall.

3) Children as young as eleven, can manipulate quite sophisticated mnemonics (acrostics) effectively.

4) Children in the mnemonic group actually recall nearly one item more in the recognition test, (7.157 v 8.081) whilst the uninstructed and rote-learners recall only c. half of what they were able to at immediate free-recall re-test.

\[ ^1 \text{ In fact, at immediate re-test, E.-group performed only as well as C and R groups.} \]
GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
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<td>GIRLS</td>
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<td>62</td>
<td>3.263</td>
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^ t 0.128 -- df 34

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<th>MEAN</th>
<th>S.D.</th>
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<tbody>
<tr>
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<td>GIRLS</td>
<td>19</td>
<td>40</td>
<td>2.105</td>
<td>1.860</td>
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^ t 2.744 -- df 33

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<tbody>
<tr>
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<td>135</td>
<td>7.941</td>
<td>1.609</td>
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<td>GIRLS</td>
<td>20</td>
<td>164</td>
<td>8.2</td>
<td>2.039</td>
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^ t 0.423 -- df 35

DISCUSSION

There is one significant result to report. In the rote condition, boys well out-performed the girls. This trend is conducive with earlier experiments (e.g., experiment 1; experiment 2, Planets). Given that the boys in R.-group initially learned this material more effectively, it is perhaps not surprising that this material has also been retained and was recalled more effectively.

As in experiments 1, 2 and 4, there are no significant gender differences in E.-group.
EXPERIMENT 7b (Historical periods 2)

<table>
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<tr>
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<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-Group</td>
<td>36</td>
<td>48</td>
<td>1.333</td>
<td>1.333</td>
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<tr>
<td>R.-Group</td>
<td>37</td>
<td>69</td>
<td>1.864</td>
<td>1.662</td>
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<tr>
<td>E.-Group</td>
<td>37</td>
<td>193</td>
<td>5.216</td>
<td>1.694</td>
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</table>

$F = 74.30 \ / \ p \ 0.000$

t SCORES

CONTROL v ROTE ....... 1.503 -- df 71

ROTE v EXPERIMENT ..... 8.592 -- df 72

EXPERIMENT v CONTROL ..10.864 -- df 71

DISCUSSION
On an analysis of variance, this result is highly significant. Highly significant results ($t > 3.460; df > 60; p < .001$) are reported for R v E and E v C scores. These results are interpreted to suggest the following:

1) Although younger children are able to manipulate and apply quite sophisticated mnemonics (e.g., nine-item acrostics, see "experiment 2") following limited instruction, younger children can manipulate mnemonics containing fewer items more easily.

2) On an identical, time-matched learning task, arbitrarily related material learned several weeks previously, is almost totally forgotten by children adopting their regular method of learning. The mnemonic group however, whilst performing poorly at immediate re-test, [2] produced considerably better performance (e.g., R v E; R v C) on the recognition task, around two-and-a-half times as well!

GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>GENDER</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>19</td>
<td>26</td>
<td>1.368</td>
<td>1.384</td>
</tr>
<tr>
<td>GIRLS</td>
<td>17</td>
<td>22</td>
<td>1.294</td>
<td>1.272</td>
</tr>
</tbody>
</table>

$^t \ 0.166 \ -- \ df \ 34$

2 Possibly due to the fact that they had to learn both the learning material and the mnemonic. Children in alternative learning conditions spent the whole time focusing on the learning material presented.
**DISCUSSION**

Using the measure of significance, \( p < 0.05 \) (\( t > 1.684 \)) There were no significant gender differences to report.

**EXPERIMENTS 7c and 7d** (design process 2, and assessment-scale 2)

**EXAMPLES OF ALL MATERIALS CAN BE FOUND IN THE SECTION MARKED "APPENDIX."**

**PURPOSE:** To test the long-term efficacy of group-generated nine item, (design process) and six-item, (assessment scale) first-letter mnemonics at different re-test intervals, against rote and uninstructed learning conditions. Graphs displaying a comparison between immediate and long-term recall for each condition can be found on page 291.

**Target Year:** 3 (mean age 13.5 yrs)

**Target groups:**  
C.-group (uninstructed)  
R.-group (told to recall rote-learned material)  
E.-group (told to recall mnemonic material)
EXPERIMENT 7c (design process 2) boys girls

E.-group..... Wednesday 12th July 8 16 14

R.-group..... Thursday 13th July 8 19 21

C.-group..... Friday 4th July 8 21 19

EXPERIMENT 7d (assessment scale 2) boys girls

E.-group..... Wednesday 12th July 4 16 14

R.-group..... Thursday 13th July 4 19 21

C.-group..... Friday 14th July 4 21 19

No. WEEKS RE-TEST ^

MATERIAL TO BE RECALLED:

1) The order of the various stages in the design process (LEARNED IN EXPERIMENT 3).

2) The order of the assessment scale (LEARNED IN EXPERIMENT 5).

PROCEDURE:

Each third-year group heard an identical audio-tape which contained instructions about how to respond to the two answer sheets provided.

METHOD:

Subjects enter experiment room, are welcomed and reminded that their performance on the test will in no way affect their school career.
"In front of you, there is a card. Turn it over now. Do not write anything until you are told.

The second time you learned information for me, I asked you to learn the names of the various stages in the design process, and also, the particular order of these stages. Near the top of the card, you will see the names of all the various stages in the design process, BUT THEY ARE NOT IN THE CORRECT ORDER.

Below these names, there are nine spaces, one for each stage in the design process. ONLY WHEN I TELL YOU, I want you to write these names in their correct order. I will give you one minute to do this. START NOW."

TAPE RUNNING......

SIREN SOUNDS WHEN TIME UP

EXPERIMENTER SAYS:

"At the bottom of this sheet, where it says "house", circle either B, D or R. Where it says "sex", circle either "B" or "G". Where it says "family", (form) put your family number, and where it says "initials", put the first letter of your Christian and surnames.

Now I want you to change this sheet with the one under your chair, making sure to put the new sheet face-down on to your work board. Now please listen to the tape again."

RE-START TAPE......

"In front of you, there is a new card. Turn it over now. Do not write anything until you are told.

The third time you learned information for me, you were asked to learn an assessment scale, which could be used to assess the quality of a product. On the card, you will see the names of all the stages used in the assessment scale, BUT THEY ARE NOT IN THE CORRECT ORDER.

Below these names, there are six spaces, one for each stage. Only when I tell you, I want you to write these various stages in their correct order. I will give you one minute to do this. START NOW."

TAPE STILL RUNNING......

SIREN SOUNDS WHEN TIME UP

AUDIO-TAPE ENDS

Experimenter repeats instructions about the identification of scripts, (see above).

SCRIPTS COLLECTED IN SILENCE, CHILDREN THANKED

END.
RESULTS OF DESIGN PROCESS RE-TEST (experiment 7c)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-Group</td>
<td>30</td>
<td>53</td>
<td>1.766</td>
<td>1.584</td>
</tr>
<tr>
<td>R.-Group</td>
<td>40</td>
<td>43</td>
<td>1.075</td>
<td>1.126</td>
</tr>
<tr>
<td>E.-Group</td>
<td>40</td>
<td>101</td>
<td>2.525</td>
<td>2.872</td>
</tr>
</tbody>
</table>

\[ F \, 7.84 \, / \, p \, 0.001 \]

**t** SCOREx

CONTROL v ROTE ...... 2.134 -- df 68

ROTE v EXPERIMENT .... 2.973 -- df 78

EXPERIMENT V CONTROL .. 1.305 -- df 68

DISCUSSION:

On an analysis of variance, this result is significant. Using the criteria previously established for t-tests, the scores for C v R and R v E are also significant. It is hypothesised, that the uninstructed group were adopting a range of strategies spontaneously, which were almost as effective as the mnemonic used here. The poorer result of C.-group, is interpreted as evidence that older children, under instruction to either restrict their normal repertory of strategies or learning without the aid of more sophisticated strategies, will display impoverished learning.

GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>C.-GROUP SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>16</td>
<td>38</td>
<td>2.375</td>
</tr>
<tr>
<td>GIRLS</td>
<td>14</td>
<td>15</td>
<td>1.071</td>
</tr>
</tbody>
</table>

\[ ^t \, 2.466 \, -- \, df \, 28 \]

<table>
<thead>
<tr>
<th>R.-GROUP SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>19</td>
<td>7</td>
<td>0.368</td>
</tr>
<tr>
<td>GIRLS</td>
<td>21</td>
<td>33</td>
<td>1.571</td>
</tr>
</tbody>
</table>

\[ ^t \, 3.804 \, -- \, df \, 38 \]
**DISCUSSION:**

Using the measure of significance, \( p < 0.05 \) (\( t > 1.684 \)) there are two significant results to report, C.-group boys v girls and R.-group boys v girls.

C.-group girls performed better than C.-group boys at immediate re-test although the result was not significant. It is difficult to explain why at long-term recognition re-test gender performance should be reversed.

R.-group gender differences were highly significant. This is also somewhat difficult to explain. Although this trend was noted following the uninstructed matching experiment, differences were not significant, (e.g., \( t = 0.258 \)). Further, there appears to be no intra-gender performance trend, except on both experiments which tested long-term recall using rote learning as the dependent variable.

In experiment 5, (assessment scale experiment) R.-group boys performed slightly better than the girls, (e.g., boys mean = 4.857 v girls mean 4, \( t = 1.739 \)). If the results of the two long-term recall tests are taken together, they suggest that whereas boys derive more immediate benefit from rote rehearsal, girls derive more long-term benefits. It is hypothesised that this anomaly is related to cognitive maturation and might be investigated empirically as a separate issue.

No gender differences for E.-group are reported.
RESULTS OF ASSESSMENT SCALE RE-TEST (experiment 7d)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-Group</td>
<td>30</td>
<td>32</td>
<td>1.066</td>
<td>1.030</td>
</tr>
<tr>
<td>R.-Group</td>
<td>40</td>
<td>52</td>
<td>1.3</td>
<td>1.417</td>
</tr>
<tr>
<td>E.-Group</td>
<td>40</td>
<td>174</td>
<td>4.35</td>
<td>2.393</td>
</tr>
</tbody>
</table>

\[ F \ 123.19 / p \ 0.000 \]

\( t \) SCORES

CONTROL v ROTE .......... 0.765 -- df 68
ROTE V EXPERIMENT ..... 6.936 -- df 78
EXPERIMENT V CONTROL .. 7.034 -- df 68

DISCUSSION:
On an analysis of variance, this result is highly significant. It is important to note a replication of the acrostic span-effect, also observed in results relating to the younger children investigated. Like their eleven-year-old counterparts, the thirteen-year-olds demonstrate more effective manipulation of shorter acrostic material. This effect may be a function of the actual mnemonics employed, and so will need to be addressed in more detail through subsequent investigations.

Again, inter-group differences were very highly significant. There were no significant differences between the uninstructed and rote groups' performance.
GENDER DIFFERENCES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>16</td>
<td>20</td>
<td>1.25</td>
<td>0.968</td>
</tr>
<tr>
<td>GIRLS</td>
<td>14</td>
<td>12</td>
<td>0.857</td>
<td>1.059</td>
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</table>

^ _t_ - 1.062 -- df 28

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SCRIPTS</th>
<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>19</td>
<td>17</td>
<td>0.894</td>
<td>0.787</td>
</tr>
<tr>
<td>GIRLS</td>
<td>21</td>
<td>35</td>
<td>1.666</td>
<td>1.727</td>
</tr>
</tbody>
</table>

^ _t_ - 1.786 -- df 38

<table>
<thead>
<tr>
<th>GROUP</th>
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<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
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</thead>
<tbody>
<tr>
<td>BOYS</td>
<td>21</td>
<td>84</td>
<td>4</td>
<td>2.600</td>
</tr>
<tr>
<td>GIRLS</td>
<td>19</td>
<td>90</td>
<td>4.736</td>
<td>2.073</td>
</tr>
</tbody>
</table>

^ _t_ - 0.983 -- df 38

DISCUSSION:
The trend for C.-group boys to perform better than the girls was also noticed here and was statistically significant.

R.-group girls out-performed the boys on the long-term recall task, but the level of significance was not as great. This result is interpreted to suggest that girls of this age, (mode 13.5 years) are able to rehearse with greater beneficial effect, especially over long-term retention intervals. It is hypothesised that this is a result of cognitive maturation, the girls probably manipulating the rehearsed information in a qualitatively different way from the boys.

No E.-group gender differences were apparent.
GENERAL DISCUSSION OF THE LONG-TERM RECALL RESULTS:

1) Arguments relating to time-on-task and first-letter mnemonics, seem applicable only to immediate recall, where a comparison between mnemonic and two alternative learning conditions produces similar results.

2) In each of the long-term recall experiments, recall improvements resulting from mnemonic intervention was very significant. Typically mnemonic learners could recall around twice that of uninstructed and rote groups and in one case, learning was three times superior.

3) As predicted, first-letter mnemonics which involve less processing (e.g., six-items) seem to be more effective than longer ones. This effect is especially noticeable in experiment 7c, (long-term recall of experiment 3, design process) where even the mnemonic group could recall only an average of 2.5 items of the originally learned 9.

4) Acrostics constructed by the teacher/experimenter appear more effective than those constructed by the class or individuals. Consistent with the literature, (see pp.69-76 of this study) young children typically experience difficulty in knowing what is likely to be an effective or ineffective mnemonic. The poorest acrostic used in this study was one designed by a group of children, (Design process, experiment 3, pp.220-228). The acrostic has a number of idiosyncratic and confusing components which have produced an unexciting result for this particular mnemonic. Suggested guidelines for group and teacher-generated acrostics are discussed in detail under the heading of "Mnemonising material", pp.349-358.

5) A comparison between uninstructed and rote learners' long-term recall reveals little difference between the two as aide-memoirs. An important result seems to be that unless children in these age-groups are deliberately instructed to use some form of learning method, a considerable amount of material originally learned is forgotten. For example, the mean combined score for first-year groups on the initial planets experiment, (experiment 2) was around 7 items, (out of a possible 9) but at 6 week re-test, this had been more than halved in both the uninstructed and rote learning conditions. The mnemonic group’s score actually increased at re-test, from 7.157 at immediate post-test to 8.081 at 6 weeks re-test! These trends were evident in all of the long-term recall experiments comprising the 7 series.

THERE FOLLOWS EIGHT GRAPHICAL REPRESENTATIONS OF RECALL IN EACH CONDITION FOR EXPERIMENTS:

2, (table 1) 7a, (table 5)
3, (table 2) 7b, (table 6)
4, (table 3) 7c, (table 7)
5, (table 4) 7d, (table 8)
<table>
<thead>
<tr>
<th>Planets</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7</td>
</tr>
<tr>
<td>Rote</td>
<td>5</td>
</tr>
<tr>
<td>Experiment</td>
<td>9</td>
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</tbody>
</table>

*Table 1*
<table>
<thead>
<tr>
<th>Historical Periods</th>
<th>Experiment 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>3</td>
</tr>
<tr>
<td>Note</td>
<td>5</td>
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<tr>
<td>Experiment</td>
<td>6</td>
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</tbody>
</table>

*Table 2*
TABLE 3

Design Process
Experiment 3

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Rote</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate Recall</td>
<td>6</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3
TABLE 4

Assessment Scale
Experiment 5

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Note</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediate Recall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4
Table 5

Planets Experiment 2
Experiment 7a

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Rote</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5
Table 6: Historical Periods 2
Experiment 7b

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Rote</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Recall</td>
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<td>2</td>
<td>5</td>
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</tbody>
</table>

Table 6
<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Rote</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Recall</td>
<td>□□□□□□□□□□</td>
<td>□□</td>
<td>□□□□□□□□□□</td>
</tr>
</tbody>
</table>

Table 7
TABLE 8

Assessment Scale 2
Experiment 7d

Long-Term Recall

Table 8
The results of a survey related to the use of mnemonics undertaken in seven secondary schools is reviewed.
THE STAFF SURVEY

Many aspects of knowledge relating to the use and application of mnemonics within schools at present remain unaddressed. Although the main focus of research in this study has been the effects of mnemonics upon classroom learning, experimental data per se, fails to provide evidence relating to the contexts, range and scale of mnemonics presently used in secondary schools. It is hoped that these results will go some way towards clarifying these issues.

As in most research, compromises have been necessary in order to accommodate the limitations of the resources and time available.

CHOICE OF APPROACH:
After seeking advice from the Head and senior management of the study school about the type and style of questionnaire to use, it was decided to employ a fixed-alternative design, [1] as this would be relatively easy and quick to complete, and facilitate subsequent coding. It was considered necessary to limit the questions to eight. This number was considered to be "just palatable", as staff in all schools can afford little time for unscheduled work.

1 Where respondents are required to choose from a selection of specified responses.
In order to improve the take-up of staff, a brief statement of purpose was attached to the front sheet which read:

Dear Colleague,

I am a full-time practising teacher. As the subject of a research degree (Ph.D), I have chosen to study ways in which classroom learning can be improved by the use of simple techniques.

The main aims of the work are:

a) To find out what recall strategies (mnemonics) fellow teachers use in the classroom.

b) To develop a range of mnemonics to help children remember facts and information more effectively.

Your personal knowledge gained through teaching experience will make a valuable addition to this study. I will be pleased to share the results with your school upon conclusion and additionally, credit individual members of staff if they feel that naming their contribution is appropriate.

Thank you, in anticipation, for your help.

Yours faithfully,

Stephen D. Booth

To improve the questionnaire’s general appearance, the paper was printed on one side only.
CHOICE OF AGE-GROUP

It was decided to target secondary schools for the following reasons:

a) Schools catering for this age-group are more likely to offer information relevant to the target-groups of this study, (e.g., ages 11-14 years).

b) At a pragmatic level, my Head Teacher was able to use a number of contacts to improve the "take-up" of questionnaires.
PREPARATION:

1) Northampton Education Department's mainframe computer used to identify potential target-schools (secondary). Six schools randomly assigned.

2) First draft prepared and discussed with Senior Education Inspector representing the Authority.

3) Small-scale pilot completed to check operational validity.

4) Second draft prepared and printed.

5) Headmaster of the study school wrote to Head Teachers requesting support on my behalf.

6) Good response, communication with Head Teachers followed by delivery of surveys.

7) Surveys collected and information disseminated.
THE QUESTIONS

Questions 1, 2 and 3 were designed to elicit the year-groups to which mnemonics had been introduced by each teacher, (if any) and details of those most regularly used, together with the subject material or information they were designed to accompany.

It was thought useful to know which of these mnemonics were considered most useful. This was addressed in Question 4.

Data relating to children’s attitudes toward the use of mnemonics in classroom learning is unavailable. Although this is a feature subsequent studies may address in more detail, it was possible to obtain teachers' perception of how children generally responded to using mnemonics. This information was obtained by asking teachers to rate how they thought children had responded to using mnemonics. A four-point scale was used in an effort to avert mid-range responses.

It was considered important to obtain more complete knowledge relating to the number of mnemonics (if any) teachers had used during their careers and also the subject-areas in which they had been used. Questions 6 and 7 respectively, addressed these points.

There is little or no objective data relating to:

a) The origin of the mnemonics teachers use.

b) The techniques and style employed by teachers to teach children about mnemonics.

c) How teachers acquired specific mnemonics.

d) How teachers learned to apply specific mnemonics.
Interesting as these areas of research are, it was only practicable to address the subject of application. Question 8, probed this aspect of teachers’ mnemonic knowledge.

A space for additional contributions was included and all contributors were informed that named contributions would be credited.

I have decided to submit the names of schools which contributed to this aspect of the study at this stage. These are accredited in the study and it seems somewhat artificial to mask the names here.

**CODE**

D 1) Daventry School, Daventry.
C 2) Campion School, Bugbrooke.
H 3) Sir Christopher Hatton School, Wellingborough.
P 4) Pemberton School, Rushden.
B 5) Beanfield School, Corby.
M 6) Montagu School, Kettering.
L 7) Lodge Park School, Corby. (STUDY SCHOOL)

Some of the items classified in the survey might be considered "rules" as opposed to mnemonics. It is worth reiterating the initial broad brief which classifies mnemonics as "schemes designed to assist learning and recall".
I feel it inappropriate to discuss the actual number of respondees in each school. At present, many innovations compete for staff time and I would not wish some of the poorer take-ups to reflect any school's response.

Each had a staff of c.60, and the take-up was in the region of 25-30%, except in the study school where the take-up was c.100%. The most important factors governing take-up, were perhaps not surprisingly, the support of the Head Teacher and the specific regional and national pressures each school was experiencing at the time [2].

It will be clear that because take-up was so (predictably) limited, there is no accurate method of assessing what percentage of teachers use mnemonics as part of their regular teaching programmes. It is likely that teachers who use mnemonics would be more willing to respond, but it is more than conceivable that even teachers who regularly employ mnemonics, were either unable or unwilling to respond. For these reasons, it was decided to use this material as a resource, from which inference and broader generalisations could be obtained, rather than using the material to make specific generalisations, which in any case, was never the purpose of this aspect of the study.

Because the take-up in the study school was c.100%, these survey results were analysed in detail.

2 For example, inter-school activities, Government initiatives, school productions.
SAMPLE:
The master computer belonging to the Northamptonshire Education Department was used to assign five target-schools from the Authority's secondary school pool.

In addition, two further schools were randomly assigned as reserves. Of the five schools approached, four offered support, so it was decided to enlist both reserve schools and also involve staff at the study school. This would provide more comprehensive information about the regular use of mnemonics within the school curriculum and with an expected take-up of c.100% at the study school, offer an insight into regular mnemonic practice using an intact [3] group of teachers.

It could not therefore, be claimed that the survey schools were purely randomly assigned, but nonetheless, there was a strong element of objective targeting involved in identification.

---

3 The normal population of a group or institution.
IDENTIFICATION

In order to achieve a more precise analysis of the survey results, all the questionnaire responses have been divided into one of four groups:

First choice mnemonic of teachers at the study school
Other than first choice mnemonic of teachers at the study school
First choice mnemonic of the teachers at all other schools surveyed
Other than first choice mnemonic of the teachers at all other schools surveyed

For convenience, the survey results from the study school are discussed separately, and compared with results from the other five schools that contributed. Mnemonics originating from the study school, are accompanied by the letter "S", those originating from the other schools, with the letter "O".

For example, 14-S "O.I.L.R.I.G.", indicates item 14 originating from the study school, 29-O, "BODMAS", item 29 from a source other than the study school.

In addition, the number of times each mnemonic has been cited within a category, appears below the main reference which is in bold type. Each member of staff in each school that contributed has been given a number with an accompanying letter to facilitate cross-referencing.

For example, the following citation:

4-O "I before E except
P2 after C".................Spelling rules
P9
D3
C4

Indicates the item was cited by 4 staff from 3 different schools,

P = Pemberton
D = Daventry
C = Campion
THE SURVEY

Some teachers use recall "tricks" (strategies) in order to improve the chances of their pupils being able to remember facts and knowledge. An example would be, "Every Good Boy Deserves Food", a sentence used by music teachers to teach stave notation.

There are many such remembering strategies. You may well know them as mnemonics.

There is little direct evidence to suggest how widespread is the use of mnemonics or where and when they are used in schools.

PLEASE OFFER ANSWERS TO THE FOLLOWING QUESTIONS, EITHER BY TICKING THE BOX PROVIDED, OR BY MAKING A COMMENT IN THE SPACE PROVIDED

School:.................................

Age:          (  ) 18-25          (  ) 26-35          (  ) 36-45
              (  ) 46-55          (  ) 56-65

Sex:          (  ) M
              (  ) F

Number of years as a teacher:

              (  ) 0-5
              (  ) 6-10
              (  ) 11-15
              (  ) 16-20
              (  ) 21+
Q1) Have you ever used a mnemonic (memory-aid) as part of your lessons?

(  ) YES
(  ) NO

Q2) With which year-groups have you used mnemonics?
Please tick, as appropriate:

(  ) 1
(  ) 2
(  ) 3
(  ) 4
(  ) 5
(  ) 6i
(  ) 6ii

Q3) Please give examples of the mnemonics you have used/use the most regularly, (if any)?

a) ........................................................
This helps to teach ..................................

b) ........................................................
This helps to teach ..................................

c) ........................................................
This helps to teach ..................................

PAGE 2
Q4) Please indicate which of the three mnemonics you have found the most useful in aiding your children’s memory?

( ) a  
( ) b  
( ) c

Q5) If you have taught children to use mnemonics in order to help them remember, was the activity received with?

( ) Strong reservation?  
( ) Caution?  
( ) Interest?  
( ) Enjoyment?

Q6) Roughly how many different pieces of fact/information have you tried to help children remember by teaching them a mnemonic?

( ) 1-3  
( ) 4-8  
( ) 9-15  
( ) 15+

Q7) For which subjects have you used mnemonics (if any)?

( ) English  
( ) Mathematics  
( ) Science  
( ) Humanities  
( ) Design & Technology  
( ) Expressive Arts  
( ) Foreign Languages  
( ) Religious Education  
( ) Economic Awareness  
   Other/s, please specify  
( )  
( )
Q8) If you personally use mnemonics to help you remember facts or information, did you learn how to use the mnemonic/s:

( ) By intuition?
( ) During your own schooldays?
( ) From a colleague?
( ) As a result of reading?

Other/s? Please specify.

( )

( )

If you have any other comments you feel may be helpful to this study, please write them here.

Many thanks for your kind help in completing this questionnaire.

If you would like to discuss any of the responses or comments you have made in more detail, or alternatively, share ideas or information, please do not hesitate to contact me.

Stephen Booth
House Tutor
Lodge Park Comprehensive School
Shetland Way
Corby
Northants Tel: Corby 203817
SURVEY AT STUDY SCHOOL

Although the other schools targeted for the survey provided vital information about the mnemonics teachers actually use in their classrooms, the number of returns reduced both the validity and reliability of any ensuing generalisations.

Fortunately, all of the staff at the study school completed the questionnaire, providing an invaluable source of information about the mnemonic habits of an entire teaching staff within a state comprehensive school. Clearly, rich as this information is, it can serve only as a useful indicator of current mnemonic practice.

**MNEMONICS CITED BY STAFF AS THEIR FIRST CHOICE:**

<table>
<thead>
<tr>
<th>MNEMONIC</th>
<th>THIS TEACHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-S &quot;SOHCAHTOA&quot;; Pronounced</td>
<td>L1 &quot;Sock-a-toe-a&quot; Trigonometry</td>
</tr>
<tr>
<td>3-S &quot;Never Eat Shredded Wheat&quot;</td>
<td>L13 Points of the compass</td>
</tr>
<tr>
<td>4-S &quot;Every Good Boy Deserves Food/Fun/ Football&quot;, etc.</td>
<td>L20 Treble clef notation</td>
</tr>
<tr>
<td>5-S &quot;Many Naughty Rabbits Eat Green Rhubarb Stems&quot;</td>
<td>L4 Characteristics of living things</td>
</tr>
</tbody>
</table>

6-S "Richard Of York
L3 Gave (gained)
L9 Battle In Vain"..............Sequential order of spectral
colours

7-S "Big Elephants Are
L6 Ugly".....................To aid the spelling of
BEAUTIFUL

8-S "Real Old Yokels
L32 Gorge Beef In
L11 Volumes"...............Sequential order of spectral
colours

9-S "Stupid Brickies
L34 Invented Some
Bricks Made with
Red Aspirins...............An aid to teaching the Design
process in sequential order

10-S "Pelicans Find
L34 Vindaloo Curry
Awfully Satisfying"........An aid to the teaching of a
six-point assessment-scale
for C.D.T.

11-S "H.A.K.E. &
L24 D.R.A.K.E"..............Fat/Water soluble vitamins

12-S "WE"......................West & East (exploration)
L25

13-S "DRAPERS VAN M.M.T"........An aid to the teaching
of French verbs
L26

14-S "OILRIG"....................Teaches facts about oxidation
L28

15-S "D.O.G.E.W.U.F."
L30 Pronounced
"doggy-wuff"..............Aids the recall of German
prepositions

16-S "HOMES"....................Great lakes of Canada
L31
17-S "'C' a noun not a verb"..........................Aid to English Grammar

18-S "VAIN AZ UHO", pronounced: "Vain as you"..........................An aid to the teaching of German accusative prepositions

19-S "Not on the list. On the list without 'ist'. On the list with 'ist'."..........................An aid to teaching perfect tense in German

20-S "X is a-cross"..........................Labelling graph axes

21-S "If in doubt, leave it out"..........................Prevention of over-use of commas, full stops, apostrophes etc.

22-S "Along the corridor, up the stairs"..........................An aid to teaching grid references

*************************************************************************************************************

OTHER THAN FIRST CHOICE

23-S "Richard Of York Gave (gained) Battle In Vain"..........................Sequential order of spectral colours

24-S "ROY G BIV"..........................Sequential order of spectral colours
25-S "I before E except after C"..........................An aid to spelling
L5 L32 L33

26-S "BODMAS"..........................Order of operations in
L1 mathematics
L12 L19

27-S "Naughty Elephants
L6 Squirt Water"..................Points of the compass
L13 (sequential)

28-S "TRIMLEGS"..................Aid to the teaching of the
L13 industrial location theory
L14

29-S "SOHCAHTOA"; Pronounced
L1 "Sock-a-toe-a"..................Trigonometry
L12

30-S "Many Naughty
L4 Rabbits Eat
Green Rhubarb
Stems"......................Characteristics of living
things

31-S "OILRIG"........................Teaches facts about oxidation
L16

32-S "'H' pencils Horrid
L9 for Art, 'B' pencils
Best"..........................An aid to the selection of
Art-appropriate pencil lead.

33-S "Most Elephants
L3 Prefer Buns"........Methane, Ethane, Paraffin
Butane

34-S "C.O.D.S.L.I.P"...............An aid to the teaching of the
L4 properties of gases

35-S "Elsie Feels Lonely"........An aid related to the teaching
L10 of magnetic fields in
inductors.
36-S "Catherine Never Can Manage A Live Zebra"...........An aid to the teaching that electro-magnetic fields lead the current in inductors

37-S "All Cows Eat Grass".............An aid to the teaching of bass-stave notation

38-S "Never Eat Sredded Wheat"..................Compass positions

39-S "FACE"...............................Spaces in the treble clef

40-S "Good Able Brief"..................Key signatures

41-S "Four Children Get Dates At Eliza Brown's".........Order of Sharps and flats

42-S "BASMOQ-NPN".....................Provinces of Canada

43-S "Dr & Mrs VANDERTRAMP"...........Aid to the teaching of etre verbs
RESULTS FROM THE STUDY SCHOOL

The average age of mnemonic users was (mode) between 36 and 45, comprising 17 male and 16 female staff. 63.5% of mnemonic users had more than 16 years' teaching experience and the 33 mnemonic users, represented 55% of the total study school staff.

The following table indicates the distribution of mnemonic use amongst different year-groups within the study school. Figures are expressed as percentages of the total responses for each year-group by mnemonic users. Figures in brackets are the total number of times that year-group was cited by teachers.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>%</th>
<th>(      )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>(23)</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>(19)</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>(24)</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>(27)</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>(24)</td>
</tr>
<tr>
<td>6i</td>
<td>6.5</td>
<td>(9)</td>
</tr>
<tr>
<td>6ii</td>
<td>6</td>
<td>(8)</td>
</tr>
</tbody>
</table>

In common with the results from the other schools, "SOHCAHTOA" was found to be the most useful mnemonic, but unlike the other schools, (where the mnemonic fails to feature at all!) "ROY G BIV" or its near derivatives is thought to be the second most useful. The preferred alternative mnemonic to teaching the spectral colours is "Richard Of York Gained Battle in Vain" which overall features as the most popular mnemonic. The two other first-choice mnemonics worthy of mention are "Never Eat Shredded Wheat" (compass work) and "Every Good Boy Deserves Food". Curiously, the latter fails to feature at all as a mnemonic that is used by staff in other schools.

Study school staffs' perception of how their children received mnemonics as an aid to learning is interpreted as follows. Assuming that strong reservation and caution are considered negative responses, and interest and enjoyment, positive, 90.5% of staff though their students responded positively to the use of mnemonics as learning aids.

Responding to the number of different mnemonics staff had used to help teach material, 64.5% had used between 1 and 3 mnemonics, 29% between 4 and 8, and 6.5% more than 9.
Clearly, some of the mnemonics cited, could be assigned to two or more subject-areas [4], but for convenience, each mnemonic has been assigned to the more dominant subject-user. In all, 43 different mnemonics were cited by staff from the study school, broadly related to the following subject-areas:

- English: 4
- Maths: 2
- Science: 10
- Geography: 8
- Mod. Lang.: 5
- Music: 5
- C.D.T./Art: 3

In identifying how they had learned to apply mnemonics, the responses were distributed as follows: 20.5% "by intuition", 50% during their own schooldays, 16% from a colleague, 11.5% as a result of reading and 2%, Girl Guides.

DISCUSSION:

The survey undertaken at the study school suggests that a number of teachers had selectively employed mnemonic/s at some time. Because of the writer's association with the study school, it was possible to ensure 100% returns. The study school is arguably a typical 11-16 comprehensive and although the responses obtained could not be considered "representative", such a full response provides a rich and useful source of data.

Around half the staff had used a mnemonic at some time in a variety of curricular areas. Typically, these are used to teach arbitrary material, which tends to have few "natural" associations. Examples of this would be "A-ll C-ows E-at G-rass", an acrostic for teaching the space-names of the bass clef or, the acronym: "H.O.M.E.S." used to help cue the names (not the order) of the five great lakes.

Although there were some familiar mnemonics, such as the acrostic "R-ichard O-f Y-ork G-ave (gained) B-attie I-n V-ain" [5] and the rhyme "'I' before 'E' except after 'C'" there were a number which were less familiar.

---

4 For example, "Richard Of York Gained Battle In Valn" can be used to help teach the spectral colours in either science or art/graphic domains.

5 Used to teach the spectral colours: R-ed, O-range, Y-eilow, G-reen, B-lue, I-ndigo and V-iolet.
It will be noted that there appears to be a decline in the use of mnemonics in the sixth form. The main explanation for this would appear to be that whereas most staff teach students up to and including year 5, a smaller percentage teach the sixth form. It was beyond the scope of this study to obtain more detailed information relating to this particular age-group. This would make a useful focus for subsequent work, along with a study relating to pre-secondary mnemonic use.

SURVEY RESULTS FROM THE OTHER SCHOOLS

FIRST CHOICE MNEMONICS:

<table>
<thead>
<tr>
<th>MNEMONIC</th>
<th>THIS TEACHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-0 &quot;SOHCAHTOA&quot;; Pronounced</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>C1</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>C2</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>H7</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>D4</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>B2</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>P6</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>P13</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>P14</td>
<td>&quot;sock-a-toe-a&quot;.........Trigonometry</td>
</tr>
<tr>
<td>2-0 &quot;Richard of York Gave</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>P1 (gained) Battle In</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>P3 Vain</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>P5 Sequential order of the</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>P4 spectral colours</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>H8</td>
<td>&quot;Richard of York Gave</td>
</tr>
<tr>
<td>3-0 &quot;BODMAS&quot;</td>
<td>&quot;BODMAS&quot;</td>
</tr>
<tr>
<td>C2</td>
<td>&quot;BODMAS&quot;</td>
</tr>
<tr>
<td>C10</td>
<td>&quot;BODMAS&quot;</td>
</tr>
<tr>
<td>C12</td>
<td>&quot;BODMAS&quot;</td>
</tr>
<tr>
<td>H4</td>
<td>&quot;BODMAS&quot;</td>
</tr>
<tr>
<td>4-0 &quot;I before E except</td>
<td>&quot;I before E except</td>
</tr>
<tr>
<td>P2 after C&quot; Spelling rules</td>
<td>&quot;I before E except</td>
</tr>
<tr>
<td>P9</td>
<td>&quot;I before E except</td>
</tr>
<tr>
<td>D3</td>
<td>&quot;I before E except</td>
</tr>
<tr>
<td>C4</td>
<td>&quot;I before E except</td>
</tr>
</tbody>
</table>
5:0 "Never Eat Shredded Wheat"..........................Points of the compass
B3
C6

6:O "Signs Of Happiness, Come After Having Tankards Of Ale"......................Trigonometry
H6
H4
C13

7:0 "Men Very Early Make Jugs Which Serve Useful Needs and Purposes"..................Sequential order of the planets from the Sun
P8
M1

8:0 "Some Old Hags Can't Always Heed Their Own Advice"..............................Trigonometry
H5

9:0 "Please Come Out For Goodness' Sake"..............................Classification in biology
D1

10:0 "Wufdoge"; pronounced "Woof Doggy"..........................Prepositions in German taking accusative case
M2

11:0 "Red Man V. Tramps..................Verbs taking etre in perfect tense in French
H2

12:0 "F.A.C.E"..............................Space notes in the treble clef
H1

13:0 "Never Enter Church Eating Salmon Sandwiches And Raspberry Yogurt..................Aids the spelling of "necessary"
P7

14:0 "Chin-Knee-Toe, Make-a-Bow, See-It-Go"..............................Throwing Javelin, Shot, Discus
D5
The letters stand for aspects of Hitler's rise to power.

The Five Ws: "Who did What, Where When and Why"? A way of summarising historical data.

"PIE" - One's PIE (etc) PIE

"A.D.V.E.N.T" French verbs

"Every Good Boy Deserves Favour" Line notation in the treble clef

PORT TALBOT RAILWAY 100 PTR

100 (Simple interest)

"ROY G BIV" Sequential order of the spectral colours

"The 3 P's, Preserve life, Prevent worsening, Promote recovery" Principles of first aid

"IFSWA" Method of approach to solving problems. Information (main points/data from question) Formula (to be stated) Substitution (in formula) show working, show answer

"2 a's SEPARATE 2 e's" Spelling of SEPARATE

"In 1492, Columbus" Historical dates
MNEMONICS OTHER THAN FIRST CHOICE

26-0  "Richard of York Gave
P8       (gained) Battle in
H8    Vain................................Sequential order of the
M1     spectral colours
M1
B1
C6

27-0  "I before E except
P10  after C"........................Spelling rules
P11

28-0  "PIE" - One's PIE (etc).........Pie
P11
C1

29-0  "BODMAS"........................Order of precedence
H7
H8

30-0  "SOHCAHTOA"; Pronounced
P15  "sock-a-toe-a"................Trigonometry

31-0  "Never two Ss
C4    together: Never Dear
Sir, Yours sincerely
in signing-off a
letter........................Correct terminology in
letter writing

32-0  "MEANINGFUL VARIABLES
C2    IN PROGRAMMING-BETTER
PROGRAMMING"...............Acronyms within computer
study theory

33-0  "AA" ("Artery takes
D1    Away blood")..............Circulation of blood

34-0  "The 3 S's, Stiffen,
B1    Strengthen, Shape".........Use of interfacings in
textiles
35-O Silly
B2 All

Tom
Cats

Which angles have positive ratios

36-O "You must go down the
D6 corridor before going
upstairs". The location of grid-

37-O M-VEM-J-SUN-P. The sequential order of the
B3 planets from the Sun.
"Pupils tend to remember
that Mercury is the closest
and Pluto is the farthest;
"Vem" & Sun" help them to
piece together the rest
of the sequence"

38-O T.M.P. Word order of adverbs in
H2 German

39-O "SCAP". Perfect and imperfect tense
H2 in German

40-O "FIOS". Expansion of brackets
P15

41-O W.T.B.C. - "West
C3 Tooting Broadcasting
Corporation". Wheat, Turnips, Barley &
Clover. Norfolk Four-course
Crop Rotation

42-O T.U.L.I.P. The five points of
C3 Calvinism/the doctrines of
the Puritans/Calvinists

43-O "TOY". Breast-stoke leg action. Eg,
D5 legs form letters T, O, Y,
during movement

44-O "Stamp, Slap, Brush
D5 & Bow". The bowling action in cricket
There is a RATE in SEPARATE. The spelling of separate.

Y + S = "ies". Plurals involving 'Y' endings.

A foxy moron is an oxymoron. Literary terminology.

Some Try Very Carefully To Manufacture For Consumption Nickel-Coated Zinc. The first row of transitional elements in the periodic table.

One is a bun, etc. Memory (pegs) using mnemonics.

Mrs TRAVENDAMP. Verbs in French forming perfect tense with etre.


Mary's Violet Eyes Made John Stay Up Nights Pining. Sequential order of the planets.

Mary Vincent Eats Ma's Jam Sandwiches Under Nelson's Pillow. Sequential order of the planets.

Roman Catholic. Order of matrices.

56-O "Knock Him Down My Dear Cute Man".............................Kilometres - Millimetres

57-O "Some One Has Chalked A Horrible Thing On Angela"..........................Formulae for sine/cosine

58-O "Every Good Boy Deserves Favour"..........................Line notation in the treble clef

59-O "F.A.C.E"..........................Space notation in the treble clef

60-O "Some Old Hags Can’t Always Heed Their Own Advice"..........................Trigonometry

61-O "Little Beggar Boys Catch Newts Or Fish Nearby"..........................Periodic table of elements

62-O "All Cows Eat Grass"..............Bass clef stave-space C5 notation

63-O "Rejoice Heartily Your Teacher Has Mumps"..........................Spelling of the word "rhythm"

64-O "APE"..............................The planning of learning M1 activities: Activity, Purpose, Enjoyment

65-O Complex graphics..................Ohm’s law P4

66-O Complex graphics..................Density etc. P4

67-O "All Silver Tea Cups"..............Quadrants for sine, tangent, cosine, etc. P14

68-O "Every couple has its moment: (E.C.H.I.M.)..................Couples and moments - mechanics P6
69-O "When in doubt, check it out" An aid to the avoidance of errors
RESULTS

ALL RESULTS ARE EXPRESSED AS PERCENTAGES OF THE TOTAL NUMBER OF RESPONSES.

AGE:
The average age of staff who use mnemonics was between 36 and 45 years, (43.5%) mostly male, (71.5%) with an average teaching experience of 11-15 years (mode).

WITH WHICH YEAR-GROUPS?: The year-groups with which mnemonics had or were being used are described below as percentages of the overall responses made by mnemonic users:

<table>
<thead>
<tr>
<th>YEAR</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.8</td>
</tr>
<tr>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>20.5</td>
</tr>
<tr>
<td>5</td>
<td>18.5</td>
</tr>
<tr>
<td>6i</td>
<td>8.5</td>
</tr>
<tr>
<td>6ii</td>
<td>6</td>
</tr>
</tbody>
</table>

CHILDREN'S RESPONSE TO USING MNEMONICS - STAFF PERCEPTIONS: Assuming "caution" (9%) and "Strong reservation" (0%) are negative responses, and "interest" (51%) and "enjoyment" (39.5%) are positive, 81% of staff who use mnemonics said they were positively received by their children.

THE NUMBER OF MNEMONICS ACTUALLY USED BY STAFF:
In reporting the actual range of mnemonic usage during their teaching careers, the results were as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>62.5%</td>
</tr>
<tr>
<td>4-8</td>
<td>22.5%</td>
</tr>
<tr>
<td>9-15</td>
<td>12.5%</td>
</tr>
<tr>
<td>15+</td>
<td>2.5%</td>
</tr>
</tbody>
</table>
CURRICULAR-AREAS WHERE MNEMONICS ARE USED:
These are expressed as a percentage of the total responses made by mnemonic users:

- English: 19%
- Mathematics: 32%
- Science: 13%
- Humanities: 13%
- Design & Technology: 4%
- Expressive Arts: 7.5%
- Foreign Languages: 5.5%
- Religious Education: 4%
- Economic awareness: 0%
- Computer studies: 2%
- First-aid: 2%

ORIGINS OF MNEMONIC APPLICATION:
15.5% of mnemonic users said they had designed and used mnemonics with their classes as a result of a learning need. 54.5% learned their mnemonics during their own schooldays, 17.5% from a colleague, and 8.5% as a result of reading. Additional sources were: Spouse, 1.5% and parents, 1.5%.
DISCUSSION:

These figures suggest that a variety of mnemonics are used by the teachers from reception (year 7) onwards. Although the general trend is towards an incremental progression through first to fourth-years, it would be misleading to conclude that the use of mnemonics declines in the fifth-year. A review of the mnemonics cited by staff, strongly suggests that mnemonics are used (informally) in preparation for examination during the fifth and sixth-year.

A consistent feature of the mnemonics cited, is that they facilitate the learning of important rules or facts which form essential parts of a subject’s knowledge-base. Once these rules or facts have been learned and can be recalled effectively, it becomes possible for the child to meaningfully disseminate and organise subsequent information.

Examples of this are numerous. "Every Good Boy Deserves Fun" helps teach stave line notation in the treble clef. Without which knowledge conventional music cannot be played. "Never Eat Shredded Wheat", teaches young geographers the points of the compass. It appears that, almost without exception, teachers have evolved mnemonics to "get over" the basic facts in their particular subject. Initially, this may be a simple acronym or acrostic such as "ROY-G-BIV" to teach young scientists the spectral colours. Alternatively, it may take the form of a more complex acrostic such as "Pelicans Find Vindaloo Curry Awfully Satisfying", to help in sequencing an assessment scale in Craft, Design and Technology.

The broad range of mnemonics cited by staff, related to a variety of subject-areas, and it was very encouraging to note that staff who use mnemonics thought their children adopted them positively. Of course, it would be interesting to know how effective the mnemonics were in aiding retention and recall of the learning material. This could form the focus of subsequent work.
Below is a comparison between survey results from the study school and the combined mnemonic-user returns from all the other schools surveyed.

KEY:

\[ n \] = Number of responses

\[ 1/S = n \] First choice of study-school staff

\[ 2/S = n \] Other than first choice of study-school staff

\[ 1/O = n \] First choice of staff in the other schools

\[ 2/O = n \] Other than first choice of staff in the other schools

<table>
<thead>
<tr>
<th>MNEMONIC</th>
<th>1/S</th>
<th>2/S</th>
<th>1/O</th>
<th>2/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;SOHCAHTOA&quot;</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>&quot;ROY G BIV&quot;</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Never Eat Shredded Wheat&quot;</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Richard of York...&quot;</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>&quot;I before E, except after C&quot;</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>&quot;BODMAS&quot;</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>&quot;Every Good Boy Deserves.....&quot;</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

This table displays the most frequently cited mnemonics. The most widely used is, "Richard Of York Gained Battle In Vain", [6] but the mnemonic cited as "best" by most staff is "SOHCAHTOA" [7]. Evidence that certain mnemonics are localised, is found on a number of occasions throughout the survey. For example, "ROY G BIV" (1-S) and "Many Naughty Rabbits....", (5-S) are items which fail to feature prominently in the responses from other schools. This suggests the localised transmission of particular mnemonics within departments or faculties.

6 Which helps teach the spectral colours.
7 Which helps teach aspects of trigonometry.
The same is true for a large number of the less common mnemonics. Although there are 4 or 5 mnemonics which appear to be more universally employed, (e.g., 1-S; 2-S; 3-S; and 6-S), perhaps the most surprising feature of the survey is the rich diversity of the mnemonics reported to be in classroom use. Noteworthy is the range of mnemonics used to teach trigonometry. The letters of "SOHCAHTOA" (1-O) also appear in "Signs Of Happiness Come After Having Tankards Of Ale", (6-O) and also, "Some Old Hags Can't Always Heed Their Own Advice" (8-O). Again, although 1-0 and 6-0 appear to be relatively "universal", 8-0 is reported once in the entire survey. Another example of mnemonic overlap is those used to aid learning the sequential order of the planets. Here, the more familiar "Men Very Early..." etc, (7-O) contrasts with the unfamiliar acrostics, "Mary's Violet Eyes Made John Stay Up Nights Pining" (52-O) and "Mary Vincent Eat's Ma's Jam Sandwiches Under Nelson's Pillow" (53-O) and a type of acronym, "M-VEM-J-SUN-P" (37-O).

The range of mnemonics used to help children learn these items of information indicates that some teachers respond to their children's learning needs either by using a mnemonic they have gleaned from the literature or from other colleagues, or have designed themselves. Close scrutiny of the survey responses reveals a particular association between items of largely arbitrary information and the appearance of one or more mnemonics to aid its teaching. Although a number of reduction mnemonics such as acronyms are cited, (e.g., 1-O; 3-O; 13-O; 19-O; 24-O; 38-O; et al., the vast majority of mnemonics either directly or indirectly take the form of acrostics. Many of the mnemonics cited embellish both the content and context of the material they accompany, often through plausible statements such as: "Richard Of York Gained Battle in Vain" (2-O) or by the construction of bizarre associations like: "Never Enter Church Eating Salmon Sandwiches And Raspberry Yoghurt" (13-O). A number of mnemonics incorporate rhyme, (e.g., 4-O; 5-O; 14-O; 25-O; 46-O; 50-O; 69-O) and seem to be both effective and durable learning aids as a result. Perhaps surprisingly, two of the most common mnemonics receive a poor showing. "Every Good Boy Deserves Fun/Food" etc, (4-S) received only 3 nominations, and although these were first choice mnemonics, the mnemonic was not nominated by any staff from any of the other schools surveyed! Again surprisingly, the mnemonic "Thirty days hath September......etc," failed to feature in the survey at all! It would be interesting to know if this features in the learning of junior-school children, as this is another area of knowledge where little or no information is available at present.
SUMMARY OF SECTION 8

The importance of more recent ideas related to classroom learning is discussed in association with the main findings and conclusions of this study.

This is followed by a detailed description of how teachers, unfamiliar with mnemonics might use them to promote more effective classroom learning.

GENERAL SUMMARY AND CONCLUSIONS
In the interests of brevity references will not be cited to support specific statements contained in this section unless new evidence is presented, or it is considered appropriate to justify particular proposals. 
The emphasis here will be on theoretical and practical considerations related to classroom learning using mnemonics.

RESEARCH FINDINGS

Contrary to the confused and inconclusive evidence available related to the efficacy of first-letter mnemonics, and in particular to acrostics, the results of this study offer considerable support for their potency and potential in regular classroom learning situations.

Given the findings of the present study, and those of Cox, (1991) statements condemning first-letter mnemonics as "ineffective" learning aids, (e.g., Boltwood and Blick, 1970; Perewiznyk and Blick, 1978) suggesting that they "don’t aid memory", (e.g., Carlson, Zimmer and Glover, 1981) seem certainly inaccurate if not professionally misleading.

There are at least three important reasons why laboratory trials have produced such distorted and highly conflicting conclusions.

First, the populations studied in conjunction with first-letter mnemonics have been totally unrepresentative, e.g., typically middle class, academically able students, who have participated in psychological trials as a means of obtaining accreditation towards qualification on college or university courses, e.g., subjects of Perewiznyk and Blick, (1978) and of Morris and Cook, (1978).

The sample for the present study was drawn from a state mixed-ability comprehensive school. Groups comprising the three learning conditions in the two age-groups studied were carefully matched in relation to background, academic ability and recall ability.
Second, the material that this unrepresentative sample has been required to remember has been almost wholly artificial in nature, e.g., as in Nelson and Archer, (1972) alien to regular learning situations. Learning any material in this type of context conflicts with a good deal of established psychological theory proving detrimental to effective learning, (see Bartlett, 1932). For learning to be most effective, it should occur as an integral part of a meaningful and purposeful activity engaged within a meaningful context. Further, effective learning occurs when the learner is intrinsically motivated to remember the material, (e.g., see Ames and Ames, 1984) although it is known that extrinsic rewards can also improve recall performance in children. (e.g., Booth, 1981)

In an attempt to avoid artificiality, the learning material chosen for the present study was drawn from the childrens' regular syllabus. The material was taught by a familiar schoolmaster in the context of a typical learning environment.

Third, so far the sample sizes from which data and hypotheses have been extrapolated have typically been very small in comparison to those used in the present study. It is certainly not atypical to find claims based on total sample sizes of forty subjects, (e.g., Perewiznyk and Blick, (1978) thirty, (e.g., Morris and Cook, 1978) - or less!

The conclusions and hypotheses drawn from the present study are made following the careful examination of the performance of c.240 children c.120 eleven-year-olds and c.120 thirteen-year-olds over thirty related experiments in both immediate and delayed recall conditions.
Further, unlike previous studies, an analysis of children's regular learning methods has been studied along with a detailed analysis of the responses children make in mnemonically instructed situations. Additionally, for the first time, evidence has been obtained related to the range of mnemonics teachers themselves use during lessons in order to make often arbitrarily related learning material more memorable.

The National Curriculum emphasises the need for children to learn facts and concepts effectively and recall these accurately when required.

As a concept, accurate factual recall is repeatedly mentioned throughout a wide range of the standard attainment targets. Teachers and educationalists have been charged with the task of ensuring that students, regardless of ability, achieve their optimum potential. This is a formidable goal. Whereas most teachers have both the expertise and ability to deliver completely new syllabuses, no National Curriculum document is forthcoming about how to make "the acquisition of facts" and "knowledge of" things more durable, despite these forming the crucial foundation or knowledge base of every curricular-area, (e.g., Newell, 1980; Resnick, 1982; Chi, 1985).
I recently examined a number of D.E.S. documents related to the Curriculum From 5 to 16. Emphasised repeatedly is "....the importance of concepts", and of "Remembering terms", [1] "knowledge, skills and understanding" and "what children should normally be expected to know", [2] but nowhere is it made explicit precisely how children's memory might be improved. Once again the emphasis is on informing teachers about what children should know, at what stage information should be taught and what form it should take, without supplying teachers with appropriate psychological schema to achieve these objectives most effectively and efficiently.

Objective evidence suggests that strategy instruction in general may not be sufficient to promote children’s spontaneous use of a strategy, (e.g., Keeney, et. al., 1967) but there are strong indications to suggest that children who are taught when and how to employ strategies (along with periodic revision of the technique) subsequently generate learned strategies spontaneously, (e.g., Brown, 1975; Belmont and Butterfield, 1977; Kail, 1979). Further, children with a broader more flexible repertory of learning and cognitive strategies at their disposal, learn more effectively than their 'strategy impoverished' colleagues, (e.g., see Flavell, 1971; Swanson, 1990) evidence endorsed by the present study.

1 D.E.S., Mathematics From 5 to 16, (1989) H.M.S.O.
MAIN FINDINGS

The evidence presented both in this study and that of Cox, (1991) permit the following conclusions to be drawn:

1) A broad range of mnemonics are used by a number of practising secondary teachers covering a wide variety of curricular areas.

2) Children taught to use simple mnemonic skills and techniques, demonstrate the ability to learn and recall considerably more curricular related arbitrary information than either regular or rote learners.

3) Although children instructed to use simple mnemonics typically perform little better than regular or rote learners at immediate re-test, at delayed recall, mnemonic users demonstrate very significant learning improvements.

4) Children as young as eleven are fully capable of generating and applying their own first-letter mnemonics after limited instruction on how to mnemonicise material.

MNEMONICS:
OVERCOMING THE PREJUDICE

Over the years considerable derogatory discussion has been directed at mnemonics in general. At least some of this criticism concerns the contention that mnemonics are merely "crutches" or are an "artificial" means of acquiring information and learning.

This ridicule appears to be wholly unjustifiable. They are not a learning substitute where meaning is lost at the expense of knowing additional facts. Neither is learning via mnemonics an "improper" or "impoverished" way of learning. It might be considered that learning without mnemonics reflects impoverished learning!

Knowing when a mnemonic might be useful in the classroom ought to be a simple skill that all teachers possess. Such is the range of mnemonics that they can aid children's acquisition of knowledge in a rich variety of contexts from foreign vocabulary instruction to factual knowledge related to Craft Design and Technology.
Enter reality! Even among colleagues in the teaching profession one is aware of reluctant attitudes toward both theoretical and applied innovation especially if this falls outside their directed teaching brief or is considered impracticable. An associated problem is identifying an adequate if not efficient means of communicating more recent knowledge to practising teachers.

With some justification teachers express concern about the speed with which change in the structure of curriculum is occurring and many feel that their integrity to allocate and prioritise current learning time is being threatened. Indeed, the force of educational change is so awesome that keeping abreast of current ideas has been likened to "Shoeing a galloping horse without the knowledge of which direction the horse is being ridden" [3]. Perhaps unsurprisingly, teachers more than ever feel that experimenting with teaching methodologies is a luxury best reserved for "better times". Given such circumstances it is prudent for the student of mnemonics to ask at least three important questions:

How can teachers be persuaded that mnemonics are effective learning aids?

How can natural communication between researchers and teachers be achieved?

How can teachers become informed about what mnemonics are and how they can considerably facilitate classroom learning?

3 A statement made by an NUT delegate at a conference in May, 1991.
Teachers' attitudes towards using mnemonics appear to be very different, (see the section marked Staff-survey in this study, pp.293-325) This could partly be due to the impoverished way cognitive strategies are addressed in formal instructional programmes, where how to teach and what to teach has traditionally dominated teacher-training syllabi. Of course, there is only a finite amount of time available to prepare student teachers for the classroom, but there would appear to be a strong argument for making much more explicit to student teachers how children can be helped to remember more of the facts, concepts or skills communicated in lessons.

Another reason why teachers appear to adopt the use of mnemonics in an arbitrary, ad-hoc manner, is that the resourcing of in-service and regional courses for teachers appears to be almost exclusively devoted to familiarising teachers with innovative educational packages [4] and curricular developments [5] rather than transmitting more recent psychological findings and developments.

It seems such an inadequate policy to leave to chance how children remember the plethora of facts we tell them to remember. Probably the D.E.S. has formal plans for addressing this crucial issue?

Recently evidence of a more positive attitude towards mnemonics has appeared. Over the past decade or so the media has publicised a number of commercial study techniques which use mnemonics to promote learning. On the T.V. light entertainment is frequently punctuated by displays of "memory-men" who offer convincing examples of the potential effectiveness of mnemonic techniques. Other evidence too, suggests a changing climate in which mnemonics are becoming more generally accepted and respected learning tools, a small but growing

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4 For example, National Records of Achievement.
5 e.g., assessment at relevant key stages.
number of useful books related to study techniques is also emerging, (e.g., Reid's 'Improve Your Memory Skills', published by Usborne, 1988) which actively promote the use of a wide range of mnemonics to aid learning.
COMMUNICATING ABOUT RESEARCH

"Liberation from the classroom on full pay: that was the life for a typical M Ed student luxuriating on a one-year secondment in the sixties and seventies......now few teachers in Britain are able to study full-time. Secondments have disappeared...... What is certain is that the ability of the profession to stay in touch with a level of discourse beyond the immediacy of the classroom now seems to depend upon teachers being willing to give up their own time and spend their own money." (Gerald Haigh, TES, 31/5/91)

Another link which remains largely unaddressed is that between research and classroom practice. If the rationale underlying individual or collaborative programmes of research is that the knowledge gained should be disseminated amongst those in the most effective position to capitalise upon its acquisition, why are there no formal communication arrangements between research institutions and teachers? Indeed, to the writer’s knowledge, no arrangements exist between research institutions and schools themselves!

The absence of planned arrangements between research institutions and schools might lead teachers along with others to ask a number of very important questions including:

What is the point of funding research from already stretched educational budgets if the outcome is not shared with those for whom it was intended?

Given that research findings seldom filter through into schools, is professional or personal development sufficient justification for resourcing individual research projects?

What priority will research projects receive under the Local Management of Schools? Will teachers be discouraged to become involved in individual projects due to cost?
Even though this study suggests that the classroom learning of arbitrarily related facts [6] can be improved by twice and sometimes three times the effectiveness of regular and rote-learning methods, the problem remains of precisely how to communicate this information to teachers.

How might they for instance become aware of the results of this study? If they should be made aware of its conclusions, what forum exists for them to discuss the potential of acrostics in the classroom? How might they share ideas? This type of question ought to be addressed by both the Department of Education and Science and the research bodies.

There seems little point in encouraging empirical research unless there is an effective mechanism designed to facilitate the sharing of knowledge between researchers and teachers.

The prospect of teachers becoming more actively involved in empirical research seems almost ethereal fantasy. Yet, teachers are the most effectively placed professionals to pursue investigations related to real classroom learning, practice and performance. They have a keen interest in pursuing lines of enquiry aimed at maximising the cognitive, affective and physical potential of their students in the most effective, practicable and economical way possible. Sadly, there is little encouragement for practising teachers to undertake empirical research at present. In the writer's education authority there appears to be no part-time research at Ph. D level beyond the present study. I doubt that this reflects an unwillingness of teachers to become involved in research, more that the opportunities to participate have become less realistic and unresourced.

6 Of a type synonymous with the knowledge-base of virtually every subject.
With these issues clearly in mind, a discussion of how teachers can address children’s strategic thinking more generally is followed by some practical guidance to teachers related to using acrostics in the classroom setting.
RAISING CHILDREN’S METACOGNITIVE AWARENESS: SOME PRACTICAL IMPLICATIONS

The growing interest in metamemory strategies and mnemonics has considerable relevance to the management of classroom learning.

It has now been adequately demonstrated that mnemonicising skills can be taught to children. (e.g., see Cox, 1991 and results for both the mnemonic groups in experiments 2 - 7d inclusive of this study) But it has also been demonstrated that instruction per se is no guarantee that children will subsequently adopt a strategy if unprompted to do so, (e.g., Keeney et al., 1967).

Teaching children *when* it is necessary to adopt some measure to make learning material more memorable is a complex issue, and requires more than mere instruction about *how* to use a particular strategy. (see the section marked “Metacognition” in this study) But, if as the literature suggests, there are no fundamental *structural* differences between the memory of children and adults, (e.g., Chi, 1976; 1978) it seems reasonable to assume children possess the necessary “software” to apply similar cognitive and mnemonic strategies as those typically adopted spontaneously by older people.

As the acquisition of superior metacognitive judgement and reasoning has been shown to lead to more effective learning with children varying in ability, (e.g., Andreassen and Waters, 1989) it should be in the keen interest of educationalists to teach metacognitive skills.
Raising children’s awareness of the limitations of their own
cognition, and of appropriate responses to meet different types of
learning demands, might also enable them to appreciate the
circumstances in which it is necessary to make learning a planned,
resourceful and self-interrogative activity, (e.g., see Kurtz and
Weinert, 1989).

The skill of cognitive self-regulation and management is not
limited to specific curricular areas. It is cross-curricular. The
point is underlined in the D.E.S., document The Curriculum From 5 to
16, (H.M.S.O.):

"The various curricular areas should reinforce and complement one
another so that the knowledge, concepts, skills and attitudes
developed in one area may be put to use and provide insight in
another, thus increasing the pupils' understanding, competence and
confidence."

There is now convincing evidence that the acquisition of superior
metacognitive skills leads to superior learning and reasoning per se
with normal, (e.g., Cross and Paris, 1988) gifted, (e.g., Siegler and
Kotovsky, 1986) and learning disabled children, (e.g., Mastropieri,
et. al., 1985c). The self awareness of personal judgement and
reasoning limitations and the accuracy with which these are perceived
extend far beyond the school setting. They are invaluable life skills.

If at any time in one’s life they are to be taught formally, this
must be planned for and accomplished during the school years.
Given that it is desirable that children should remember more
effectively, and also appreciate how to monitor and interpret self-
interrogative metacognitive awareness in a similar way to that of
adults, teachers should be encouraged to appreciate the circumstances
in which this type of instruction can best be delivered.
This discourse leads to the following issues:

1) Do colleagues address these issues adequately?

2) What possibilities exist where teaching designed to raise children's awareness of cognitive self-knowledge can be undertaken?

3) How can teachers become informed about the importance of metacognitive training as an aid to more effective learning?

There is presently little or no evidence to suggest the extent to which metacognitive issues are addressed in regular teaching programmes within the normal curriculum. Subsequent research may investigate this aspect of teaching with a view to establishing the following type of information:

1) Do teachers discuss with their children issues relating to self-interrogative learning?

2) Do teachers suggest to their children, ways of assessing when it is important to "do something" in order to remember information more effectively?

3) If the answer to questions 1 and 2 are "yes", what and how?

4) If the answer to either question is "no", this may suggest a definitive need for the situation to be addressed with more urgency.

Promoting amongst teachers an awareness of the importance of metacognitive training is at the same time a complex and elusive issue.

The opportunity of communicating recent knowledge concerning cognitive-developmental issues to teachers is likely to be masked by the variety of innovations presently in contention for curricular time and faculty finances.
This is unfortunate. Although the focus has more recently moved toward methodology, concern appears largely directed toward *what a child has attained, how the child has attained* in relation to others of similar age, and *how children can be assessed* to confirm whether or what they have attained.

While this type of innovation is both important and significant, there appears to have been no *explicit* expression of a desire to promote children’s own awareness of the limitations and strengths of their own cognition despite this being an essential feature of all problem-solving activities. (see "Knowledge and the National Curriculum", pp.90-95 of this study).

Once the demands of The National Curriculum and G.C.S.E. courses become less through familiarity, it might be possible for bodies associated with educational research and the training of teachers to address metacognitive issues. Researchers focusing on this area of study, could contribute considerably to this discussion by demonstrating:

1) The efficacy (or otherwise) of metacognitive training in a regular learning context.

2) The most appropriate methods of promoting metacognitive awareness amongst children within a regular learning context.

3) The extent to which metacognitive training can promote learning over more regular learning methods.

From a philosophical perspective, it could be argued that children have a *right* to anticipate that teachers will inform them of how *best* to study and learn information. Similarly, teachers have a right of access to information which might facilitate classroom learning and make lessons more effective.
Where this knowledge is unavailable, educationalists might be forgiven for proceeding with learning activities in much the same way as they have for millennia. But the rapidly growing wealth of knowledge related to how children learn, and how they can learn more resourcefully and effectively, should now be in the hands of practising teachers.

Again until some effective method of communicating this type of knowledge to classroom teachers exists, and access to this knowledge is carefully planned and managed, one wonders whether this will ever be the case.
CROSS-CURRICULAR MNEMONICS

If the curriculum is society’s formal means of conveying knowledge and skills to children in preparation for adult life, [7] common sense suggests that this knowledge should be made as durable as possible. Unfortunately there appear to be no formal arrangements to raise the metacognitive awareness of children in schools, [8].

The most important cognitive skills which we each have an interest in developing are those which facilitate learning, and also help us remember material in a such a form that subsequent recall is accomplished with the minimum of effort and the greatest precision.

Competence in the skills of learning and recall has considerable implications for all age-groups. Remembering lists, names or facts forms part of the daily routine. Typically adults have evolved a variety of responses to meet individual learning needs.

These responses represent the accumulative acquisition of a lifetime’s metacognitive experience; during which trial and error, intuition, and the scant knowledge of mnemonic hand-me-downs have resulted in the formulation of each individual’s strategy repertory.

Why should each individual’s knowledge of task-appropriate cognitive and metacognitive strategies be acquired in such an haphazard way and be so impoverished until adulthood?

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8 For example, metacognitive training appears in the National Curriculum only in very couched terms; it is never made explicit, the nearest related reference concerning more general problem-solving.
It seems such an obvious part of the learning process to encourage children to identify the type of circumstances in which they might need to do *something extra* in order to learn material more effectively, (e.g., Flavell, 1971). At a simple level this "something" may be an instruction by the teacher to *attend* to what is being said, to focus carefully upon a diagram or picture, or to appreciate a relationship between present and previously learned material, (e.g., see Carver and Scheier, 1986: Wigfield, 1988).

When a series of words have to be learned to form part of a broader knowledge-base, teachers have traditionally responded to this need by instructing children to rehearse or rote-learn. Although the efficacy of this method has received empirical support, (see Kail, 1979) the method is thought to be effective because successive memory traces are superimposed upon each other whilst simultaneously establishing a relationship (traces of identical strength) between associative items. This effectively processes the learning material to greater "depth". (e.g., see Craik and Lockhart, 1972) Hence when we are asked: "What are three fours?", if the times-table was initially learned using the rote method, we are able not only to respond almost immediately, "twelve", but also anticipate "four fours". In this way, each item cues successive items, (Whittaker, Mc Shane and Dunn, 1986) and helps organise learning material into more manageable and meaningful "chunks". (e.g., see Ceci and Bronfenbrenner, 1985)
To be most effective this sort of instruction should ideally be accompanied by discussion aimed at raising the children's metacognitive awareness about the type of circumstances in which rehearsal will promote learning in the future. (see Kail, 1979) But as it may be recalled, children often experience natural difficulties in expressing abstract concepts, (Vliestra, 1982) and so periodic review of the strategy may be necessary. (e.g., see Ornstein, et. al., 1985)

Traditionally, the suggestion that younger children could be successfully instructed in the use of mnemonics has been received with scepticism by psychologists. (see Richardson, 1980 for an historical discussion) Progress has been made.

1) The findings of the present study and those of Cox, (1991) provide firm evidence that children in school years 6 and 7 are able to effectively manipulate mnemonic material. Further, they demonstrate competence in constructing mnemonics themselves and applying these to real learning situations.

2) Children using mnemonics remember learning material considerably better than children adopting alternative learning strategies. Additionally, a communication with Cox supports the writer's unproven hypothesis that children who use mnemonics to aid learning, find the learning activity itself intrinsically more rewarding and enjoyable.

There is supportive and encouraging evidence suggesting that sentence-mnemonics [9] acronyms and acrostics may be useful in the classroom, (e.g., for a review see McLaughlin Cook, 1989) especially if they are produced by the teacher. (e.g., see the section marked "First-letter mnemonics" in this study) The evidence suggests that first-letter mnemonics in particular make list learning far easier and more reliable than learning without instruction.

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9 A "sentence-mnemonic" is a mnemonic formed of to-be-learned words. The target words are arranged in a memorable form (sometimes together with filler-words) as the name suggests.
Information related to how children cope with learning is important to the teacher.

At the time when children are inundated with unfamiliar lists, facts and names, (e.g., when they enter the multi-subject arena of the secondary school) they are typically without the cognitive expertise and skills to learn material as strategically or as effectively as older children and adults. (Flavell, 1971) The child is confronted with volumes of arbitrarily related concepts facts places and names, from as many as ten or more separate subject-areas [1] and typically told to "learn this, or that" with little or no guidance about how to proceed.

Acrostics now offer a proven, reliable and effective answer to these learning needs.

The results of the present study and that of Cox, (1991) confirm that an effective method of helping children with this type of difficulty is through teaching them the **appropriate** circumstances in which to use mnemonics.

It is unrealistic for teachers to expect children to achieve specified targets or goals, such as remembering information, without offering them the most effective means of achieving this.

If it is accepted that children should be **deliberately** (formally) helped with learning demands and instructed about the circumstances in which mnemonic strategies might facilitate learning, it must be asked: What opportunities exist in schools for this to occur?

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1 A typical range of subjects at secondary level might include: English, Geography, History, Maths, Modern Languages, Music, Religious Studies, Science, Technology, et al.
MNEMONIC MANAGEMENT:
SOME PRACTICAL CONSIDERATIONS

Teachers would not expect courses or lessons which had been badly
designed to achieve the results of those well conceived. Careful
planning, resourcefulness and time-management are at the heart of good
practice.

No one in education, least of all teachers, has time to allocate
innovation which has little or no educational benefit or return. One
of the main objections to using mnemonics as alternatives to other
methods of learning information appears to relate to the extra time
required to process the information at both the learning and recall
stage.

The results of this study suggest otherwise.

Considerable care was taken to match the learning and recall time of
the mnemonic, rote and uninstructed conditions. If it is claimed that
the arbitrarily allocated learning time on each task penalised the
uninstructed and rote learners as the evidence seems to suggest this
would have impeded their long-term performance still further.

During informal classroom trials the writer has found the
teaching of acrostics to be both an effective and economical use of
class-time, typically taking no longer than it might have taken to
deliver and consolidate the information [11] using more conventional
means. At immediate re-test [12] learning arbitrary information using
acrostics produces considerably superior recall to learning which
might have been achieved adopting regular instruction. After a delay,
typically of about two weeks, the influence of the mnemonic becomes
progressively more pronounced, an effect substantiated by the long-term

11 Fix the learning material in the children’s minds.
12 Verbal or written confirmation (or otherwise) that the child/ren
have learned the mnemonic in connection with the target material,
typically seconds or minutes after the initial learning.
re-test results of this study and similar to that obtained in long-
term effects of bizarre mental imagery. (e.g., O'Brien and Wolford,
1982)

Group-generated first-letter mnemonics have a tendency to be less
reliable (see Kerst and Levin, 1973) for a number of reasons:

1) They take longer to design.

2) The context in which they have been designed and the
associations made in their formulation have a tendency to
restrict their effective transfer to other groups.

3) Despite instruction, students often forget to differentiate
between items in a list which are either phonetically similar,
or bear the same first letter. For example, if there are two
Ss in a sequence of material to be learned, students tend to
make no effective discrimination between the two words leading
to difficulties at both the encoding and recall stage.

Given this knowledge it is important to review how acrostics may be
constructed and the types of circumstances in which they will be most
effective.

AUTHENTICITY OF SOURCE MATERIAL

The importance of obtaining accurate source material cannot be over
emphasised. The material used in experiment 4 of this study,
(historical periods experiment) was obtained from a booklet which
provided information which is to historians, factually inaccurate.

Although the material was mnemonised in good faith there was
clearly a failure on the writer's part to cross-reference and
investigate the source more comprehensively. Although this knowledge
does not diminish the results of this study, the point has to be made
that it is wise to have all source material checked by a specialist
representing the curricular-area for which a mnemonic is being
designed.
MNEMONISING MATERIAL

What follows is intended as a guide. The type of material traditionally targetted for mnemonising is that comprising lists, the knowledge and sequencing of which forms an essential part of a subject's knowledge-base. For example, the incomplete acronym "ROY-G-BIV", in addition to providing the science learner with first-letter cues, also sequences the information at recall provided the learner remembers all of the acronym. In the case of both acronyms and acrostics, if any of the mnemonic words are forgotten, or recalled out of sequence, the associated learning material will be defectively recalled. To this end, it is vital that the mnemonic is memorable and its association with the learning material is made as strong and durable as possible. These are the two most important features of mnemonising.

Given this information, additional criteria can be established:

a) Unfamiliar words are best avoided.

b) Long words are best avoided unless their inclusion results in a more memorable mnemonic.

c) The mnemonic, together with the learning material, should be maintained in memory through periodic self-testing.

d) Ridiculous, even bizarre word combinations, depicting totally implausible events are often the most memorable. (e.g., see the section marked "The bizarre versus plausible imagery debate", pp.115-119 in this paper,)

e) Children unfamiliar with acrostics will benefit from experiencing some examples. This will illustrate both how memorable they can be and also the associations required in their operation.
Studies related to first-letter mnemonics have stressed the importance of subjects knowing the learning material prior to its being mnemonicised. For example, an acrostic designed to help children learn the sequential order of the spectral colours like: "Richard Of York Gained (or G-ave) Battle In Vain" may be of little practical use unless the child already knows the names of some of the less familiar colours such as violet and indigo. Where the child is unable to cue the words "violet" and "indigo" because these names have been totally forgotten, recalling the mnemonic accurately will only assist in cueing the forgotten material. In this type of case even if a child can correctly recall the mnemonic, the information cued will be incompletely recalled, albeit in the correct sequence, e.g., Red, Orange, Yellow, Green, Blue, _____? _____?

A more obvious weakness of acrostics is the possibility that the learner will fail to recall parts of the mnemonic itself. Using the same example, if the learner is able to recall nothing more of the mnemonic than someone or something or other "Gained (or "Gave") Battle In Vain", not only will the appropriate first letter cues for R-ed O-range and Y-ellow be inaccurate, but so will the sequencing.

Problems of this type highlight the need to form strong associations between the learning material and the mnemonic. The mnemonic has to be effective both to cue the first letters of names, and to sequence appropriately those names once recalled.
SPOTTING OPPORTUNITIES TO USE ACROSTICS

It is difficult to imagine any area within the curriculum where a series of unrelated facts or names do not have to be learned. Such information often forms an important part of each subject's knowledge base, (e.g., see pages 86-101 of this study). The evidence available suggests that acrostics can be very effective for lists of previously learned words of up to nine items.

The results of this study suggest that there is a fall off in the potency of the mnemonic after six-item lists [13] but further work is needed to establish this scientifically. Given this knowledge, teachers interested in making this type of learning more effective should scrutinise their syllabi to identify material suitable for mnemonising.

MNEMONISING METHODOLOGY

To the writer's knowledge no practical suggestions have yet been made about how to mnemonise learning material in connection with acrostics. What follows is not intended to be a definitive statement on how this should be accomplished, merely an attempt to provide a formative framework with a view to promoting further discussion on the process.

Two examples of the mnemonising process will be reviewed. The first is related to the writer's experience of using student-generated acrostics. The second, describes the methodology used in teacher-generated acrostics.

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13 Consistent with Miller's (1956) theory of "The magical number seven".
STUDENT-GENERATED ACROSTICS

The example here will be that used to mnemonise the learning material for experiment 5, (C.D.T. assessment scale). It is a student-supplied mnemonic.


1) Teach the individual meaning of the terms/words or concepts and where appropriate, their relationship and context, as might be accomplished in a regular lesson. (For an example, see experiment 5 of this study).

2) Decide whether the order of the words is important. In this particular case (and in most cases) it is. If the material targetted for mnemonising comprises a group of words, whose serial order is unimportant, a more flexible approach to mnemonising can be adopted. Any vowels forming the first letters of the learning material can be rearranged to form an acronym. For example, in educational management there is much talk of "S.M.A.R.T" targets, "SMART" forming an acronym of the first letters of the words: Simple, Manageable, Attainable, Realistic and Testable. Although there is no pragmatic need to recall the words in serial order, by arranging the first letters in this way a memorable mnemonic is formed. If it was essential that the words were to be recalled in the format: Realistic, Testable, Simple, Manageable, Attainable, an acronym [14] cannot be formed. Given the latter example, an acrostic could be constructed to meet the learning need. (e.g., see pp.354-359)

14 See "Acronyms" in the section marked "First-letter mnemonics," (pp.141-143) of this study.
3) If children as members of the learning group are unfamiliar with how to mnemonic material, use an illustration of how acrostics function. The writer has found the "Richard of York..." example is easily grasped even by young children. Write the first letters of the learning material on the board, e.g., P. F. V. C. A. S. Ask the group to either divide into small groups or pairs and ask them to construct a suitable acrostic. I have found that even as I finish writing the letters on the board, some of the more able are anxious to share their ideas. Set a time limit - make the exercise a form of a competition.

4) Request solutions. Here, the teacher must guide the group towards what may be the most appropriate acrostic proposed, (see above for suggestions) and it is a good opportunity to collectively identify inherent weaknesses in those proposed.

5) Arrive at concensus agreement about which acrostic is most suitable or memorable and learn this in association with the learning material. Ask members of the group to ensure the correct associations have been made.

6) Check that the students are still able to recall the information at the start of the next lesson.

7) Review and check periodically.
This procedure may sound both time consuming and protracted, in reality, learning material using mnemonics is more economical, more effective and more efficient. This is endorsed by the outstanding results of both mnemonic groups, (e.g., see experiments 2, 3, 4 and 5 of this study) and can typically be achieved in the same time that it takes using regular teaching methods. This is because, without the aid of the acrostic, it typically takes longer to teach this type of arbitrary information and get children to learn it in the correct serial order.

TEACHER-GENERATED ACROSTICS

The example here will be that used to mnemonic the learning material for experiment 2, (Planets experiment). The mnemonic was provided by the experimenter/teacher. The approach discussed here may seem somewhat detailed, but a full analysis was felt necessary as informal discussions suggest that although teachers are familiar with how to use supplied acrostics, [15] less is known about mnemonicising new material.

Learning material: Sun Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune Pluto

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15 For example mnemonics passed on by other teachers or learned from other sources.
STEP 1

Decide whether the order of the words is important. In this particular case it is. Where the order of the names or words to-be-learned is unimportant, (as in the "S.M.A.R.T." example above) the first letters of each word-to-be-learned can be organised to form an acronym. Even if there are insufficient vowels to form an acronym filler-words can be used to make the acronym read with integrity, although research suggests that filler-words can result in cancelling the mnemonic’s effect. (e.g., see the section on "Acronyms" in the section marked "First-letter mnemonics" in this study, pp.141-143) For example, L.A.S.E.R. is a word which has become synonymous with the energy of concentrated light beams, yet the acronym contains two sets of little known filler-words: Light Amplification (by the) Stimulated Emissions (of) Radiation. The inclusion of the filler-words facilitates the decoding of the acronym.

As the subject of this study is the efficacy of the acrostic, what follows will focus upon how an acrostic was constructed in connection with this particular target material.

(The Sun was incorporated into the mnemonic as it is an integral feature of the illustration forming the learning material).
STEP 2

a) Write down or word process the first letter of each target (learning word) item. In this case: S M V E M J S U N P.

b) Construct a small item-bank of words [16] which begin with the same first or first two letters as the target words, (a dictionary can facilitate this process). Mnemonic words containing the first two letters of each target word offer stronger cues at the time of recall than first letters alone, provided they concur with the serial order of the letters comprising the target-words.

c) Write each word on a small piece of card and arrange them as follows: (the target words appear in brackets, possible acrostic-words in bold italics)

(Sun) (Mercury) (Venus) (Earth) (Mars)

Sun/ny/ier Six Merry Vegetable/s Eat/s/ing Mars/'s
Mercury/'s Venus/'s Earth/'s March/ing
Venus/'s Very Early/ier Marble
Earth/'s Ear/s Mardy
March/ing Ear/s Mardy

(Sun) (Mercury) (Venus) (Earth) (Mars)

Subject/s Mercy Vessel/s Ear/s Mardy
Merchand/s Vessel/s Ear/s Mardy

Submarine/s Subject/s Mercury/J
S Mermaid/J Verse/s
Mercury/J Verse/s

Subway/s Mermaid/J Verse/s
Mercury/J Verse/s

Sun/ny/ier Mercury/J Verse/s
Mercury/J Verse/s

(Sun) (Mercury) (Venus) (Earth) (Mars)

Submarine/s Subway/s Merry Vegetable/s Eat/s/ing Mars/'s
S Mermaid/J Verse/s Ear/s Mardy

Subway/s Subway/s Merry Vegetable/s Eat/s/ing Mars/'s
S Mermaid/J Verse/s Ear/s Mardy

16 This may at first appear to be an uneconomical use of time, but once even a limited item-bank has been established it can be used on subsequent occasions ad infinitum. The writer has found that four or five words are often sufficient.
STEP 3

Aware of the practical criteria suggested earlier in this section, next establish whether one or more suitable acrostics can be constructed.

Sometimes this is difficult. Having constructed all but two items in the acrostic, Uranus and Pluto were still unmnemonised. The item-bank failed to provide items that could be incorporated into the nearly complete acrostic. It was therefore decided to use the letters U-R together and to promote the association "you are". At the level of associating the mnemonic with the learning material it would of course be essential to explain this point to children in each of the learning groups.

To facilitate this process it was decided to ask children to think of "U-R" not as isolated letters, but how they might be written in a love-letter. In both pilot and experimental trials, children were quick to appreciate this relationship and there was no evidence to suggest that the inclusion of this item caused any problems.

Given the original brief, that longer acrostics can be made more memorable by incorporating rhyme, it is necessary to determine the metre required. Then, by manipulating the potential acrostic words, a range of potential acrostics can be revealed.
Since it was not possible to provide a conventional word comprising the first two letters of the target word "Pluto" and which rhymed with "Junk", (the mnemonic word for Jupiter) the substitute "Plunk" was adopted. Although it might be thought that this artificial word would be less memorable than a real word, in fact the corollary seemed the case. The word "Plunk" aroused much amusement and became firmly associated with the learning material. (e.g., see the section marked "Research methodology in this study, p.190). The chosen acrostic, "Six Merry Vegetables Eating Mars Junk, Saturday U-R Never Plunk", represented one among numerous possibilities.

**GENERAL DISCUSSION**

There is no right or wrong acrostic. There are more and less memorable ones.

One difficulty facing teachers who are attempting to design acrostics, is knowing how to differentiate between memorable and less memorable mnemonics. Further knowing when children are sufficiently primed, sufficiently responsive and able to mnemonise material with guidance, (and appreciating how to manage the situation) is largely a function of the teacher's awareness of the child/group's individual or collective limitations.

Initially it will be necessary for teachers to supply mnemonics themselves, as it is known that mnemonising material requires both application and some skill.

If this activity is undertaken seriously and professionally, the evidence suggests that children will become progressively able to spontaneously mnemonise lists, names and facts as the need arises.
FUTURE RESEARCH

As in the case of metacognition there is much important work yet to be undertaken concerning first-letter mnemonics. Given the conflicting evidence it would be useful if this research had strong \textit{applied} associations. To this end a recent study has tested acrostics within the upper primary school setting. I will review the work in some detail as it is closely linked with the present study. For a more detailed analysis, see the section marked "appendix" pp. xlv-1ii.
COX’S STUDY

Although Cox’s samples were only one third the size of those used in this research the similarity of his findings offers considerable credibility to the present study. In addition the evidence suggests:

1) The power of acrostics can readily be adapted for use with upper junior school students.

2) At immediate re-test, there will be little evidence of an acrostics power.

3) At intervals extending beyond eight days, material learned using acrostics becomes more easily retrievable. This has been noted with three age groups to date 10, 11 and 13-year-olds.

4) Material learned without instructions of how to learn or by rote methods, is far less durable and less easily retrieved from memory than that which is encoded mnemonically.

5) Material encoded using acrostics considerably facilitates the recall of serial ordered items. This is true at all three ages so far studied.

Additional future work which would contribute to the present knowledge of mnemonics might include:

1) A survey designed to extend Cox’s (1991) evidence relating to current informal mnemonic practice in junior schools.

2) Applied empirical work testing the effects of subject and experimenter-generated acrostics amongst junior schoolchildren.

3) A survey designed to obtain evidence of current informal mnemonic practice in universities, higher and further education.

4) Applied studies designed to test the efficacy of acrostics against regular and rote learning conditions at long-term and very long-term re-test. There is a need for knowledge related to this issue, which addresses all age-ranges.

5) Applied studies designed to extend the present work in relation to maturation and the child’s ability to
   a) mnemonise acrostics spontaneously,
   b) mnemonise material using supplied mnemonics.
6) Applied studies designed to test the long-term effects of acrostics in free-recall conditions. Cox, (ibid.) has undertaken small-scale work to this end but little is known about the effects acrostics have on the learning of older children at long-term free recall re-test.

**MNEMONICS IN SCHOOLS: THE FUTURE ...........**

There is already some evidence that mnemonics are becoming acceptable learning aids in the educational community. A recent document published for the D.E.S. entitled 'History in the Primary and Secondary Years: An H.M.I. View' actually advocates the use of acronyms suggesting:

"We begin in our course at the school by presenting a brief outline of world history, organised under fifty headings and into groups whose initial letters form mnemonic words which can be easily learned by pupils." (pp. 60-61)

Using acronyms, the document presents seven groups of information each one containing key course elements. An example will suffice. "RODMAN" is an acronym for:

Romans
Our Lord
Dark Ages
Mohammedans
African Kingdoms
Norsemen

Although it is highly encouraging to see first-letter mnemonics being advocated by such an influential body, it is important to ask what is directly on offer for classroom teachers? Further, what do they stand to gain from the present research?
The answer is in two parts. First, the writer hopes for an opportunity to communicate the present evidence to the scientific community. Coupled with the evidence of Cox, (1991) this would enable some considerable clarification of our present understanding of the efficacy of acrostics in schools.

Despite the muddled findings of laboratory work using unrepresentative samples and artificial materials, it appears that contrary to Carlson, Zimmer and Glover’s (1981) findings e.g., "First Letter Mnemonics: DAM (don't aid memory)" , first letter mnemonics DAM - DO AID MEMORY!

The opportunity to report these findings would go some way to upholding the traditional faith many teachers justifiably have in the efficacy of acrostics.

Second, if educational research is to have any real practical value, teachers themselves must have access. To this end, Northamptonshire Education Authority have requested that a mnemonic handbook is designed which lists the mnemonics identified in the section marked "Survey" of this study, and provides an item-bank of examples related to National Curriculum key stages covered in Maths, English, Science and Technology. It is hoped that other education authorities might follow this lead, especially as acrostics can more than double children’s recall of factual information.

Factual recall for children in the more distant future may well be influenced by Orwellian prophesies. Only today, (10/6/91) the writer watched a fascinating “Horizon” programme on the TV relating to so-called “memory busters”, drugs that stimulate the synapses to improve recall. Possibly in the classroom of the future teachers will distribute such neural stimulants along with the lesson 'software', but until then, .......... who needs drugs?!
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THE APPENDIX

CONTENTS:

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all main experiments ---------------------- pp.liv-lvi
On the night of Monday January 16th, a robbery took place at the Midland Bank in Barton. Earlier in the evening, two men had been seen outside the bank. One was tall and about thirty years old, the other, a smaller man in his early twenties. The tall man was wearing red-coloured check trousers and a navy blue overcoat. The smaller man was thought to be wearing a grey raincoat and a yellow hat.

At around 7-20pm, they were seen running from the bank towards a green Ford Cortina car. The number of the car is believed to be GMS 629A. The car sped off in the direction of Hecton Road and was later found abandoned at Minster.

If you saw anything suspicious yourself, you are asked to contact the local police, phone number: Barton 57883.
1) On what day of the week did the robbery take place? ________________
2) In what month did the robbery take place? ________________
3) On what date did the robbery take place? ________________
4) What was the name of the bank that was robbed? ________________
5) In what town did the robbery take place? ________________
6) About how old was the tall man? ________________
7) About how old was the smaller man? ________________
8) What sort of trousers was the tall man wearing? ________________
9) What colour was the tall man’s coat? ________________
10) What was grey that the smaller man was wearing? ________________
11) What colour was the smaller man’s hat? ________________
12) At around what time were they seen running from the bank? ________________
13) What colour was their getaway car? ________________
14) What particular make was their getaway car? ________________
15) What was the number of their getaway car? ________________
16) The car sped off in the direction of which road? ________________
17) Where was the car later found abandoned? ________________
18) What phone number are you asked to ring with information? ________________

THANK YOU
On the night of Monday, January 16th, a robbery took place at the Midland Bank in Barton. Earlier in the evening, two men had been seen outside the bank. One was tall and about thirty years old, the other, a smaller man in his early twenties. The tall man was wearing red check trousers and a navy blue jacket. The smaller man was thought to be wearing a grey raincoat and a yellow hat.

At around 7-20pm, they were seen running from the bank towards a green Ford Cortina. The number of the car is believed to be GMS 629A. The car sped off in the direction of Highway Road and was later found abandoned at Minster.

If you saw anything suspicious yourself, you are asked to contact the local police, phone number, Barton 57883.
1) On what day of the week did the robbery take place? ________________

2) In what month did the robbery take place? ________________

3) On what date did the robbery take place? ________________

4) What was the name of the bank that was robbed? ________________

5) In what town did the robbery take place? ________________

6) About how old was the taller man? ________________

7) About how old was the smaller man? ________________

8) What sort of trousers was the taller man wearing? ________________

9) What colour was the taller man's jacket? ________________

10) What was grey that the smaller man was wearing? ________________

11) What colour was the smaller man's hat? ________________

12) At around what time were they seen running from the bank? ________________

13) What colour was their getaway car? ________________

14) What type of car was their getaway car? ________________

15) What was the getaway car's registration number? ________________

16) The car sped off in the direction of which road? ________________

17) Where was the car found abandoned? ________________

18) What phone number are you asked to ring? ________________
SUN
1) MERCURY
2) VENUS
3) EARTH
4) MARS
5) JUPITER
6) SATURN
7) URANUS
8) NEPTUNE
9) PLUTO
VI
SIX MERRY VEGETABLES EATING MARS JUNK;
SATURDAY UR NEVER PLUNK

One of the first things you will notice about this funny sentence, is that it's a rhyme. If you look carefully at the table below, you will notice that at least the first two letters of each word in the rhyme are also the first two letters of a planet.

If you can remember this little rhyme, you will almost certainly be able to remember the order that the planets are in.

Take half-a-minute to learn the rhyme by saying it over and over quietly to yourself.

SIX .................... SUN
MER-RY ................. MER-CURY
VE-GETABLES .......... VE-NUS
EA-TING ............... EA-RTH
MARS ................... MARS
JU-NK ................. JU-PITER
SATUR-DAY .............. SATUR-N
UR ..................... UR-ANUS
NE-VER ................. NE-PTUNE
PLU-NK ................. PLU-TO

Just remember, that UR is NOT spelt YOU ARE, but how you might write it in a love letter!

When you are asked to remember the planets in their correct order from the Sun, just remember the rhyme and you will know the first two letters of each planet AND their CORRECT order. The rest will be easy.
PLANETS ANSWER-SHEET

SUN

1) ___________

2) ___________

3) ___________

4) ___________

5) ___________

6) ___________

7) ___________

8) ___________

9) ___________
1) SITUATION
2) BRIEF
3) INVESTIGATION
4) SOLUTIONS
5) BEST SOLUTION
6) MODEL
7) WORKING DRAWING
8) REALISATION
9) APPRAISAL

THE DESIGN PROCESS

- SITUATION
- BRIEF
- INVESTIGATION
  - FUNCTION
  - SHAPE AND FORM
  - MATERIALS
  - ECONOMICS
  - SHAPING & FORGING
  - JOINTING
  - FITTINGS
  - STRENGTH
  - SURFACE FINISH
  - SPECIAL FACTORS
  - SAFETY
- SOLUTIONS
- BEST SOLUTION
- MODEL
- WORKING DRAWING
- REALISATION
- APPRAISAL
STUPID BRICKIES INVENTED SOME BRICKS
MADE WITH RED ASPRINS.

S-TUPID ............ SITUATION
B-RICKIES .......... B-RIEF
I-NVENTED .......... I-NVESTIGATION
S-OME ............ S-OLUTIONS
B-ICKS .......... B-EST SOLUTION
M-DE .......... M-ODEL
W-ITH ............ W-ORKING DRAWING
R-ED ............ R-EALISATION
A-SPRINS .......... A-PPRAISAL

Just remember that there are two Ss and SITUATION comes FIRST.

There are two Bs but notice that the first two letters of BRICKIES are the same as the first two letters of BRIEF!
DESIGN-PROCESS ANSWER-SHEET

PLEASE NAME EACH STAGE OF THE DESIGN PROCESS IN THE CORRECT ORDER.

1) ______________________
2) ______________________
3) ______________________
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HOUSE: B D R
YEAR: 1 3
SEX: BOY GIRL
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**PERIODS OF THE MODERN AGE**

**TUDOR**

**STUART**

**GEORGIAN**

**REGENCY**

**VICTORIAN**

**EDWARDIAN**
TEN SWANS GET RED VESTS EASY

T-EN ............T-UDOR
S-WANS ........S-TUART
G-ET ...........G-EORGIAN
R-ED ...........R-GENCY
V-ESTS ..........V-ICTORIAN
E-ASY ..........E-DWARDIAN
HISTORICAL PERIODS ANSWER SHEET

1) 
2) 
3) 
4) 
5) 
6) 

HOUSE: B D R YEAR: 1 SEX: BOY GIRL
After products like; shoes, cars, clothes and furniture have been made, companies must assess or check their products for quality. If their products are of poor quality, the public will buy from someone else!

Below, you will see SIX headings under which products can be assessed. This is called an ASSESSMENT SCALE.

* PERFORMANCE
* FUNCTION
* VALUE FOR MONEY
* CONSTRUCTION
* AESTHETICS
* SAFETY

Some of the words look difficult and complicated, but they are not really. I will explain what they mean.

PERFORMANCE, means how well a product works or performs during regular use. For example, a car's engine shouldn't need repairs for the first few years of its life.

FUNCTION, means does the product do what the maker claims it should do? For example, if Ford say a car in their Fiesta range should do more than forty miles to the gallon, then it should!

VALUE FOR MONEY, means is the product good value for the money spent?

CONSTRUCTION, means is the product well-constructed and strongly made?

AESTHETICS, is the designer's word for appearance or looks.

SAFETY: Is the product safe when in regular use?
PELICANS FIND VINDALOO CURRY AWFULLY SATISFYING.

P-ELICANS .......... P-ERFORMANCE

F-IND ................. F-UCTION

V-INDALOO .......... V-alue for money

C-URRY ............... C-ONSTRUCTION

A-AWFULLY .......... A-ESTHETICS

S-SATISFYING ......... S-AFETY
ASSESSMENT SCALE ANSWER SHEET

1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________
6) ______________________

HOUSE: B D R YEAR: 3 SEX: BOY GIRL
I want you to imagine that you are a driver for a delivery company. On your first day at work, you have been asked to make SIX deliveries in the Midlands area. In order to save time and petrol, your company has told you to make your deliveries to various places in a particular order, which should also help you to get back without being late.

Here are the names of the places which you have to deliver to in the correct order:

1) BEDFORD
2) LUTON
3) AYLESBURY
4) OXFORD
5) STRATFORD
6) RUGBY

Just in case you lose this list, it might be best to put the place names and the particular order of them into your memory.
DELIVERY COMPANY ANSWER SHEET

THESE PLACE-NAME ARE NOT IN THE CORRECT ORDER.

AYLESBURY, STRATFORD, BEDFORD, OXFORD, RUGBY, LUTON

1) __________________
2) __________________
3) __________________
4) __________________
5) __________________
6) __________________

HOUSE: B D R YEAR: 1 3 SEX: BOY GIRL

FAMILY: _____ INITIALS: ___ ___
E.- GROUP QUESTIONNAIRE

QUESTION 1

Did you use a silly sentence to help you remember where to deliver in the correct order?

(  ) YES
(  ) NO

If you did use a silly sentence, please write it here:

..............................................................

If you used another way of remembering the delivery places in the correct order, please write here how you did it:

..............................................................

..............................................................

QUESTION 2

You have been taught to remember names or information twice before using a silly sentence to help you. Did you find using a silly sentence to help you remember, either:

(  ) NOT VERY HELPFUL?
(  ) FAIRLY HELPFUL?
(  ) HELPFUL?
(  ) VERY HELPFUL?

YEAR:  1  3  SEX:  BOY   GIRL
C.- GROUP QUESTIONNAIRE

QUESTION 1

Please can you explain to me exactly how you tried to remember the place names you were to make deliveries to?

.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

QUESTION 2

If you used a DIFFERENT way of remembering names and information when you have learned things for me before, please try and write down what the other way/s was.

.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

YEAR: 1 3   SEX: BOY GIRL
R.- GROUP QUESTIONNAIRE

QUESTION 1

Did you say the names of the delivery places over and over again, quietly to yourself or not?

( ) YES

( ) NO

If you answered NO, please explain how you did try to remember the places in the correct order? Write here:

.................................................................
.................................................................
.................................................................

QUESTION 2

You have been taught to remember names and information by saying information you need to remember quietly over and over again to yourself. Did you find this:

( ) NOT VERY HELPFUL?
( ) FAIRLY HELPFUL?
( ) HELPFUL?
( ) VERY HELPFUL?

YEAR: 1  3    SEX:  BOY  GIRL
THESE PLANET-_NAMES ARE NOT IN THE CORRECT ORDER.

JUPITER, PLUTO, MARS, NEPTUNE, EARTH, URANUS, VENUS, SATURN, MERCURY.

SUN

1) ____________________

2) ____________________

3) ____________________

4) ____________________

5) ____________________

6) ____________________

7) ____________________

8) ____________________

9) ____________________

HOUSE: B D R YEAR: 1 SEX: BOY GIRL

FAMILY: _____ INITIALS: _____
DESIGN PROCESS ANSWER SHEET (2)

THESE DESIGN PROCESS NAMES ARE MIXED UP:
BEST SOLUTION * WORKING DRAWING * APPRAISAL * BRIEF * SOLUTIONS
MODEL * REALISATION * SITUATION * INVESTIGATION

IN THE NINE SPACES BELOW, PUT THESE DESIGN PROCESS STAGES IN THE CORRECT ORDER.

1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________
6) ______________________
7) ______________________
8) ______________________
9) ______________________

HOUSE:  B D R   YEAR: 3   SEX: BOY GIRL
HISTORICAL PERIODS ANSWER SHEET (2)

THESE PERIOD NAMES ARE MIXED UP:

GEORGIAN TUDOR VICTORIAN STUART EDWARDIAN REGENCY

IN THE SIX SPACES BELOW, PUT THESE PERIOD NAMES IN THEIR CORRECT ORDER.

1) __________________  
2) __________________  
3) __________________  
4) __________________  
5) __________________  
6) __________________

HOUSE: B D R  YEAR: 1  SEX: BOY GIRL
ASSESSMENT SCALE ANSWER SHEET (2)

THESE NAMES ARE NOT IN THE CORRECT ORDER.

VALUE FOR MONEY, AESTHETICS, PERFORMANCE, SAFETY, CONSTRUCTION, FUNCTION.

1) ____________

2) ____________

3) ____________

4) ____________

5) ____________

6) ____________

HOUSE: D D R

YEAR: 3

SEX: BOY GIRL

FAMILY: _____

INITIALS: ___ ___
INTERVIEW RESPONSES RELATING TO EXPERIMENT 6 (delivery company)

PLEASE NOTE: The following four responses were used earlier in the study to illustrate work related to this particular section - B1U3, M1N3, T3U1, M3N1 and are therefore missing from the appendix.

SAMPLE

FIRST-YEAR  n = 12

USERS

CODE
K1U1
L1U2
B1U3
J1U4
C1U5
M1U6

NON-USERS
R1N1
C1N2
M1N3
W1N4
M1N5
N1N6

THIRD-YEAR  n = 12

USERS

CODE
T3U1
M3U2
F3U3
N3U4
J3U5

NON-USERS
M3N1
D3N2
A3N3
T3N4
C3N5
R3N6
S3N7
Q.: K., when you did this test for me, (subject shown experiment response) you made up a silly sentence; "Birds Always Lay On Straight Rocks" (a first letter mnemonic for Bedford, Aylesbury, Luton, Oxford, Stratford, Rugby.)

A.: Yes.

Do you remember how long it took you to make up the sentence? Did it come quickly or did it take a little while? Were you struggling to do it in the time you had or what?

A.: It came quickly.

Q.: Did you find it easy to make up a silly sentence?

A.: Well, sort of.

Q.: You said, you had found the sentence "useful". Have you used a silly sentence since then or not?

A.: No.

Q.: Would you know how to make up a silly sentence on your own in future to help you remember things?

A.: Yes.
Q.: L., (referring to script) when I asked you to make up a silly sentence in order to remember these place names, do you remember whether it took a long while to do it or whether it happened quite quickly?

A.: It took me quite a while.

Q.: You've put down that you found the silly sentences "fairly helpful"?

A.: Yes.

Q.: You didn’t find them very helpful?

A.: No.

Q.: Did you use them?

A.: Yes.

Q.: Why do you think you didn’t find them very helpful?

A.: Because I remember things.

Q.: So you can remember things anyway?

A.: Sometimes, yes.

Q.: So what was the reason you put down "fairly helpful"?

A.: Because sometimes I can remember words, but sometimes you can forget words.

Q.: So you used the silly sentences as a sort of safety net; you can usually remember words but it helped as a check?

A.: Yes.

Q.: Do you use silly sentences to help you remember other things or not at all?

A.: Not at all.

Q.: Do you think you might do in the future, when it comes to learning for exams?

A.: Yes.

Q.: Do you think that it would help you to get things in the right order if you used a silly sentence?

A.: Yes.
J1U4

Q.: J., (referring to original script) you've made up a silly sentence to help you remember these place names; "Bad Ladies Also Offered Stupid Rhyme". Do you remember whether it took a long while to make up or did it flash into your head?

A.: It didn't take me all that long, but I made up one and it didn't fit, and then (this one) it just popped into my head in about a minute, with about fifteen seconds to go.

Q.: Do you think you would have remembered these place names in the right order if you hadn't used a rhyme?

A.: No, probably I wouldn’t.

Q.: You've put down here, (referring to script) that you found the silly sentences "helpful". Can you explain just what you mean? In what way were they helpful?

A.: Well, if you've just got a few places to memorise, sometimes you get muddled up because you feel like you're under pressure. But if you've got a sentence (silly sentence) it sticks in your mind longer.

Q.: Can you still remember the silly sentence you made up?

A.: Yes.

Q.: Do you think you could make up a silly sentence of your own?

A.: Yes, I'd know how to do it now, but I don't usually.
Q.: C., (referring to original script) a little while ago, I asked you to imagine you were a driver with deliveries to make. To help you do this, I asked you to make up a silly sentence like I had shown you twice before. You made up the silly sentence: "Being Loved, Alan Ordered Stupid Rags".

I gave you a minute and a quarter to do this. Do you remember whether it took all of the time? Did it come to you in a flash or what?

A.: In about a minute - something like that.

Q.: Did you think of any other ones or was this one the only one that you thought up?

A.: That's the only one I thought up.

Q.: Did you find it difficult to make up the silly sentence?

A.: Yes.

Q.: You've used two silly sentences before with me. You said that you found these "helpful" to remember things in order. Can you tell me in what way you found them helpful?

A.: It was the silly sentences that ...... the first couple of letters went straight into my mind, and I kept them there.

Q.: So you think that once you'd got the first couple of letters, that helped you to remember the other words?

A.: Yes.

Q.: C., if a teacher asked you to remember a list of names before we completed these tests, how would you go about remembering them?

A.: I wouldn't do (remember) the first couple of letters I'd just do the first one.

Q.: You'd remember the first letter and then you think that would help you remember the rest of the information?

A.: Yes.

Q.: Do you think you'd be able to make up a silly sentence to remember some names in future - and do this on your own?

A.: Probably, yes.
M1U6

Q.: M., (referring to original script) I gave you an opportunity to make up a silly sentence to help you remember these place names. Your sentence was "Better Live Alone Or Stay Relaxed". I gave you a minute and a quarter to make up the silly sentence. Do you remember if the sentence came quickly or did it take a long time?

A.: Well, it just came, because I had looked and practised what I was going to write.

Q.: So, in the time that I was talking, you actually made it up?

A.: Yes.

Q.: So it came very quickly really?

A.: Yes.

Q.: You've used silly-sentences twice before with me to remember things. You said (on the questionnaire) that they had been "very helpful". Can you explain?

A.: Well, sometimes if there isn't a silly sentence, it's quite hard to memorise it, so I thought they are very helpful.

Q.: So you though silly sentences were helpful in remembering things you might have otherwise forgotten?

A.: Yes.

Q.: If a teacher normally, asks you to remember some names or a list, how do you go about it?

A.: Well, I'd write the first letter and then see if I can memorise it.

Q.: How do you memorise it?

A.: By saying it over and over.

Q.: Using all the first letters?

A.: Yes.

Q.: So, you wouldn't just keep reading the list through?

A.: No.

Q.: Do you think in the future, you would be able to make up a silly sentence to help you remember things - on your own?

A.: Yes.
M1U6 continued.....

Q.: Have you thought about doing this since (the experiments)?
A.: Not really.

R1N1

Q.: R., When you were trying to remember the place names for the delivery company experiment, you didn't use a silly sentence. Why was that?
A.: Because I never had enough time.

Q.: But you did use a certain way of remembering the names. You tried to remember the first two letters of each place name. Did that help you at all?
A.: No, not really.

Q.: When I asked you whether you had found silly sentences helpful in the past, you answered "fairly helpful". Why didn't you find them anything more than fairly helpful? Can you tell me why that was?
A.: I got muddled up with them.

Q.: What do you normally do when you've got to remember lists or names for school?
A.: I just write them down.

C1N2

Q.: C., When I asked you to use a silly sentence that you'd made up yourself, you didn't use one. Can you tell me why this was, please?
A.: Because I couldn't think of one and there wasn't enough time.

Q.: Can you tell me why it was that you thought the silly sentences were only "fairly helpful"?
A.: Because sometimes I'd forget them.

Q.: If you had to remember lists or names for schoolwork, and a teacher just said to you "I want you to learn these", how would you learn them?
A.: I'd just keep going over it, keep reading it to myself.
Q.: W., (referring to original script) when I asked you to remember these places, I said you could make up a silly sentence as I had shown you before in the past. Can you tell me why you didn’t make up a silly sentence of your own please?

A.: I couldn’t find one of my own. I thought that yours were more helpful. I just took the first letters of mine.

Q.: You say you found the silly sentences in the past “very helpful” (questionnaire response). Can you explain what you mean by that? Do you think you would have had difficulty in learning things in the right order without a silly sentence, or what?

A.: Yes, I think I would have.

Q.: Before you did all this (mnemonic training), if a teacher had asked you to learn some names or a list in a certain order, how would you have gone about doing it?

A.: I’d have just remembered the first few letters.

A.: Is this how you have always tried to remember things?

A.: Yes.
Q.: M., (referring to original script) a little while ago, I asked you to remember some place names and imagine that you were a driver. You had to design a silly sentence of your own to help you remember the correct order of the places you were to deliver to. I had shown you twice before how to do this, but I notice that on this occasion, you didn’t make up a silly sentence. Can you tell me why you didn’t please?

A.: Because I couldn’t make one up in that time – I couldn’t think of one.

Q.: You’ve put down (referring to questionnaire script) that when you have used silly sentences before, you found them "fairly helpful". In what way did you find them fairly helpful?

A.: Sometimes, I get muddled up with them.

Q.: If a teacher asked you to remember some names or a list in a particular order, how would you go about doing it?

A.: I read from No 1 to the last one and go over it again until it gets into my memory.
Q.: N., (Referring directly to original script) a little while ago, I asked you to remember the names of some places, and imagine you were a driver for a company. You had to put these names in order, and memorise the order to help you with your deliveries. Previously, I had asked you to use a silly sentence to help you remember lists or names in a particular order. When I gave you the chance to do this yourself, I notice you didn’t. Can you tell me why that was please?

A.: it was a bit hard to remember - I couldn’t devise it that quickly.

Q.: Do you mean you couldn’t make up a silly sentence in the time you had?

A.: Yes.

Q.: You used the first letter of the words to help you remember the place names?

A.: Yes.

Q.: Did you make a word up out of each of the letters of the names of the delivery places you had to deliver to?

A.: Yes.

Q.: In the questionnaire I asked you to fill in, you said that you found silly sentences “fairly helpful” in the past. What did you mean by that?

A.: I don’t know really, they were just easy to remember - and not quite easy. Some words I could get mixed up!

Q.: You mean silly sentence words?

A.: Yes.

Q.: If a teacher normally asks you to remember some names or facts in a particular order, what would you do to help you remember them?

A.: I would remember the first letter, or the first three letters, or something.
Q.: D., in the past I taught you to make up a silly sentence, and then, when you were asked to do this, you didn't. Can you tell me why this was please?

A.: I couldn't think of one.

Q.: You thought it was too hard to think one up?

A.: Yes.

Q.: How do you normally remember things (like this)?

A.: I remember the first letter.

Q.: So the first letter helps you does it?

A.: Yes.

Q.: What happens if you forget the first letter?

A.: You forget the word.

Q.: How would you normally remember a list of things? Would you do it the same way?

A.: Yes.

Q.: Why did you answer that silly sentences were fairly helpful (in helping learn information)?

A.: Sometimes they were helpful, but not all the time.

Q.: Do you remember what the silly sentence was for the "design process"?

A.: No.
A3N3

Q.: A., (referring to original script) after I had asked you to make up a silly sentence to help you remember these place names, you didn’t do this. Can you tell me why you didn’t please?

A.: Because I thought it would be harder.

Q.: It would be harder to make up a silly sentence than to learn it normally?

A.: Yes.

Q.: You used the first letter of each word to help you remember the place names in the correct order. Can you tell me how you actually did that?

A.: I just remembered the first letters.

Q.: Did you make up a word?

A.: I just used the first letter.

Q.: You said you found the silly sentences “helpful”. Have you ever used them before or was that the first time?

A.: That was the first time.

Q.: If a teacher normally gave you a list or some names to learn in a certain order, how would you have gone about it before I started doing this sort of thing with you?

A.: Just read them over and over again.
Q.: T., (referring to original script) I gave you, in the past, some silly sentences to help you remember information and names in the right order. In this experiment where you had to remember where to deliver to, I asked you to make up a silly sentence all of your own. Can you tell me why you didn’t do this?

A.: Because I found it quite hard and it was easier to remember first letters than words.

Q.: You put down that the silly sentences were only “fairly helpful”. Is that for the same or a different reason?

A.: It’s just the same reason really. It was too hard so I couldn’t put “helpful”.

Q.: If a teacher gave you some names, facts, information or lists to remember in the correct order, how would you go about remembering them?

A.: I’d just read them over and over again.
Q.: C., (referring to original script) When I asked you to remember the delivery company names in the right order, I gave you a chance to make up a silly sentence like the ones you had been taught previously. Can you tell me why you didn't?

A.: Because I remembered it by saying it over and over again.

Q.: So you didn't find the silly sentence helpful?

A.: No.

Q.: Why not?

A.: I just remembered it. I just found it easier to remember it without the silly sentence.

Q.: In the other experiments you did for me, did you find the silly sentences helpful or not very helpful?

A.: Not very helpful.

Q.: Why not?

Pause.

Q.: Do you remember?

A.: No.

Q.: If a teacher asked you to remember a list or names, how would you go about doing that?

A.: I'd just remember it in my head.

Q.: How do you remember it in your head? What do you do?

A.: Keep on reading it.
Q.: R., (referring to original script) when I saw you the time before last, I asked you to imagine that you were a driver for a delivery company and asked you to remember six names in a certain order. I also told you to make up your own (silly sentence) in the same sort of way that I had shown you before on two other occasions. Can you tell me why you didn’t make up a silly sentence when you were asked to remember these names?

A.: I found it easier just to remember it (the names) in my head.

Q.: You said you didn’t find the silly sentences very helpful at all. In fact, you put “not very helpful”. Why was that?

A.: Because I hardly ever used them. I just tried to remember the order they were in in my head.

Q.: Can you remember the place names now?

A.: No.

Q.: If a teacher asked you to remember a list or some names in a certain order, how would you go about remembering the information?

A.: I’d just keep it in my head, just say it over and over again.
Q.: S., (referring to original script) when I asked you to remember these place names for the delivery company, I asked you to make up a silly sentence based on what we had done together before on two previous occasions. Now, when it came to actually doing that, you didn’t make up a silly sentence. Can you tell me why you didn’t?

A.: Well, I said it over and over again, so I didn’t really need a silly sentence.

Q.: So you found it (the names of the delivery company) easier to learn without a silly sentence?

A.: Yes.

Q.: You said you found the silly sentences before "helpful". In what way did you find them helpful?

A.: Well, some silly sentences stuck in your brain, but sometimes you’d forget them and they’re not really helpful.

Q.: If a teacher asked you to learn a list or some names normally in a lesson, how would you go about doing it?

A.: I’d just say it over and over again.
Q.: M., (referring to original script) A little while ago, I asked you to remember some place names, and also to imagine that you were a delivery driver delivering items in a certain order to particular places. The silly sentence you made up to help you remember the place names in the correct order was "Big Lemons And Oranges Start Rolling". I gave you a minute and a quarter to do this. Did it take all that time up or not?

A.: It took about a minute.

Q.: Did you find it difficult to do (make up the silly sentence)? Did you have other ideas or was this the only idea you came up with?

A.: It was the one that stood out the most.

Q.: But you had other ideas - you though of others.

A.: One other.

Q.: On the questionnaire, you put down that this and the other silly sentences that you had used were "fairly helpful" rather than helpful or very helpful. Can you explain this please?

A.: Well, at the time, they didn't seem very helpful, but now, I can remember it much better than I would have been able to do.

Q.: If a teacher gave you a list of names or facts to remember in a certain order, how would you normally go about doing it? Forget (disregard) what I've taught you to do. How would you normally go about it?

A.: Read through it (the to be remembered material) several times or write it down on a piece of paper.

Q.: Do you think that if you wanted to remember lists or names in the future, you could use this (silly sentence) method by generating the silly sentence yourself?

A.: Yes, if I didn't have a piece of paper handy, yes.
Q.: F., (referring to original script) a little while ago, I asked you to remember some silly sentences to help you remember things (names and facts) and also, later, I asked you to remember some places to which you were asked to deliver in an imaginary situation. I also asked you (for the delivery company experiment) to make up a silly sentence to help you remember the order of the places. Yours was: "Betty Loo As Often She Remembers".

I gave you a minute and a quarter to make up the silly sentence. Can you remember whether it took you a long while to make one up or did it come (into your mind) quite quickly?

A.: It came quite quickly.

Q.: Did you only think of one silly sentence or did you think of others and this was the best one, or what?

A.: I just stuck with the first one I thought of.

Q.: In the questionnaire, you put down that you found the silly sentences "fairly helpful" (in helping you to remember facts). Can you explain what you mean please?

A.: I put down fairly helpful because I don’t think we had enough time to think of a sentence.

Q.: If a teacher asked you to remember a list or some names in a particular order, (before I taught you strategies) how would you go about doing it?

A.: Probably just look at them, stick them through my head and the next time I saw them (remember) what I did.

Q.: When you say look at them (the names or information) do you mean just look at them (the names) or read them over and over again or what?

A.: Read them through or look at them.

Q.: Would you be able to make up a silly sentence of your own in future to remember things? Do you think you know how to do it now or not?

A.: Yes (I could).
Q.: N., (referring to original script) a little while ago, I asked you to remember some places to deliver to and imagine that you were a lorry driver. I gave you six place names to remember in a particular order and asked you to use a silly sentence in the same way that I had taught you to use them twice in the past. The silly sentence you made up was: "Buy Lemon Aftershave Or See Red". What I want to know, is how much of the minute and a quarter that I gave you to do this, did it take to make up the silly sentence? Did it come quite quickly - did you have more than one? First of all, did it take you long?

A.: No, it came just straight away.

Q.: What, in about the first fifteen seconds or so?

A.: About that - perhaps twenty seconds.

Q.: Did you think of more than one, or was this the one that you stuck with?

A.: Yes it is. After thinking of that one, I thought of a few more, but they didn't seem very good, so I just stuck with that one.

Q.: In the questionnaire, I asked you whether you thought that using the silly sentences in the past were either very helpful, helpful fairly helpful or not very helpful. You answered "helpful". Can you tell me what you mean by that?

A.: Usually, I can remember without a silly sentence, but for the long-term memory of it, using a silly sentence for me is helpful.

Q.: If a teacher asks you to remember some names or items in a particular order, before you did anything like this with me, (mnemonics) how would you go about it?

A.: I'd go over them in my head first.

Q.: Can you explain what you mean by "going over them in my head"?

A.: I just keep thinking about the words, just keep thinking about them in the right order. They just come.

Q.: Would you be able to make up a silly sentence of your own in future, to remember things? Do you think you know how to do it now or not?

A.: Yes.
Q.: J., (referring to original script) a little while ago, I asked you to remember some place names for me, and to imagine you were a lorry driver having to deliver items to these places in a particular order. You made up a silly sentence "Before Leaving, Alison's Oranges Started Rioting". I gave you a minute and a quarter to make up a sentence. Did this one come quickly, or did it take quite a long while to come into your mind? Were you struggling for time at the end?

A.: Struggling for time at the end.

Q.: Was this the only silly sentence that you thought of?

A.: Yes.

Q.: In the questionnaire, you put that you thought silly sentences were "very helpful" in the past for helping you to remember information. Can you explain in what way they were very helpful?

A.: Well, I'm not very good at remembering anything, so they helped me a lot there.

Q.: Do you use silly sentences at all now? Having found them helpful, would you use them at all to remember things?

A.: Probably, because Mum sometimes asks me to go to the shops .... and she asks me for things. I'd make up a silly sentence to remember them.

Q.: If a teacher asked you to remember some facts, a list or some names in a particular order - before you did this sort of work with me, how would you have gone about it?

A.: I'd write it down.

Q.: Say you didn't have a chance to write it down, how would you go about remembering it then - say the teacher put the information on the board and you hadn't got a piece of paper?

A.: I'd probably go over and over it in my head.

Q.: Do you think that you would be able to make up a silly sentence for things that you wanted to remember now without being given any help?

A.: Yes.
RESULTS OF COX’S (1991) STUDY WITH UPPER PRIMARY CHILDREN

In collaboration with the writer, Cox, (1991) has used all the materials associated with experiment 2 (planets experiment) of this study with fourth year primary children (mode 10.5 years). Children were assigned to the same learning conditions used in the present study following the results of matching techniques as used in experiment 1 of the present study.

Using three matched groups, [1] (c. 3 X 10 ) Cox employed the precise approach and materials adopted in experiment 2 of the present study apart from the exceptions listed on the following two pages.

---

1 Following careful general ability and gender matching, Cox used the same procedure established in experiment 1 (matching experiment) of this study, to ascertain inter-group parity on a short-term memory task.
PRE-TEST STRATEGY INSTRUCTIONS

Prior to the learning phase, a period of ten minutes of informal, recorded discussion was held with children in each of the three conditions.

NB: It may be remembered that the mnemonic group performed poorly at immediate re-test of this experiment in the present study and it was hypothesised that this might be due to the fact that the mnemonic group had the dual tasks of learning how to use the mnemonic offered, in addition to learning the target material. It was further hypothesised that if children in the mnemonic group had received prior instruction about how to use acrostics, they might have displayed immediate learning benefits compared with the rote and uninstructed learners.

The discussion was aimed at raising the strategic awareness of children in each of the three learning conditions.

Children in the rote condition received illustrated discussion and instruction related to rote-learning protocols.

Children in the uninstructed condition were invited to share and discuss their regular methods of learning factual information. The experimenter was careful to act as an impartial mediator and made no effort to suggest any particular learning method was superior to others.

Children in the mnemonic group received illustrated discussion on how to use acrostics adopting two examples: "N-ever E-at S-hredded W-heat" (used to help teach the compass points in sequential order) and Cox's "Red-dish (red) Orange-ade (orange) Yell-ed (yellow) Gree-dy (green) Blue (blue) Indi-ans (indigo) Viole-ntly" (violet), an alternative acrostic to help teach the sequential order of the spectral colours.
TIME OF RE-TEST AND RECALL PROTOCOLS

At immediate re-test, Cox adopted the same re-test procedures and materials as those undertaken in the present study. He also tested again at eight days post-test using two approaches: free-recall (an approach not used in the present study at long-term re-test) followed immediately by a replication of the recognition test used in the present study.

The following was hypothesised:

1) Children in the mnemonic group may show immediate learning gains, being largely free of the joint constraints of learning how to manipulate the mnemonic and learn the target material.

2) At eight days post-test, children in the mnemonic group would out-perform those in the other conditions on both the free-recall and recognition tests.

3) The mnemonic group's performance on the recognition test would be superior to that on the free-recall test.

Cox's results are shown below:
Target Year: 1 (mean age 11.5 yrs)

Target-groups: C.-group (uninstructed)

R.-group (instructed to rote-learn material)

E.-group (instructed to use experimenter-generated first-letter mnemonics).
RESULTS OF EXPERIMENT 1 (IMMEDIATE FREE-RECALL RE-TEST)

For inter-group measures, \( n = c.20, p < 0.05 \)
\( (t > 1.725) \) is used and for intra-group measures,
\( n = 9, p < 0.05 \) \( (t > 1.833) \).

<table>
<thead>
<tr>
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<th>SCORE</th>
<th>MEAN</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.-GROUP</td>
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<td>7.11</td>
<td>3.6</td>
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<tr>
<td>R.-GROUP</td>
<td>57</td>
<td>6.33</td>
<td>2.50</td>
</tr>
<tr>
<td>E.-GROUP</td>
<td>53</td>
<td>5.89</td>
<td>3.98</td>
</tr>
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</table>

\( t \) SCORES

CONTROL V ROTE ........ 0.592 \( -- df = 16 \)
ROTE V EXPERIMENT ..... 0.281 \( -- df = 16 \)
EXPERIMENT V CONTROL .. 0.729 \( -- df = 16 \)

DISCUSSION:

Despite pre-instruction of how to use and apply acrostics, Cox’s immediate re-test results reflect similar E.-group learning deficits. These results are interpreted to suggest that regardless of pre-use instruction about how to manipulate and utilise mnemonics, when asked to learn both a mnemonic (acrostic) and material in some sequence, the task demands are too great for the mnemonic learners to demonstrate immediate benefits. The means of first year secondary (mode 11.5 yrs.) and top juniors (mode 10.5 yrs.) compares favourably with one main exception:

<table>
<thead>
<tr>
<th>MEAN 10.5 yrs.</th>
<th>MEAN 11.5 yrs.</th>
</tr>
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<tbody>
<tr>
<td>C.-GROUP</td>
<td>7.11</td>
</tr>
<tr>
<td>R.-GROUP</td>
<td>6.33</td>
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<tr>
<td>E.-GROUP</td>
<td>5.89</td>
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<tr>
<td></td>
<td>7.1</td>
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<tr>
<td></td>
<td>6.714</td>
</tr>
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<td></td>
<td>7.157</td>
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</table>

The ten-and-a-half-year-old uninstructed learners are able to recall over one item more than the mnemonic group and even the younger rote-
learners out-perform the mnemonic group although the result is not significant.

The evidence from the two studies strongly suggests that at immediate re-test acrostics will not benefit learners significantly. Further, the learning of younger children using such mnemonics might actually regress initially if their performance is compared with either uninstructed or rote learning conditions.
RESULTS OF EXPERIMENT 2a (eight day FREE RECALL post-test)

For inter-group measures, \( n = c.20, p < 0.05 \) 
\( (t > 1.725) \) is used and for intra-group measures, 
\( n = 9, p < 0.05 \) \( (t > 1.833) \).

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<th>S.D.</th>
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<tr>
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<td>3.23</td>
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<tr>
<td>R.-GROUP</td>
<td>48</td>
<td>5.33</td>
<td>3.32</td>
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<tr>
<td>E.-GROUP</td>
<td>75</td>
<td>8.33</td>
<td>0.87</td>
</tr>
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</table>

\( t \) SCORES

CONTROL V ROTE ....... 0.719 -- \( df = 16 \)
ROTE V EXPERIMENT ..... 2.622 -- \( df = 16 \)
EXPERIMENT V CONTROL .. 3.686 -- \( df = 16 \)

DISCUSSION:

At eight days post-test Cox's results mirror the dramatic long-term effects produced by mnemonic learning found in the present study.

The uninstructed learners mean actually regress by almost three items. The rote-learners follow a similar but less conspicuous trend regressing by just one item.

The mnemonic group using acrostics, actually increased their score by two-and-a-half items! An effect also reported in connection with the long-term recognition of experiment 2 of the present study, but here reported for the first time using a free-recall re-test.

The rather poor result of the uninstructed learners is probably due to their failure to employ more sophisticated strategies. Even rote learning proved a more effective learning mediator than children instructed to use their regular learning methods. It is hypothesised that at least some children in C.-group had failed to engage any type of strategy to make the target material more memorable.

Clearly rote-learning was a better learning mediator than regular learning methods, suggesting that for at least some of R.-group, knowing how to learn by rote was both a novel and useful strategy acquisition.
RESULTS OF EXPERIMENT 2b (eight day RECOGNITION post-test)

For inter-group measures, \( n = c.20, \ p = < 0.05 \) 
\( (t = > 1.725) \) is used and for intra-group measures, 
\( n = 9, \ p = < 0.05 \ (t = > 1.833) \).

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<tr>
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<td>R.-GROUP</td>
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<td>5.44</td>
<td>3.28</td>
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<tr>
<td>E.-GROUP</td>
<td>81</td>
<td>9</td>
<td>0</td>
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</table>

\( t \) SCORES

CONTROL V ROTE ........ 0.078 -- \( df = 16 \)
ROTE V EXPERIMENT ..... 3.256 -- \( df = 16 \)
EXPERIMENT V CONTROL .. 3.185 -- \( df = 16 \)

DISCUSSION:

Whereas C v R groups score is not significant, both R v E and E v C results are highly significant, again mirroring the substantial effect acrostics can have on long-term retention a feature first demonstrated in experiments in the 7 series of the present study.

In the nine-item recognition test, the uninstructed and rote groups recalled c.three and a half items less than the mnemonic group who achieved 100% recall. The results are further encouraging in that the mnemonic group were assigned to the experimental condition after performing least well in a matching experiment. Further, the progressive effects of the acrostic enabled E.-group to demonstrate three-item superiority over their scores at immediate re-test. As a ceiling effect was obtained by the mnemonic group, it is hypothesised that performance differences may have been further extended if re-test had been delayed or the number of items comprising the mnemonic had been greater.

N.B. The ten-year-olds' long-term re-test was at **eight days**, the eleven-year-olds' was at **eight weeks**.
Below is a comparison between the younger and older children’s scores on the long-term recognition test, the younger children forming Cox’s sample, the older children my own.

<table>
<thead>
<tr>
<th></th>
<th>MEAN 10.5 yrs.</th>
<th>MEAN 11.5 yrs.</th>
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<tbody>
<tr>
<td>C.-GROUP</td>
<td>5.56</td>
<td>3.305</td>
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<td>R.-GROUP</td>
<td>5.44</td>
<td>3.114</td>
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<tr>
<td>E.-GROUP</td>
<td>9</td>
<td>8.081</td>
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The results are virtually symmetrical. Allowing for the fact that the post-test interval was seven times longer for the older children represented in the present study, similar trends are evident. The recall of C and R groups in both studies is conspicuously similar, as is that of the mnemonic groups who demonstrate considerable superiority on the recognition test. The progressive effect of the acrostic is also noteworthy. The eleven-year-olds in the present study obtained a mean of 7.157 at immediate re-test, this figure actually increased to 8.081 at eight week re-test. It is hypothesised that if the eleven-year-olds had been re-tested after eight days, like the mnemonically instructed primary children in Cox’s study, the mnemonic group would also have scored 100% correct.
A REANALYSIS OF THE DATA USING ONE-WAY ANALYSIS OF VARIANCE (MINITAB STATISTICAL SOFTWARE PACKAGE) YIELDED THE FOLLOWING RESULTS:

Key: C1 = Control
C2 = Rote
C3 = Mnemonic

EXPERIMENT 11 (matching - year 1)

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<td>99</td>
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<td>9.96</td>
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<tr>
<td>TOTAL</td>
<td>101</td>
<td>1110.67</td>
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LEVEL
N  MEAN  STDEV
C1 34  14.912  2.610
C2 34  15.882  2.114
C3 34  13.206  4.312

POOLED STDEV = 3.156

EXPERIMENT 111 (matching - year 3)

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<td>MEAN</td>
<td>STDEV</td>
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<tr>
<td>C1</td>
<td>40</td>
<td>14.875</td>
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<tr>
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POOLED STDEV = 2.977
**EXPERIMENT 2** (planets)

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<td>462.45</td>
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LEVEL

<table>
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<tr>
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<tr>
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<tr>
<td>C3</td>
<td>38</td>
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POOLED STDEV = 2.041

**EXPERIMENT 3** (design process)

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LEVEL

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<tr>
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<td>C3</td>
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<td>1.832</td>
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POOLED STDEV = 2.061

**EXPERIMENT 4** (historical periods)

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<td>96</td>
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TOTAL

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<tr>
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<tr>
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<tr>
<td>C3</td>
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POOLED STDEV = 1.499
EXPERIMENT 5 (assessment scale)

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<td>STDEV</td>
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EXPERIMENT 6I (delivery company)

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EXPERIMENT 6II (delivery company)

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### EXPERIMENT 7a (planets long-term recall)

#### Individual 95 PCT CI's for Mean

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#### Level

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Pooled STDEV = 2.074

### EXPERIMENT 7b (historical periods long-term recall)

#### Individual 95 PCT CI's for Mean

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#### Level

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Pooled STDEV = 1.515

### EXPERIMENT 7c (design process long-term recall)

#### Individual 95 PCT CI's for Mean

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#### Level

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Pooled STDEV = 2.022
## EXPERIMENT 7d (assessment scale long-term recall)

### INDIVIDUAL 95 PCT CI’S FOR MEAN BASED ON POOLED STDEV

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<tbody>
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### LEVEL N MEAN STDEV

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<th>Mean</th>
<th>STDEV</th>
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<tbody>
<tr>
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<td>1.067</td>
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<td>C2</td>
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POOLED STDEV = 1.208