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Factors of Mental Rigidity Related to the  
Ability to Adapt to Decimal Currency.

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for the degree of Doctor of Philosophy.

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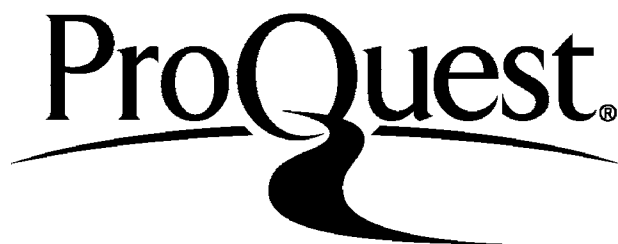
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Abstract

The aim of the study was to examine the relationships between 'rigidity', particularly as shown by older people, and the ability to adapt to Decimal Currency.

The first part of this thesis discusses the age changes with respect to rigidity and flexibility which have been found in previous experimental work. Because of the slowing of central neural processes and because of the less efficient use of stimulus redundancy there is a lowering of the levels of complexity which can be dealt with effectively. These changes result in a decline in the ability to deal logically with new stimuli and therefore a decrease in practical adaptability.

People will also be more rigid at any age if they are less proficient at the cognitive and perceptual abstract manipulation of information. Thirdly, rigidity may be due to attitudes and personality e.g. living to a routine, rejecting new ideas and adhering to the conventional way of doing things.

The tests chosen for measuring rigidity and Decimal adaptation were administered to an adult subject sample. The results showed that logical reasoning was the most important factor in adaptation. Feelings of insecurity and resistance to change were important personality factors. Age itself was not an effective variable, and older people were only less adaptable if they were less able on abstract intelligence or higher on the rigidity measures.

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I wish to dedicate this research to Fred White.

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SECTION A

A theoretical background and review of the literature

Introduction

In February 1971 Britain changed from its traditional £ s d coinage to Decimal Currency. This provided an opportunity to measure the capacity of the general population to adapt to a new way of thinking.

This adaptability is thought to be related to three main factors of rigidity. Firstly is rigidity due to the natural aging process. Chapters 1 and 2 will show how aging brings a natural slowing of mental processes, which together with a decline in the ability to transmit information results in less efficient handling of new ideas and information. There is also an age decline in short- and long-term memory which impairs the ability to learn. Therefore in older people in whom these natural changes have occurred we would expect to find greater rigidity in adapting to the new system of Decimal Currency.

*The current state of*  
Secondly is rigidity due to cognitive ability,  
generally termed non-verbal intelligence. This is taken to be the ability to logically manipulate data independently of the external presence of that data. It is therefore a dimension of abstract - concrete cognition. The experiments reported in Chapter 3 will show how the objective, logical appraisal of information declines with age. But young adults at their peak of ability cover the whole range of intellectual performance on any intelligence test used.

Therefore the intelligence factor will have two effects: firstly the intellectual decline with age will cause greater rigidity, and secondly within any age group the people scoring lower on intellectual ability will show less ability to adapt to a new system of thinking than their more able peers.

Thirdly is rigidity of cognitive style. In this research several such styles will be discussed. They overlap each other to a certain extent, but they can be distinguished from each other by the extent of their influence on behaviour. Chapter 5 will deal with styles that primarily affect individual actions or short sequences of behaviour. This includes perceptual field-dependence, set and behavioural rigidity. The perceptual factor involves a person's ability to react to one part of the stimulus field alone, and can be measured by the extent to which his reaction is influenced by other parts of the field which are either in close physical proximity, or which have similar physical characteristics.

The set factor involves the degree for which preparedness for one event inhibits the reaction of a person to an unexpected event, and evidence will be given to show that older people have greater difficulty in overcoming the effects of set. Behavioural rigidity is used in this research to describe an increasing reliance on known ways of problem solving and habitual methods of tackling new information. It would be expected that older people would exhibit this type of rigidity as they become less able to

appraise and cope with new ideas, but people of any age who are intellectually below average would be more inclined to use methods they know than try to devise new ones.

Chapter 6 will deal with cognitive styles that affect wider ranges of behaviour. They can therefore more appropriately be called attitude systems, and the degree of rigidity or flexibility a person shows in dealing with new situations will be affected by the degree of tolerance or openness of his attitudes. If his attitudes are closed then he tends to reject new ideas because they contradict the ones he already has and he is not able to rearrange his own ideas to incorporate new ones. A person with open attitudes tends to seek out new ideas because he enjoys integrating his beliefs, and being aware of the logical consistency within them. Between these two extremes fall the majority of people who vary in the degree to which they react to contradictory ideas and the flexibility with which they deal with new information.

Chapter 1    Age Changes in Speed and Efficiency

Aging brings a slowing down of central neural processes. Birren and Botwinick 1955 (a) measured subjects' reaction time from finger, foot and jaw to an auditory stimulus. There was a difference of between 21% and 29% between the reaction times of subjects aged 18 to 36 years, and those aged 61 to 91 years. Since the length of nerve fibre involved had no significant effect on the reaction time, the increase in reaction time with age must have been due to the slowing of central initiating processes, not to the speed of neural conduction.

Surwillo 1961 also measured the reaction time of subjects to auditory signals. In this case the signals came at irregular intervals with no foreperiod, whereas Birren and Botwinick 1955 did use foreperiods which may have induced different amounts of set in older and younger subjects. Surwillo also measured the alpha rhythms of his subjects and found a significant correlation between the length of the alpha cycle and reaction time. He also found that subjects aged from 53 to 72 years had significantly slower reaction times and longer alpha periods than subjects aged 18 to 49 years. Therefore age produces a measurable decline in the speed of brain function.

The age decrement is increased in tasks of greater complexity. For example, Birren and Botwinick 1955 (b) presented subjects with 48 pairs of vertical lines viewed tachiscopically. For each pair the subject had to decide

which line was the shorter, and to respond as quickly as possible by saying 'right' or 'left'. The difference in length of each pair of lines varied from 1% to 50% of the length. Subjects aged 61 to 91 years had significantly longer response times than subjects aged 19 to 36 years for all levels of stimulus difficulty, but the difference was disproportionately greater at higher levels of difficulty. Therefore tasks which are perceptually more difficult cause more pronounced slowing of behaviour in older people.

Griew 1959 gave subjects an aiming task with a display of 2, 4 or 8 metal targets, and a corresponding display of 2, 4 or 8 lights. When a light came on the subject had to touch the target below the light with a metal stylus. This was called the easy response; the harder response was to first touch the correct target and then move the stylus to the hole in the centre of the target to touch the metal disc beneath.

The subject groups were aged 20 to 26 years and 50 to 57 years. Both groups found the task relatively easy, but whereas the young group showed no significant increase in reaction time with the harder response, the older group did. Both groups however showed the same constant increase in reaction time between the 4 - choice and 8 - choice conditions, where one would have expected the older group to be disproportionately longer with the 8 - choice task. Perhaps the reason was that the task was not difficult enough to tax the ability of the older group, or that they were more susceptible to added complexity of response than to added complexity of perception. This may be so if the

slowing with age lies mainly in the initiating of motor responses and cognitive manipulations, and less in the transmission of perceptual information.

Suci, Davidoff and Surwillo 1960, however, did find a disproportionate slowing with age as the amount of perceptually-received information increased. They compared a group of mean age 63 years with a group of mean age 18.5 years, all of whom had had a college education. They learnt 4 nonsense syllable responses to 4 lights, and then had blocks of trials in which 1, 2 or 3 of the lights came on and then after an interval of between 2 and 4 seconds one of the lights went off. The subject's response was the syllable associated with the light that went off; the light thus conveyed between 0 and 2 bits of information.

The regression curve of the reaction time on the bits of information was linear for both age groups but there was a significant difference between the two curves, with the older group being disproportionately slower as the amount of information increased. A reason for the discrepancy between this result and that of Griew 1959 may be that in Suci, Davidoff and Surwillo 1960 the association of the nonsense syllables provided more information than allowed for by merely counting the lights. The associations were, after all, recently-acquired learning, and when the light went off the subject had to recall the correct association, discriminate it from the other nonsense syllables and initiate its verbal pronunciation.



So these two experiments may be reconciled by saying that it is probably the complexity of the response and its initiation that causes disproportionate slowing with age, rather than information transmission alone. Further evidence to support this comes from Szafran's report in Welford and Birren (eds.) 1965. He tested airline pilots under information-overload conditions, by giving them a main task of responding manually to random visual and auditory signals, while at the same time doing a subsidiary task. The subsidiary task was either to monitor a series of signals and remember which one occurred twice in the series, or to respond to each signal of the main task with one of three code words. Delayed auditory feedback of the subject's own speech added further stress.

Results showed that there was no real reduction in information transmission with age until an overload condition was reached. At this point the over - 40 year-olds transmitted fewer bits per second than the under - 40 year-olds. Szafran also found a significant correlation between cardiac efficiency and the size of the reduction in decision time in the overload condition. These results point to two conclusions: firstly that the blood supply to the brain is an important determinant of the maximum ability of older people and therefore that mental age changes follow closely on physical age changes; and secondly that these natural aging processes bring down a person's potential, so that he reaches his limit of efficient performance sooner, as task complexity increases. Therefore we cannot say that information transmission declines with age, but it is more

likely that the complexity of situations, under which efficient information transmission occurs, must become more limited with age.

Efficiency of cognitive functioning involves not only the rate of gain of information, but also the coding of information. If information is coded logically it gives the minimum number of bits to be transmitted. But if the redundancy in the information is not effectively used, then more bits must be transmitted to achieve the same cognitive reasoning. If older people code less effectively, then they are imposing on themselves a greater information load at the same time as their information overload limit is getting lower. Experiments suggest that this is what actually happens as people get older, particularly the experiments of Rabbitt 1964 (a)(b)(c), and 1965.

Rabbitt 1964 (a) gave subjects 4 letters and 4 numbers presented individually on a screen. The subject had two response keys at his right hand for the letters and two response keys at his left hand for the numbers. The conditions of the experiment were firstly, an uninformative flash of light which appeared on the screen at random foreperiods before the test stimulus; secondly, an 'L' signifying that the test stimulus would be a letter, or an 'F' signifying a number was flashed on the screen at random foreperiods before the test stimulus. This partial advance information reduced the possible stimulus outcomes from 8 to 4, and the possible responses from 2 hands to 1 hand; thirdly, a few conditions of false advance information were randomly mixed in to give a total block of 256 trials.

The older subject group were of a mean age 71 years and the young group were of a mean age 23 years. For all the foreperiods used the young subjects were significantly faster with advance information than without it. But the old group showed no significant benefit from the advance information, though like the young group they suffered when this advance information was false. Therefore the reaction times of the old group were as short as they could manage, and although they must have perceived the advance information it could not improve their behaviour. With false information the young group showed maximum slowing effect after a 0.5 second foreperiod, but for the old group the effect was greater after a 1 second foreperiod and at a maximum after 1.5 second foreperiod. Therefore even in its briefest extent of influence, a pre-set attitude was inhibiting for longer in older people than young.

Rabbitt 1964 (b) gave subjects a card sorting task in which the number of piles to sort into, and the number of symbols to be sorted per pile were varied. In comparing subjects of mean 72 years with subjects mean age 19 years, Rabbitt concluded that the limitations met by the older group on the 2- and 4- choice task were not met by the young until the 6- and 8- choice tasks. This suggests that the size of categories which people could handle in a continuous sorting task, also becomes more limited with age.

Rabbitt 1965 used another card sorting task. This time the cards each had a relevant letter which designated which pile to sort it into; and this letter was randomly put on the card among 0, 1, 4 or 8 irrelevant letters. Comparing the sorting ability of subjects mean age 67 years with a group of mean age 19 years Rabbitt found that while an increase in the number of relevant symbols to be sorted did not increase sorting time in either age group, the increase in irrelevant symbols did significantly increase the sorting time of the older group, and more so when there were 8 rather than 2 relevant symbols to sort.

Presumably the older group took more time because they not only discriminated between the relevant letter and all non-relevant ones, but also discriminated between the irrelevant letters themselves. If true, this would suggest older people being ultra-methodical at the expense of efficiency. A general conclusion seems to be that older people cannot take advantage of all the redundancy in a stimulus situation and therefore waste time and effort on unnecessary discriminations. As a result they cannot form effective hypotheses for action, and must therefore rely on more persistent monitoring of the stimulus field and also more frequent decision making. Thus as inefficiency increases the cognitive load becomes greater, at the same time as the ability to handle the extra load is declining. This would explain why people show disproportionately greater disadvantages as they grow older.

A good experiment showing this basic inability to act on hypotheses was by Rabbitt and Birren 1967. The task was to touch contact grids to put out corresponding lights. Only a few lights were used, and they came on repeatedly in the same order so that the subjects had a repetitive 2- or 4- movement cycle to maintain performance. There were 16 disruptive signals though, mixed in randomly with a series of 288 repetitive signals. Comparing subjects of mean age 73 years with a group of mean age 22 years, the older subjects made fewer continuation errors when disruptive signals occurred and their reaction time was not increased so much by them as it was in the young group. The older group were also slower and less accurate in general than the young group, and more so on the 4- than the 2- movement cycle.

It would seem that the young group were willing to act on the high probabilities of the repetitive signals occurring, and kept smooth response sequences going. But the older group would not gamble in this way and tended to monitor the lights more continuously, giving themselves an extra perceptual load which prevented smooth response initiation. This seems likely since Leonard 1952 has shown that people in their late 60's could not overlap the initiation of an arm movement with the perception of a light, whereas people in their late 20's could.

These age changes bring a difference in problem solving technique of younger and older people. The young can work out the expectancies of different outcomes more efficiently

and therefore act confidently in response to what they think is most likely to happen, because they are sure enough of their own ability to act quickly if the unexpected should occur. For older people though a new problem is approached with more caution. Older people are usually aware of the deficiencies appearing in their behaviour as the years pass and are therefore less confident. They want to be sure of the outcome before they act because they would rather avoid the task of handling an unexpected outcome. But with less efficient use of information they have to rely on the methodical checking of data to work out the probable outcome.

These differences in technique were well described by Brown 1957. She was investigating the effect of paced work on older workers. Her subjects were faced with a grid-matching problem, in which they had to move the ball on their own grid to match the position of a ball on the test grid. Under paced and self-paced conditions the peak of ability varied from the 30's to the 40's, but Brown concluded that younger people were better at paced work because they tended to guess the position of the test ball and used large confident movements on their own grid to move the ball into the approximate area, needing only a small amount of fine adjustment to finish the match.

The older subjects though spent more time counting the grid and checking the position of the test ball before they even started to move the ball on their own grid. In this experiment it seemed that subjects in their 50's were at a

transitional stage because some of them could improve their performance if given advice on stopping the ball more quickly, and then approached the performance of the 40 year-olds. The 60's however did not benefit from such advice.

To conclude this chapter it may be said that natural physical age changes bring about a slowing down of the speed of cerebral processes, and this combines with a growing inability to make full use of stimulus redundancy to produce less efficient processing of information, and consequently a slower more laboured grasp of new ideas, such as Decimal Currency. The comparison groups used in the experiments discussed above were often separated by 40 or 50 years of age, so that this decline in ability is a very slow process covering all of the young and mature adult years.

Chapter 2    Age changes in Learning and Problem Solving

Learning and problem solving are overlapping cognitive processes that occur in simple and complex form all the time in any person's behaviour; few actions are entirely automatic and requiring of no new appraisal of the stimulus situation. Chapter 1 attempted to show that age changes in the appraisal of information lie mainly in a reduction of the complexity of information that can be handled. In learning and problem solving it is again complexity which seems to be most affected by age, primarily because older people are more restricted in the number of items that they can hold separately in mind at one time in order to perform mental operations on them.

The result is that increased complexity seems to cause more interference in older people. For example, Bromley 1958 found that short term memory for a list of digits did not decrease in span with age, but having to repeat the series backwards caused a decline from the late 50's onwards. Thus, even a simple rearranging of data caused a memory deficit in older subjects. Bromley also gave subjects a visual memory task with geometric shapes; but only got a significant age decline in one of the three subject groups. Rote learning of nonsense syllables showed an age decline to begin in the 40's for women, but not until the 60's for men. It seems that in relatively simple learning, age differences are either not found, or do not occur until late middle age.



Kirchner 1958 presented subjects with 12 keys to switch off 12 corresponding lights. The conditions were varied so that the subject had to switch off the light which was currently on, or the light which was on one, two or three lights ago. This involved a constant changing of the short-term memory store, though the number of items required to be held at any one time were few.

This kind of complexity showed large differences in ability between subjects aged 18 to 24 years, and those aged 60 to 84 years. The older group had difficulty understanding the instructions and only 3 of them could even attempt the 'three-back' condition. There were no age differences in extinguishing the light which was currently on; but in the 'one-back' condition, while the young group maintained the same level of performance, the old group became inaccurate and made more omission errors.

On the 'two-back' condition some older people could not manage the task at all, while the others who did attempt it made far more omission errors than in the simpler condition. The young group on the 'two-back' condition made only as many omission errors as the old group on the 'one-back' condition; and on the 'three-back' condition the young group did not make as many omission errors as the old group on the 'two-back' condition.

In this experiment then, the older group quickly felt the effect of complexity on their running memory span, when responses to the keys had to be initiated at the same time.

Since the scoring method was based on the number of omission errors, it is possible that the age effect was exaggerated by the non-response tendency of older people under speeded conditions, although 4.5 seconds per light were given on the more difficult conditions.

Another experiment designed to create a memory overload was by Broadbent and Heron 1962. From subjects' performance on a task of crossing out all of a certain digit on a sheet of digits, they measured the effect when this task was hindered by a subsidiary task. The subsidiary task was to listen to series of letters and at the end of each series record on the digit sheet of the main task the letter which had occurred twice in the series.

When the main task was to cross out all of one type of digit, then subjects of 18 to 25 years were almost unaffected by the interference task; but subjects of 45 to 60 years did make more errors than on the main task alone. When the main task was made more complex by asking subjects to change the type of digit to be crossed out each time they came across a digit in a red circle; then both age groups were slower and made more mistakes. When the hardest main task was given, namely to cross out numbers 0 to 9 in succession then both age groups took significantly longer again, but the young group took longer than the old because they were tackling both tasks, while the recordings of the older group showed that they paid little attention to the subsidiary task.

Again the complexity of response initiation and conflicting simultaneous short-term memories caused the older group to reach an overload point sooner than the young group. In this experiment also, the age difference between the two groups was not so great as in most aging comparison-studies.

Conflicting information does not necessarily have to be present to cause interference. For example, Suci, Davidoff and Braun in Tibbitts and Donahue (eds.) 1962 compared subjects of over and under 60 years of age on learning to discriminate the size of a set of 5 squares. Then half of each age group were given a set of 5 larger squares to learn, while the other half were occupied by conversation. All subjects were then required to relearn the first set of squares. Results showed no age differences on the original learning of the squares, but the older group were significantly worse on relearning after they had learnt the set of larger squares.

While the learning required in this experiment was simple enough to show no age deficit, once it had been complicated by adding more size discriminations the older group were at a disadvantage. Presumably the memory of the larger squares still encroached on the relearning memories of the smaller set; they could not be coded as irrelevant and subsequently ignored, but remained to cause an information overload.

Talland 1968 p.93 in one of a series of experiments found a 50% age decrement in short term recall among subjects of 30 to 70 years of age if the word lists given were longer than the established memory span. That means that older people could not ignore the extra information even though it was beyond their powers to recall it, and it persisted to create interference with the items that would have been within their span.

This inability to ignore is part of the larger coding process discussed in Chapter 1. Heron and Craik 1964 in Talland (ed.) 1968 reported experiments which varied the redundancy of information to be memorised. For example subjects of 23 to 35 years old showed no superiority in memory span over subjects of 60 to 72 years, when the material to recall was meaningless Finnish words; but the young group had a significantly longer span when the material was meaningful English words. In another experiment with subjects between 20 and 79 years of age there was no age difference in memory span for colour names, but there was a significant age decrement in the memory span for English text and scrambled proverbs.

When the stimulus lists were different statistical approximations to English text it was found that older subjects of a high verbal intelligence could equal the learning rate of the younger subjects; but the older subjects of a lower verbal intelligence (at the 75th percentile) showed a levelling off of improvement after the 3rd order approximation to English and could not benefit from further increases in redundancy.

To summarise these three experiments it seems that older people, despite their longer experience of the language, are less able to use the predictability of the language for coding and chunking. Chunking reduces information to fewer bits for memorising, but with age chunking becomes less efficient and the memory load is increased.

In experimental tests of learning it is important to bear in mind that older people are more cautious and need to be surer of their actions before responding. Part of this general tendency is reflected in more omission errors in older groups during speeded tasks. If the task is fairly demanding and time is short then older people tend not to respond, rather than to risk a guess or a mistake.

Eisdorfer, Axelrod and Wilkie 1963 reported that omission errors did decline significantly with age as the exposure time per word in a serial learning task was increased from 4 to 6 and 8 seconds. The comparison groups were aged 28 to 49 years and 60 to 80 years.

Canestrari 1963 compared a group of mean age 24 years with a group of mean age 65 years on a paired-associate learning task. The word pairs were presented at paced rates of 1.5 and 3.0 seconds per pair and in a self-paced condition. The older group made fewer omission errors with 3.0 than 1.5 second exposures, and showed a further significant drop in omission errors in the self-paced condition; while the young group showed a drop in errors between the two paced conditions but did not benefit further from the self-paced condition.

Canestrari's subject groups were matched on Wechsler vocabulary ability, but the older group were still poorer at learning than the young in all the experimental conditions. It was in the self-paced condition though that their performance most approached that of the young, and results showed that the older group utilized significantly more of the time limit of the paced conditions to respond in.

Also, Eisdorfer in Talland (ed.) 1968 using a rote learning experiment found that subjects of 67 to 83 years of age with high WAIS vocabulary scores did better at learning than both young and old average-score subjects, but they still made more omission errors in paced learning conditions than a group of 23 to 48 years of age who had equally high WAIS scores. Therefore reluctance to respond seems to be an inevitable part of the aging process, offset, but not prevented by superior intelligence.

To conclude this chapter, two experiments on problem solving will be discussed. They involve the application of short-term learning to solve a wider problem. Firstly, Kay 1954, who tested factory-worker subjects of 15 to 72 years of age. The apparatus was a row of 12 keys in front of the subject, and a row of 12 lights three feet behind the keys. The subject was told to mentally number the lights from 1 to 12, and then when a light came on, to decide which number the light was, and then find this number on the index card which was put behind the keys. The key below the correct number on the index card would switch off the light. The positions of the 12 numbers on

the index card were randomised.

There were three conditions for the test trials:-

- 1) with the index card directly behind the keys
- 2) with the index card mid-way between the lights and the keys
- 3) with the index directly in front of the lights.

The nearness of the index card to the lights caused disproportionately greater difficulty in the older subjects. The older subjects tended to omit the use of the card when it was moved away from the keys, and in the over-65 year-olds over half of the total responses were errors. This was because the older subjects tended to repeat the same errors, despite the fact that the light would not go out until the correct key had been pressed and the correct response thereby reinforced.

Variability of both error scores and time increased in the over 35's and again in the over 55's. This means that in older age groups there are some people who show little loss of ability and behave as efficiently as younger people, while other people feel age changes more keenly.

Another interesting fact from Kay's study was that with subjects over 35 years of age there was an increasing number who could not understand the written instructions, though about 44% of all age groups said that they understood the instructions when verbal checking showed that in fact they did not. Therefore it seems that people of average ability and any age do not approach problems in the most

efficient way, because they do not fully utilise the information available to begin with.

Clay 1956 designed a task in which a squared board was used. Numbered counters could be put in the squares to give designated column or row totals at the edges of the board. There was no age difference among subjects of 20 to 70 years when column totals alone, or row totals alone were required, but then the two processes were combined. For this each square was divided diagonally and the counters contributing to the row totals were to go in the upper section of each square, while the counters contributing to the column totals were to go in the lower section of each square. This meant that neither task had been objectively complicated, but that the two tasks had been perceptually combined.

Ability on this combined task was better for 20 and 30 year olds than on the two tasks separately which meant that they had benefited from practise. The 40 year olds were quicker but less accurate on the combined matrix than the two separate ones, while the 50 year olds took much more time to maintain accuracy as good as that of the 40 year olds. The over 60's were worse on both time and accuracy.

These experiments of Kay and Clay both show that perceptual complications are much more confusing for older people, even when they have not altered the objective difficulty of the task. It seems that keeping items or responses separate and coded as relevant or irrelevant are both processes which suffer from natural age changes at



both the conceptual and perceptual levels.

Considering these age changes in relation to the introduction of Decimal Currency we would expect older people to be slower and less able to adapt to a fluid use of the new system.

Chapter 3   Age changes in Intelligence

From Chapters 1 and 2 it would be expected that age would bring about a decline in intellectual ability in the average person. As the maximum complexity with which they can deal decreases, then older people will become increasingly dependent on the physical form and presence of the stimulus field in order to carry out everyday cognitive processes. If intelligence is defined as the ability to form logical relationships between objects, then as older people become more concrete in their cognition they will become effectively less intelligent. Harvey, Hunt and Schroder 1961 agree that 'The greater one's abstractness, 1) the greater is his ability to transcend immediacy and to move more into the temporally and spatially remote, 2) and the more capable he is of abstracting relationships from objects of his experience and of organizing them in terms of their relatedness.' In this research intelligence will be taken to be the level of abstract ability of which any subject is capable.

A good test of this ability is the Progressive Matrices designed by J.C. Raven in 1938. In Raven 1948 he describes his test as 'a non-verbal test of a person's capacity.... to form comparisons, reason by analogy, and develop a logical method of thinking regardless of previously acquired information' and said that 'It is not a test of general intelligence, and it is always a mistake to describe it as such,' it is rather 'a test of observation, or a person's capacity to understand and apply a fresh method of thinking.'

This is indeed the ability which needs to be measured here; the ability to apply logical processes to any new material regardless of past education or training. The concept of flexibility is implicit in the process of logical abstraction, because any type of set or rigid use of habit would prevent maximal abstract reasoning.

Raven 1948 described the age differences in ability on the Progressive Matrices test. He found a steep rise in ability to 14 years of age, then a levelling off till 24 years of age, followed by a slow but linear decline with advancing age. The rates of decline were parallel for people whose scores were in the 50, 75 and 95 percentiles of their own age groups, but there was a more rapid decline for people in the 25 percentile. Raven standardised his test on large numbers of militiamen, students, children and postal workers, so that its results can be said to be applicable to the general population.

Unlike the Progressive Matrices the Wechsler Adult Intelligence Scale (WAIS) includes subtests for different abilities, and the use of pictures, words and numbers in its items renders it more susceptible to variance from the educational level and social class of subjects. Birren and Morrison 1961, in an analysis of the WAIS from the scores of subjects aged 25 to 64 years found that there was a general ability factor which accounted for 51% of the variance on scores, and, as predicted, loaded highly on education. Age came out as the second factor accounting for less variance and in fewer subtests.

Since higher education correlates generally with higher social class than very often the subject samples used in experiments on aging will give a deceptively better picture of ability with age. Subjects are often recruited from skilled or professional occupations, or from social clubs, and as people get older it is only the more confident and capable who join these clubs. There is a further selection effect in that only the well-adjusted and above-average older people are likely to agree to take part in experimental studies. The final samples then, are often made up of people who had a good education, have always been intellectually above average, and have probably had the advantages of a middle class existence. Therefore, while the WAIS may measure actual ability level, the Progressive Matrices would gauge the present level of flexible abstract reasoning.

Another intelligence test, widely used, is Thurstone's Primary Mental Abilities test (PMA). Schaie, Rosenthal and Perlman 1953 analysed the results of the PMA on subjects of 53 to 78 years of age. They found the steepest age decline was for space and reasoning abilities, while verbal meaning and word fluency decline least. This again is a clear distinction between present ability and the use of acquired information.

The changes in logical ability with age have been shown in other ways also. For example, Speakman 1954, in a learning experiment, gave subjects a clue card to help them remember the values and colours of old and new stamp issues.

The value discs cut out from both old and new stamps meant that each value had two colours, plainly discriminated on the clue card, yet older people found the card a hinderance rather than a help, and although some of them might start to use the card correctly they often abandoned it and fell back on guess-work, choosing colours which looked right, regardless of the inconsistencies thus created. The younger subjects however, could easily make use of the card for logical deductions. Speakman found that logical use of the card declined only slightly after the 40's but abruptly after the 60's.

Bromley 1956 gave the Shaw Test to subjects of 17 to 82 years. This test consists of 4 wooden blocks which can be arranged according to height, weight or position of notches on them etc. Results showed that logical responses decreased with age as illogical, confused and concrete responses increased. Since the actual quantity of responses did not decline as quickly it was not just decreased output which caused this result.

A third example is that of Friend and Zubek 1958, who gave the Watson-Glaser Critical Thinking Appraisal Test to subjects of 12 to 80 years of age. This test includes 99 items of events likely to occur in everyday life. Evaluation and interpretation of the items showed a peak of ability in the 20's and a fall after the 30's, while assumptions and deductions reached a peak in the 30's and then declined. Friend and Zubek also devised an Index of Objectivity by comparing neutral and emotionally-charged test items.

From this they found the over 60 year olds to be significantly less objective than the under 25 year olds.

Applying these results to ability to adapt to Decimal Currency, it would seem that, since decimal computation is a logical process, older people would have more difficulty organizing it in their minds. This would be even more important if they tried to convert back to the old currency for comparing values of items in the shops. The overall effect would be greater difficulty in using the new currency in all cash transactions or mental arithmetic. Also, when inconsistencies appeared in their own reasoning efforts, they would be less able to deduce the cause of the contradiction and therefore would perceive the new system as more forbidding and difficult than it actually is.

Before leaving this topic it is important to make a further distinction in the intelligence of younger people. For intelligence may change not only quantitatively with age, but qualitatively as well. Guilford 1956 in an effort to describe the many facets of the intellect, divided the production factor into convergent and divergent abilities. Basically convergence implies the logical assessment of given data to find one correct answer, while divergence implies beginning from one given fact and generating as many answers or ideas that can be objectively related to that fact.

Tests such as the Progressive Matrices, the WAIS, and the PMA are made up of items which require one correct answer, and therefore measure convergent intelligence. Divergent intelligence could be measured only by open-ended tests in which the subject could give as many answers as he could think of. For this, Guilford devised 'Unusual Uses' and 'Uses for a brick' tests. These gave subjects an ordinary object to think about, and by considering the possibilities of all its physical properties to devise as many uses for it other than the use it was meant for.

Hudson 1966 and 1968 used open-ended tests and convergent tests on adolescent school boys. He found that individuals varied greatly and could be classified as extreme - or moderate -, divergers or convergers, while less than half of the sample could be considered of equal ability on both aspects of intelligence. This classification is important to this research because of the connection that Hudson found between extreme convergent ability and authoritarian characteristics.

Hudson decided that boys who were extreme convergers used thought as a defence against personal feelings, while boys who were extreme divergers used emotion as a defence against impersonal thought. He gave them a personal qualities questionnaire in which they recorded the degree to which they approved or disapproved of certain qualities. Significant differences were found between the two extreme groups, they were as follows: convergers approved more of

being obedient, of having set opinions and accepting expert advice, of being socially adept, neat and tidy and of being a good team member; they disapproved of being independent of their parents, of being imaginative and artistic, of arty clothes and bad language.

Therefore an overall impression is that the convergers respected authority, and believed in a person knowing his place in the authority structure. They also placed great importance on a person's external appearance and behaviour. Chapter 5 will show how these characteristics are the same as those often measurable in authoritarian and ethnocentric people.

Hudson's subjects were young and highly intelligent, and the convergence - divergence distinction may take different forms in a more average adult sample. But it would be worthwhile to try and measure both aspects of intelligence in this study.



Chapter 4 Behavioural Rigidities and Age

The extent to which people are perceptually and conceptually rigid varies greatly within any age group, but since susceptibility to the effects of set and the use of habit both seem to increase with age, it is the aging trends which will be discussed here, since they form an integral part of the age decline in adaptability.

Set has been defined by Brinley in Welford and Birren (eds.) 1965 as 'inferred anticipations and predispositions with respect to the concrete details of performance', and with reference to aging and set he says that 'Studies of reasoning and problem solving do provide evidence that difficulty in maintaining set impedes the performance of the elderly, in more complicated reasoning and problem solving activities', p.122.

This is contrary to what one would expect from the results of experiments such as Rabbitt 1964 (a) discussed above in Chapter 1. In Rabbitt's experiment the preparatory set of the older subjects seemed to go on increasing in effect for longer than in young people, for it had its greatest inhibiting effect on subsequent responses after a lapse of 1.5 seconds, whereas the younger subjects could overcome the effect of set more easily as the response foreperiod increased from 0.5 seconds onwards. Such responses could not, however, be called complicated reasoning.

Brinley reported an experiment carried out in 1963 in which subjects of 59 to 82 years were compared with subjects of 18 to 35 years on performance in three types of speeded tasks, which involved shifts or non-shifts of response. The main result was that slower performance and an increase of errors became more positively correlated as age advanced. Since the tasks were simple, Brinley attributed the increase in errors to a 'set lapse' rather than to inability. An example being that older subjects tended to confuse synonyms with antonyms when asked to tick only synonyms. The effect of 'set lapse' seemed greater when older people had to actively consider alternative responses; to inhibit inappropriate responses; or to shift from one type of operation to another. In this study 'set' was operative for minutes rather than seconds.

The contradiction in conclusions may be explained by suggesting that the two experiments involved different levels of preparedness. In Rabbitt's 1964 (a) experiment the stimuli were randomly presented, so responses were only prepared for one at a time. Since the advance information prepared the subject for responding with one hand or the other the greater length of time during which 'set' was effective may have been due only to the longer time needed by older people for response initiation. It was the preparedness for responding with one particular hand that took so long to overcome.

In Brinley's experiment though, a series of similar responses was required, e.g. ticking synonyms. As Rabbitt and Birren 1967 have shown, even when subsequent stimuli and responses are almost entirely predictable, older people still do not behave fluidly but tend to react to each stimulus on its own merits. So 'set lapses' here would be more a result of older people being less able to form effective hypotheses and act confidently on them. This would be particularly true when more complex response shifts were required.

Botwinick, Brinley and Birren 1957 tested response times to auditory tones after foreperiods of between one and six seconds. The mean response time decreased as the foreperiod increased in both groups aged 61 to 83 years and 20 to 36 years. The older group though, seemed more prepared for an average foreperiod because they responded fastest for a 4 second interval, and tended to overestimate the shorter foreperiods. But this was not always true, for long foreperiods 'set' the older group for further long foreperiods so that their reaction times were increased for a short foreperiod which followed a long one. The young group reacted best to short foreperiods, but could easily overcome any set to react quickly to longer ones as well.

This result seems to show that older people need an optimum of 4 seconds to prepare themselves for response initiation and find it hard to respond quickly when less time is given. This seems more likely than the view that they are prepared for the average foreperiod.

Botwinick, Brinley and Robbin 1958 tested subjects' ability to alternate between subtraction and addition computations. The speed of alternation correlated more highly with total time taken in subjects aged 18 to 32 years than in those aged 65 to 81 years. Therefore in the older group the ability to alternate was a more independent process than in the young, because they had to keep alternating the process they were set for, and because the processes of deciding on and initiating the next response took longer. The young group could act more fluidly because alternating responses meant that the next process was predictable, and could be prepared for in advance.

Another important factor though, is motivation. Botwinick, Brinley and Robbin 1959 tested reaction time to an auditory stimulus with regular and irregular foreperiods and in no-shock or shock conditions. The shock was given to the subject's wrist whenever his response was longer than the average, and in this condition subjects of 65 to 81 years of age showed a significantly greater decrease in reaction time with regular than irregular foreperiods. This suggests that part of the inefficiency in behaviour shown by older people is due to the over-cautions checking of information, and when given sufficient motivation they can make better use of the redundancy of the situation to predict events and react faster.

In the non-shock condition the group aged 19 to 31 years reacted relatively faster than the old group to the longer foreperiods (up to 25 seconds), so that the young

group were holding their set for longer than the old group.

To conclude then, the change in set with age involves a decrease in the flexibility of preparedness. Older people find it as hard to prepare themselves for a quick response as for a delayed one. They respond best when they are given optimum time to prepare for response initiation and no more. Similarly, they find it harder to maintain a preparedness for the repetition of a more complex mental manipulation because this involves acting on an abstract hypothesis of future events, and they feel happier waiting to see which events actually occur before they decide a response. This decline in the flexibility of 'preparedness' results in an increased tendency to use habitual modes of response. Schaie 1955 defined behavioural rigidity as 'a tendency to persevere and resist conceptual change, to resist the acquisition of new patterns of behaviour and to refuse to relinquish old and established behaviour patterns.' Later in Schaie 1958 a factor analysis of a battery of tests gave three rigidity factors.

The first was motor-cognitive rigidity, and was concerned with the ability to change familiar behaviour patterns. The measure of this type of rigidity was a Perseveration scale of 9 items used by Lankes 1915. The over - 25 year-olds scored significantly higher on this measure than the under 25's.

The second factor was personality-perceptual rigidity, and was concerned with adjustment to new stimulation. The measure of this factor was the California Personality Inventory Rigidity Scale compiled by Gough 1951. This type of rigidity did not increase significantly until the 41 to 45 year-old age group.

The third factor was psychomotor speed, and was concerned with the ease of emission of familiar cognitive responses. The tests for this factor were firstly, the substitution of small and capital letters in speeded writing; and secondly, the production of antonyms and synonyms for given word lists. The verbal nature of these tasks meant that this factor correlated more significantly with educational level than the other two factors. Ability on these tests decreased significantly in the 31 to 35 year-old age group.

To summarise these three factors, it seems that the tendency to rely on habitual means of coping with life, and a subsequent difficulty in producing new conflicting responses, becomes pronounced as early as the late 20's. The personality rigidity shown in new situations does not become pronounced until 15 years later. Thus there seems to be a time lag between the beginning of inefficiency in cognition and its resultant effect on personality characteristics.

Intelligence and rigidity are inevitable negative correlates. Schaie compared high and low scorers from the rigidity tests, on their Primary Mental Abilities score. The resultant differences were nearly always significant for all age groups, and it is important to note that the effect of high or low rigidity had its greatest effect on general intelligence in the middle years. This could mean that age changes in cognitive ability are hastened or offset by the level of behavioural rigidity of any individual, or vice versa.

Strother, Schaie and Horst 1957 tested a group of college graduates of 70 to 88 years of age. Compared to a group of 17 year olds they showed significant decrements on the space and reasoning subtests of the PMA, but were equal to the mean score of the young group on verbal and numerical subtests. Their memory was also as good as that of young adults except in reproducing visual figures which involved more coding. Also, on a Gestalt-Symbol test they were as good as average 40 year old subjects. Despite this superior ability for their age they still scored higher on rigidity than did middle aged people, although their personality rigidity was comparatively lower than their motor cognitive rigidity.

Therefore it seems that people of superior ability can hold their own as regards acquired knowledge and personality flexibility, but they still cannot escape the increasing use of habit and the loss of abstract reasoning ability that results from natural aging processes.

The Gough-Sanford 1952 Rigidity Scale has 22 items which form part of the Wesley Rigidity Inventory (Wesley 1953) of 39 items. This also can therefore be considered a measure of the personality-perceptual rigidity described by Schaie 1958, but its additional items would give it wider coverage. Chown 1960 did a factor analysis of the Wesley Rigidity Inventory from the scores of male subjects aged 20 to 82 years.

This analysis gave three factors. The first factor was made up of 10 items which loaded highly on this factor alone. The items it included were concerned with being methodical in work and paying attention to detail. The second factor included 11 items which loaded highly on this factor alone. The items of this factor were concerned with dogmatic thinking and the tendency to agree with cliches. Since this factor loaded substantially on both the Mill Hill Vocabulary Scale and the Progressive Matrices test, this kind of dogmatic thinking was postulated to be a result of insufficient intelligence to enable critical appraisal of cliches and the like.

The third factor included 6 items that occurred in this factor only. The items concerned the liking for routine and habit and loaded highly on both age and the Mill Hill Vocabulary Test; but fairly insignificantly on the Progressive Matrices test. The liking for routine was therefore an accompaniment of age and was greater in people who had had high abstract ability when young, since the Mill Hill Vocabulary Scores hold up with age. Abstract



ability as it then existed in older subjects was relatively independent of this preference for habit.

Chown 1961 found that abstract ability as measured by the Progressive Matrices test accounted for 20% of the variance of scores in a battery of flexibility tests. Tests which loaded highly on this intelligence test were ones which required divergent thought, namely, Uses for a brick, Unusual Uses for other objects, the naming of objects in a given class, and the listing of impossibilities.

Writing speed also loaded highly on intelligence, as did more convergent tasks such as a Gottschaldt-type embedded figures test, and the arranging of matches and crosses to give a required number of shapes. Age came out in the analysis as factor two, accounting for only 10% of the test variance, since performance on the tests of divergent ability did not begin to decline until after the 40's. From these results we would expect older people who are of above-average intelligence to be as flexible as young people, and conversely, young people of below average intelligence will be relatively rigid.

*Witkin's work deals with*  
The third aspect of behavioural rigidity, ~~is~~ perceptual dependence on the stimulus field. Presumably the more one's perception is dependent on the actual stimulus configuration then the more rigid and limited can be one's perceptual reorganisation and appraisal of that stimulus field. The dimension of field dependence-independence has been studied by Witkin (Asch and Witkin 1948, Witkin and Asch 1948 (a), Witkin and Asch 1948 (b), Witkin 1949, Witkin 1950) and

was summarised in Witkin et al 1954. In these experiments, different sets of apparatus were used to discover the relative influences of the visual field and the proprioceptive responses of the body to gravity on the subjective perception of the upright.

Examples of these apparatus set-ups are: 1) a large box furnished as a room with a movable rod at the back of the 'room' which the subject has to adjust to the upright; while either standing upright himself or sitting in a chair. Studies were made in which both the 'room' and the subject's chair were systematically tilted. 2) a luminous square frame viewed in a dark room; and an adjustable rod within the frame which the subject had to adjust to the upright, while the frame was at varying degrees of tilt. 3) the subject's chair was situated inside the box 'room' and the 'room' rotated slowly while the subject adjusted his own chair or a rod to the upright.

Correlations between these tests using student subjects showed that individuals are consistent within themselves in their perceptual style under varied conditions. When the test conditions required the subject to separate his bodily proprioceptions from the perception of the visual field, then women usually tended to be significantly more influenced by the perceptual field than their bodies, and consequently accepted greater degrees of tilt of the box 'room' and of their own bodies as upright.

Another sex difference was found when Witkin 1950 correlated scores on a Gottschaldt-type embedded figures test with results on his perceptual tests. For men the correlations between perceptual field independence and abstract ability on the embedded figures test were all positive and significant, but for women only half of such correlations were significant. Since women could be made to utilise their bodily cues if their attention was drawn to them, it would seem that perceptual style relies partly on the acquired sexual image of one's own body. Men perceive their bodily sensations as abstractly as they perceive external stimuli, while women tend to have separate degrees of dependence for their own bodies and for the external environment. Heron and Chown 1967 also found that men were better than women on a perceptual maze test in all ages groups; and that men were better on the Progressive Matrices test, which involves the process of abstracting and mentally reorganising parts of the perceptual field.

Relating field-dependence to age, Witkin found that field-independence increased until 17 years of age and thereafter declined slightly. Therefore it would seem to develop and decline with the abstract cognitive ability measured by the Progressive Matrices test.

Using a different type of perceptual flexibility test Korchin and Basowitz 1957 compared a group of doctors and nurses aged 22 to 33 years with a group of 68 to 88 years from a home for the aged. The groups were matched on the

vocabulary subscale of the Wechster-Bellvue Intelligence Scale. The perceptual test was made up of 13 ambiguous drawings which began as a cat and turned gradually to a dog. When viewing these pictures the young group changed their responses near the middle of the series and maintained the new choice, but the old group vacillated more and did not finally make up their minds until the end of the series. It could be said from this, that the old group were more tolerant of ambiguity because they changed their minds more often. Among the young group the nurses took nearly as long to decide a response on the ambiguous pictures in the middle of the series as did the old group. But the old group did not take much longer to decide on the ambiguous pictures as on the clear pictures.

The results seem to point to a sex difference similar to that found by Witkin 1954, because the young doctors decided quickly and efficiently, while the young nurses were more confused by stimulus ambiguity. The older group took longer to respond as would be expected, but found all the pictures of fairly equal difficulty, suggesting that even simple pictures present more coding difficulties for older people.

Another experiment by Basowitz and Korchin 1957 used a Gestalt completion test of 72 ambiguous drawings, and a Gottschaldt-type embedded figures test. Young subjects were significantly better than older subjects on both tests. The main error tendencies noted in the older group were:-

fixation on detail, perseveration of the same response on successive drawings, and passive acceptance of the elements as separate parts.

Cohen and Axelrod in Tibbitts and Donahue 1962 also found a significant correlation between ability on visual and tactile versions of the Gottschaldt embedded figures test. And in both versions subjects of 62 to 78 years were significantly worse than subjects of 21 to 34 years.

In conclusion, the ability to abstract part of the perceptual field is a constant perceptual style within any individual, and is constant not only within different sense modalities but is also a probable correlate of the abstract ability at higher conceptual levels. Overall degree of abstractness varies within each age group but the average ability declines steadily after the 20's to become more stimulus-bound and concrete.

Chapter 5      Attitude Rigidity

Chapter 4 dealt with styles of perception and response that are relatively small-scale in effect. This chapter will deal with wider attitude systems that give a more permanent bias to cognition and the evolution of one attitude from previous ones.

The study of rigid attitudes began as a study primarily of the content of attitudes (Adorno et al 1950) and progressed to a study of the structure and function of attitudes, (Rokeach 1960). As a result of the Second World War many studies were carried out on the rigidity of ethnocentrism and authoritarian attitudes. Bettelheim, who had had first-hand experience in Dachau and Buchenwald of what the ultimate in rigid right-wing attitudes could produce; joined with Janowitz in 1950 to report a study of ethnic prejudice in American war veterans.

Their main finding was, that the veterans who were least tolerant of minority groups subjectively felt that they had had a 'raw deal' from life, whereas objectively they were no worse off than the more tolerant veterans. Since tolerance was also negatively related with downward social mobility in the past life of the veterans it seems likely that prejudice was the externalising of the frustration they felt from their own disappointments. Veterans who were not personally able to reconcile their feelings of guilt over their own actions, or to face their own inabilities, then projected their fears onto minority groups. The physical characteristics of the minority groups, particularly Negroes,

lending themselves to be human enough to accept blame, but different enough to be worthy of blame.

In support of this projection theory, the veterans showed an interesting divergence of stereotypes. Only half of the veterans were tolerant towards Jews, and the intolerant half showed the following stereotyped views that Jews were 1) clannish, 2) wealthy, 3) in non-manual jobs and 4) underhanded in business. This gave an overall picture of a wealthy minority who didn't really deserve their success and who did not lack friends.

Only 8% of the veterans were tolerant of Negroes, and the majority view was that Negroes were 1) dirty, 2) depreciating of property, 3) forcing out the whites, 4) lazy and 5) sexually immoral. Therefore for the prejudiced subject the Jews represented the social position he envied, and the Negroes represented the more primitive, unsocial traits that he could not recognise in himself. This divergence of stereotypes into wanted and unwanted characteristics resulted from the presence of two suitable minorities, but in Hitler's Germany both stereotypes had been projected onto the Jews.

Basically then the cause of ethnic rigidity lies within the prejudiced person, but its external form depends on the social structure and economic conditions of the time. In Adorno 1950 Levinson defined ethnocentrism as 'a pervasive and rigid in-group - out-group distinction'; which 'involves stereotyped negative imagery and hostile attitudes regarding outgroups, stereotyped positive imagery and submissive attitudes regarding in-groups, and a hierarchical, authoritarian

view of group interaction in which ingroups are rightly dominant, outgroups subordinate.' p.150.

*Adorno found that*  
There <sup>a</sup> correlate of the strength of ethnic hostility is the degree to which other races are seen as all-bad and one's own race as all-good. This would seem reasonable since the extent of 'badness' in the other group makes the corresponding extent of hatred justifiable. Thus a resultant pervasive distortion of perception and cognition must occur to keep incoming facts concordant with this black-white distinction.

Robb 1954 studied working-class subjects in East London and found anti-Semitic attitudes more intense in older people; people of 56 years of age showing the greatest hostility. This may have been due to social and economic conditions at the turn of the century when these people were growing up. Robb also found the same basic personality attributes as Levinson inferred in his definition above. The prejudiced east Londoner was pessimistic, seeing himself and his social group as good, strong and honest, but unable to succeed because everyone else is bad and working against them. The Jews are seen by him to have the political and economic power to control a basically bad world and thus ultimately himself.

The <sup>prejudiced</sup> ~~prejudiced~~ subjects in lower grade jobs stress obedience and never rebel openly, while the ones in a higher grade jobs rebel verbally but not in action and neither type criticises his parents. Roberts and Jessor 1958 showed subjects pictures of socially frustrating situations and



asked them for the first reply that came to mind for the frustrated person in each picture. They found that subjects scoring high on the Fascism Scale devised by Adorno et al 1950 showed more displaced hostility to high status figures and more open hostility to low status figures than did subjects scoring low on Fascism.

The work on authoritarianism can be summarised as showing that extremely rigid people seek security in the goodness of their social group and the stability of the authority structure of that group. As a result of this they maintain the goodness of the group by projecting all bad desires onto out-groups, and maintain the authority structure by never questioning those above them, and demanding the obedience of those below them. They are very dependent on the demands of the external world, while the non-authoritarian are independently able to decide their own fate.

The work of Rokeach summarised in 1960 adapted this concept of rigidity to include left-wing political views. He argued that it is the rigidity with which beliefs are held, and their consequent resistance to change that makes for more rigid behaviour; rather than the actual content of those beliefs. Some of his studies have shown that extreme Communists can have just as rigid an attitude system as extreme Fascists, and indeed recent history supports this. Therefore the rigidity-flexibility dimension as regards attitude systems will be taken to be a dimension of tolerance towards opposing beliefs and contradictory ideas.

Rokeach, McGovney and Denny 1955 tried to distinguish between rigid and dogmatic thinking. Rigid thinking was taken to be that which acted on small sequences of behaviour, as described in Chapter 4, while Dogmatic thinking referred to the relative inability to integrate new ideas once the individual sets affected by rigidity had been overcome.

For this they devised a problem involving the behaviour of an imaginary insect which was trying to reach some food. The subject had to learn a set of rules which governed how many steps and in which direction the insect could move. Then they were given a problem to solve, namely to decide the means by which the insect would reach a particular item of food. To solve this Rokeach said there were three 'sets' which the subject had to overcome; these were: 1) the insect did not have to face the food to eat it, 2) it did not have to move forwards only and 3) it could have been in the middle of a movement sequence when the problem began.

Student subjects were divided into high and low scorers on the Gough-Sanford Rigidity Scale (Gough and Sanford 1952) and high and low scorers on Rokeach's own Dogmatism scale. Comparisons showed that the low-rigidity subjects overcame significantly more of these three 'sets' in the first ten minutes of the problem solving than did high-rigidity subjects. But there was no comparable difference between high and low dogmatism subjects.

The time to integrate the new ideas was measured by the time taken to solve the problem after the second and third sets had been overcome. This time it was the high and low rigidity groups which showed no significant difference in

performance, while the high and low dogmatism groups showed a significant difference in time taken after the second set had been overcome, but not after the third set. Therefore there was some evidence to suggest that rigidity was related to the ease of overcoming set in the analysis stage of problem solving, and dogmatism was related to the ease of integrating these new ideas to generate further hypotheses and conclusions in the synthesis stage of the problem. In studies by Rokeach these two measures intercorrelated between 0.37 and 0.55. Therefore the two types of inflexibility were related to a certain extent but were different enough to require different measuring scales and to produce different cognitive behaviour.

Rokeach 1956 defined dogmatism as 'a) a relatively closed cognitive organisation of beliefs and disbeliefs about reality, b) organised around a central set of beliefs about absolute authority which in turn, c) provide a framework for patterns of intolerance and qualified tolerance towards others.' The more closed a person's attitude system the more isolated would be individual beliefs so that no overall consistency or logic would be possible. Also the closed mind would show a greater differentiation of his own beliefs and a corresponding ignorance about opposing beliefs.

To measure dogmatism Rokeach devised a scale of items which discriminated well between the top and bottom quarters of the scoring results of an English college student sample and an English car worker sample. This scale had only low

correlations with right and left political views, but quite high correlations with the Fascism scale. Its correlations with anxiety measured by 30 items of the Minnesota Multiphasic Personality Inventory (Welch 1952) varied from 0.36 to 0.64 which suggests that authoritarian attitudes reflect a basic insecurity. The rigid person as Robb 1954 found, feels that the hated minority are controlling him and keeping him in a submissive state. This paranoid trait would be expected to correlate well with ethnocentrism but perhaps less with other manifestations of rigidity.

In Chapter 7 of Rokeach 1960, Rokeach, Smith and Evans report a study that compared people from the Northern and the Southern states of the USA. Using various rigidity scales they found that the Southerners tended to reject everybody whether they agreed with their views or not, more so than did the Northerners. Also the more they rejected the Negro, the more they rejected other whites as well. In this instance then, Rokeach's theory that hatred of the outgroup is proportional to glorification of the ingroup did not seem to hold. This might be because authoritarianism and paranoia as discussed above, are related, but not always in a linear fashion, or because the in-group may be restricted to a very small number of people.

For example, in Nazi Germany the authoritarian factor was more important, and the comparative strengths of in-group and outgroup reduced the influence of persecutory fears.

But in the Southern states, especially in recent decades, the Negro is getting numerically and socially more equal; therefore the stereotype fear that they are trying to take over and force out the Whites is more real. As a result fear is more important than the authority structure and paranoia results in a gradient of distrust which is strongest for Negroes and decreases slightly for Whites known to favour equal rights. This gradient decreases more as fellow Whites become increasingly anti-Negro, but to the very rigid Southerner no one can be ultimately trusted except himself - he is his own in-group.

Rokeach also examined the perceptual correlates of dogmatic thinking (Rokeach 1960, Chapter 14). Comparing extreme high and low scoring groups on the Dogmatism scale, who were of equal intelligence he found that there was no difference between the groups on a Gottschaldt embedded figures task, but there were significant differences between them in performance on the more complex designs of the WAIS block design subtest. He claimed this as support for this distinction between rigid and dogmatic thought; because the embedded figures task requires perceptual analysis, and the block design requires perceptual integration and synthesis.

Both of these tests can be thought of as tapping some aspects of abstract intelligence, but Rokeach found that only the Gough-Sanford Rigidity Scale correlated significantly with intelligence ( $r = -0.31$ ) whereas the Dogmatism Scale did not ( $r = -0.02$ ). The measure of

intelligence used was the American Council on Education Test. This might further support his distinction if perceptual analysis is involved in intelligence tests, but perceptual integration is not. However the illogical basis of rigid attitude systems should imply a negative correlation between dogmatism and abstract ability.

Another interesting correlate was the time perspective. In Chapter 20 of Rokeach 1960 he used 5 cards of the Thematic Apperception Test to get projected stories from his subjects. Analysis showed that the extreme high-dogmatic subjects scored significantly more uses of the future tense, while the low-dogmatic scorers used significantly more present tenses. The dogmatic subjects also used fearful themes whereas the non-dogmatic did not, and used more concluding remarks as if they did not like to leave the story with an ambiguous ending. Brim 1962 however, found no relationship between time orientation and independence of personality. Though Brim's result was based on a decision process study with different measures of independence and passivity. If Rokeach's results are true for his measure of Dogmatism then it involves a factor of time orientation, that could be related to the rigid person's anxiety about his personal future.

Rubenowitz 1963 gave adapted versions of the California F Scale (Adorno et al 1950) and the Rokeach Dogmatism Scale to Swedish students, military personnel and industrial workers. He found quite high correlations between the two

scales, but a principal components analysis gave factors which could be interpreted differently for each scale. The main F scale factors involved the smallness of the individual, adherence to convention and discontent about deviance from the correct values and authority structure. The main Dogmatism scale factors were concerned with aggression towards the outgroup, ingroup preference, and the need to believe in a cause.

Results from a similar study using the Gough-Sanford Rigidity Scale showed the main factors to be concerned with working in a rigid frame of reference, perseveration in inappropriate behaviour and doing 'the done thing'. Rubenowitz tested in all, nearly one and half thousand subjects, and by dividing them according to three educational levels he found that people with less education displayed significantly less flexibility in the 41 to 45 year-old age group. Those with a college education showed greater flexibility in the under 30 year-olds, but the older groups scored at nearly the same level as the lower education group. Older subjects at the college level were not available. Rokeach used mostly student subjects so there is only Rubenowitz result to suggest that dogmatism increases with age. But if Rokeach's analysis of dogmatism is correct, then as abstract ability declines with age and people became less sure of themselves they will tend to seek security in a stable authority structure and feel more paranoid about deviant people that they cannot understand. The decline in logical appraisal would also create greater compartmentalisation of beliefs and thus an overall increase in dogmatic thought.

These dimensions of attitude rigidity and their perceptual correlates might reasonably be presumed to have an effect on the ease of adaptation to Decimal Currency. Harvey 1958 in Harvey, Hunt and Schroder 1961 p.49 reports that people scoring high on authoritarianism measures are very resistant to change at low levels of stress, but at higher stress levels they tend to 'go to pieces' and accept the new concept fairly readily.

Also, Katz, McClintock and Sarnoff 1956 compared the degree of attitude change towards Negroes shown by student subjects who had been given insight tuition on the dynamics of prejudice. The subjects were divided into high, medium and low ego-defenders according to their score on selected items from the F scale, and on paranoia items from the Minnesota Multiphasic Personality Inventory. A retest after 5 weeks showed that low ego-defenders did not change much because they were tolerant already. The high ego-defenders though showed two effects, because some of them changed quite a lot and others changed only a little.

These two results taken together suggest that, as Rokeach said the person with a closed mind has compartmentalised beliefs which do not have much logical cohesion. Therefore under pressure the belief system may disintegrate, and such a person will have to accept the new system wholeheartedly because his cognition is not independent enough to think logically about the contradictory beliefs and arrive at a new personal and integrated attitude system.



This stress limit was reached by some, but not others of the high ego-defenders of Katz, McClintock and Sarnoff 1956, and might be reached by some people with the introduction of Decimal Currency.

Although emphasis has been placed on the closed end of the tolerance dimension, one would expect the level of dogmatism - openness in any individual to affect his speed and ability to adapt to Decimal Currency.

Chapter 6

Hypotheses

As stated in the introduction and discussed in Chapters 1 to 5, the three factors affecting ability to adapt are:-

- 1) Rigidity of behaviour, perception and cognition consequent on natural aging processes.
- 2) Level of perceptual and conceptual abstract functioning.
- 3) Behavioural rigidity and the biassed appraisal of information consequent on the rigidity of attitude and belief systems.

The hypotheses of this research will deal with the interaction of these three factors and their effects on the ability to adapt to Decimal Currency.

The measurement of these four variables will be as follows:-

a) Decimal Currency

The level of adaptation will be measured by the speed and accuracy with which people can:-

- 1) recognise the values of the new coins from their shape and colour alone,
- 2) give the correct number and value of decimal coins to pay for items and know what change to expect,
- 3) convert between the old and new currency systems for quick evaluation of prices, and
- 4) use the old coins to pay for goods marked in new currency during the changeover period.

b) Age changes

The aging variable itself need only be measured by the chronological age of the subject, since this gives a valid index of how advanced physical and mental age changes are likely to be in the average person. The consequent reduction with age in abstract ability which results from:- loss of speed; inefficient coding of stimulus information; (Chapter 1) decreased memory capacity and greater susceptibility to interference (Chapter 2) will be measured by the abstract ability tests (see below).

The increased tendency shown by older people, to rely on known methods of behaviour results from a decreased ability to 'set' themselves for a variety of events, (Chapter 4). They tend to wait and see what event will occur before they decide a response, so they cannot predict enough to 'set' themselves for the most probable event; yet if they are given reason to expect one particular event they find it harder to respond to a subsequent unexpected one. As a result they find it easier to respond with well-tried methods, and by living life to a routine they can reduce the number of unexpected events they encounter. This type of behavioural rigidity is measured in the rigidity tests (see below).

c) Abstract functioning

From the discussion in Chapter 3 (Hudson 1966 and 1968) both divergent and convergent functioning need to be measured. The convergent function is best measured by the Progressive

Matrices test, and the divergent function by an Unusual Uses test (Guilford 1956). The ability to abstract parts of the visual field will be measured by an embedded figures test. This gives three measures of abstract ability for comparison purposes.

d) Behavioural rigidity

Rigidity of conceptual functioning is implicit in the abstract-concrete dimension dealt with above in c). Behavioural rigidity will be measured by the Gough Sanford scale (Chapter 4, Schaie 1955, and Chapter 5, Rokeach 1960), and attitude rigidity by items from Rokeach's 1960 Dogmatism scale (Chapter 5). This Dogmatism scale will measure both authoritarianism, and the paranoid fear which accompanies it. Thus there are three rigidity measures for comparison purposes; analytic rigidity, integrative rigidity and paranoia.

The measures on these four factors, taken together will give an estimate of the flexibility of perception, cognition and behaviour for each subject. Therefore averages can be found for each measure in each subject age group, and trends observed from these means. But the results will only show facts as they exist now, and nothing can be said about the amount of rigidity or flexibility that is due to the physical status of each subject, his past experience, nor the historical context in which he received his experience.

All that can be said is that evidence presented in Chapters 1 to 5 show that certain inabilities appear as age increases and therefore in any subject sample covering

several decades of age, one would expect these inabilities to occur with greater frequency among subjects of greater age.

The hypotheses derived from the experimental evidence given above are:-

Hypothesis 1 The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur later</sup> ~~be slower~~ in older than younger age groups. This improvement deficit will be proportionately greater on the two measures involving the use of both currencies together (the greater complexity causing more interference and confusion in older subjects) than in the two measures of new currency alone.

Hypothesis 2 The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur sooner</sup> ~~be faster~~ among subjects scoring higher on the tests of abstract reasoning ability, regardless of the age of those subjects.

Hypothesis 3 The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur later</sup> ~~be slower~~ among subjects scoring higher on the rigidity measures. The effect of behavioural rigidity will be at a maximum sooner than the effect of dogmatic thinking (analytic rigidity operating before integrative rigidity)

Hypothesis 4 Older age groups will show lower mean scores on the tests of abstract ability than will younger age groups. Divergent ability will decline at a slower rate because it is measured by a verbal test, and verbal ability holds up with age.

Hypothesis 5 Older age groups will show higher rigidity scores than younger age groups, but the age trends will be different for the three measures, Behavioural rigidity will increase most, while authoritarianism and paranoia will increase only if abstract ability declines.

Hypothesis 6 The three measures of abstract ability will each be negatively related to the three rigidity measures, but the correlation between dogmatism and the two tests of convergent and divergent reasoning will be greater than that between behavioural rigidity and these reasoning tests; while the correlation between perceptual flexibility (embedded figures) and behavioural rigidity will be greater than that between perceptual flexibility and dogmatism.

Hypothesis 7 The three abstract ability measures will correlate positively and significantly among themselves, but very high scorers on the Matrices test will score relatively low on Unusual Uses, and conversely high scorers on Unusual Uses will score relatively low on the Matrices test. Women will be more perceptually field dependent than men.

Hypothesis 8 The three rigidity measures will correlate positively and significantly among themselves, but subjects scoring very high on Authoritarianism will score relatively low on Paranoia because they are the least able to admit to personal weakness.

Hypotheses 1, 2 and 3, if upheld, should show that the three proposed factors of rigidity do affect ability to adapt to a new system of thinking. Hypotheses 4 and 5, if upheld, should show that the age changes discussed in Chapters 1 to 5 are objectively observable.

Hypotheses 6, 7 and 8, if upheld, will support a theory of a general level of field dependence involving both perception and cognition (Witkin 1954, Robb 1954, Rokeach 1960) and a theoretical distinction between behavioural rigidity which operates on the analysis of a problem, and dogmatic thinking which operates on the subsequent integration and synthesis of results.

(Rokeach 1960)

SECTION B

Method

Chapter 7     Test Battery and Test Administration

From the pilot study work (see Appendices I and II) the following test battery was arrived at:-

1) £ s d test

This involved 18 examples set out thus:-

£	s	d
20	17	4
22	15	7

---

The numbers for the sums were taken out of random figure tables, omitting those which did not come within the numerical confines of pounds, shillings and pence.

Since Botwinick, Brinley and Robbin 1958 found that alternation between subtraction and addition involved a more independent process in older people, the examples in this test were laid out so that the first 9 examples involved addition, and the second 9 involved subtraction.

Since the process involved a simple set and therefore easy to code, it was hoped that older people would not be at a disadvantage from 'set lapse', (Brinley in Welford and Birren, Eds. 1965).

The instructions written at the top of the sheet were:-  
"Do as many of the following sums as you can. Please work as quickly as you can. ADD in these examples:-"



The time limit was one minute, and every effort was made to see that subjects understood the instructions before timing began.

2) £ p test

This had the same layout and time limit as the £ s d test. The only difference was that the examples were all direct conversions to £ p of the previous £ s d test examples.

An example being:- £ p  
20. 87  
22. 78  
—————

3) Unusual Uses for a pair of scissors

This was to test divergent thinking ability, (as in Guilford 1956, Chown 1960, and Hudson 1966). Since the generation of uses involves mental operations, not concrete experimentation; and the logical appraisal of these uses as physically possible in practise, it seems reasonable to call this a test of abstract reasoning ability.

The instructions written at the top of the test sheet were:- "Please write down as many UNUSUAL USES as you can think of for a PAIR OF SCISSORS, that means ANYTHING except cutting with two blades.

Here are some examples to show you what we mean:-

- 1) as a weapon, to throw or stab with
- 2) as a conductor of electricity
- 3) use the finger-holes to draw round shapes in a pattern"

The rest of the page was left blank for the subject's responses. The time given was 5 minutes.

4) Hidden Faces test

This was an adaptation of a 'Penetration of Camouflage' test as used by the American Air Force during the 1939-1945 war. The instructions were written on a separate sheet, followed by two pictures. The instructions were:-

"On the next page you will find a picture that has several camouflaged faces in it. Five of these faces have circles drawn round them; they are examples to show you the kind of faces we mean.

Put circles round as many other faces as you can find in the picture.

Go on to the second picture as soon as you can."

The two pictures were in black and white line, with the density of line varied to give shading effect. The hidden faces were particular configurations of these shading variations, conforming to the profile or full face view of a human face, with shading to imply eyes, cheeks and chin etc.

The first picture was of an American soldier kneeling to examine a path in the jungle. Five of the hidden faces had heavy black rings round them and seven were left for the subject to find. The second picture was of a soldier about to throw a grenade in the jungle. No faces were ringed and eleven faces were present for the subject to find. This gives a total maximum score of 18 faces.

The time given was two minutes, and subjects were advised to go on to the second picture when one minute had passed.

This test was chosen because it was thought that human faces would require less coding than the geometrical figures of a Gottschaldt embedded figures test, and thereby would maximise the performance of older subjects. Also, since it was a picture which hid the face and not a geometrical configuration, it was hoped that it would present a situation having more in common with an everyday visual field than with an abstract reasoning test.

This test and the Unusual Uses test will be referred to as the flexibility tests, since they require a reappraisal of the given stimulus rather than a logical deduction.

#### 5) Rigidity questionnaire

This consisted of 44 items with 'FALSE' and 'TRUE' columns for the subject to tick his response. The instructions written on the top of the first question sheet were:-

"Below you will find a number of statements, If you think a statement is true, then put a tick in the 'TRUE' column; if you think it is false, then put a tick in the 'FALSE' column. If you find a statement with which you do not fully agree or disagree, then put a tick in the column which most often applies to you.

Do not leave out any item. Please go through the items as quickly as you can. Your answers will be strictly confidential".  
There was no time limit.

The questionnaire was made up of the Gough Sanford Rigidity Scale and items from the Rokeach 1956 Dogmatism Scale. The Gough Sanford scale had 21 items; though the version used by Rokeach 1960 had one more item which concerned church-going, and since this was asking about religion rather than habit it was omitted. The Dogmatism items were taken from the Dogmatism Form E described by Rokeach 1956.

The original Form E had 40 items, and from these 20 items were chosen for use in this research. These 20 items were ones which had some of the largest 't' values in statistical tests between the scores of the top and bottom scoring quarters of Rokeach's samples. These items can be said therefore to have good discriminating power between dogmatic and non-dogmatic thinkers. Some items with large 't' values were not chosen, either because they repeated an opinion covered by other items, or because they might not have much meaning for the English general public. An example of such an item is:- 'In times like these it is often necessary to be more on guard against ideas put out by people, or groups in one's own camp than by those in the opposing camp', which had a  $t = 5.44$ .

The items chosen for the Authoritarianism subscale of the Dogmatism Scale used in this study and their 't' values are listed below, along with the theoretical headings that Rokeach used to describe his items.

Authoritarianism

't' value

- a) It is only when a person devotes himself to an ideal or cause that life becomes meaningful. 5.42
- b) In the history of mankind there have probably been just a handful of really great thinkers. 5.42
- c) Of all the different philosophies which exist in the world, there is probably only one which is correct. 4.24
- d) To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side. 4.11
- e) A person who gets enthusiastic about too many causes is likely to be a pretty 'wishy-washy' sort of person. 4.78

Intolerance

- a) There are two kinds of people in this world, those who are for the truth, and those who are against the truth. 6.74
- b) Most of the ideas which get printed today aren't worth the paper they're written on. 4.68
- c) My blood boils whenever a person stubbornly refuses to admit he's wrong. 4.22

Intolerance of small differences

A group which tolerates too many differences of opinion among its own members cannot exist for long. 5.22

Party-line thinking

In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own. 6.04

The items chosen for the Paranoia subscale of the Dogmatism Scale used in this study with the theoretical headings given by Rokeach are as follows:-

<u>Fear of isolation</u>	<u>'t' value</u>
a) Man on his own is a helpless and miserable creature.	5.55
b) Most people just don't give a damn for others.	4.33
c) I'd like it if I could find someone who would tell me how to solve my personal problems.	3.52
<u>Paranoia</u>	
a) I have often felt that strangers were looking at me critically. (omitted by Rokeach for lack of face validity).	4.44
b) It is only natural for a person to have a guilty conscience.	5.38
<u>Self-aggrandizement</u>	
a) The main thing in life is for a person to want to do something important.	4.26
b) If given the chance I would be something of great benefit to the world.	4.96
<u>Self hate</u>	
It is better to be a dead hero than a live coward.	3.51
<u>Fear of the future</u>	
It is only natural for a person to be rather fearful of the future.	6.10
<u>Compulsive repetition of ideas</u>	
In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.	3.65

It was hoped that this choice of questions had produced a scale that would not be influenced by political or religious ideas, but would be general enough to get an unguarded response from the subject on the rigidity of his attitudes and the amount of threat he felt from the outside world.

Three buffer items were also chosen from Rokeach's study, these being ones which did not discriminate significantly between the high and low scoring quarters of Rokeach's samples. They are:-

- a) The principles I have come to believe in are quite different from those believed in by most people.
- b) Its all too true that people just won't practise what they preach.
- c) If I had to choose between happiness and greatness, I'd choose greatness.

These 23 items were randomly mixed with the Gough Sanford items. The Gough Sanford items, in the order in which they appear in the final questionnaire are:-

1. I am always careful about my manner of dress.
2. I usually check more than once to be sure that I have locked a door, put out the light, or something of the sort.
3. I often become so wrapped up in something I am doing that I find it difficult to turn my attention to other matters.
4. I often find myself thinking of the same tune or phrases for days at a time.
5. I find it easy to stick to a certain schedule, once I have started on it.
6. I try to follow a programme of life based on duty.

7. I usually maintain my own opinions even though many other people may have a different point of view.
8. There is usually only one best way to solve most problems.
9. I am a methodical person in whatever I do.
10. I am often the last person to give up trying to do a thing.
11. I prefer to stop and think before I act, even on trifling matters.
12. I do not enjoy having to adapt myself to new and unusual situations.
13. I prefer work that requires a great deal of attention to detail.
14. I dislike to change my plans in the midst of an undertaking.
15. I think it is usually wise to do things in a conventional way.
16. I always finish tasks I start, even if they are not very important.
17. I have never done anything dangerous for the thrill of it.
18. I have a work or study schedule which I follow carefully.
19. I usually find that my own way of attacking a problem is best, even though it doesn't always seem to work in the beginning.
20. I believe that promptness is a very important personality characteristic.
21. I always put on and take off my clothes in the same order.

The scoring of the questionnaire was relatively simple. Each question to which the subject ticked 'TRUE' gave a score of one for the scale to which the question belonged. The simplicity of the scoring did however, present a problem because the tendency to agree with questions has been linked with rigidity measures in past research.



In support of this method of scoring are the results of Couch and Keniston 1960. They developed a 360-item Over-all Agreement Score and correlated results on this with the 'TRUE' or 'YES' categories of other tests. On a student subject group the yeasayers were higher on impulsivity, dependency, anxiety, mania, anal preoccupation and resentment; while naysayers were higher on ego strength, stability, responsibility, tolerance and impulse control, but authoritarianism and agreement response set were orthogonal factors. It does look though as if the tendency to agree might be higher in paranoid and field-dependent people, but this might be just as much a problem if a more complex likert scale of agreement was used, because the tendency to agree is part of the personality syndrome that the questions hope to measure. Also McGee 1962 said that although past research had accepted a trait of response-acquiescence associated with conformity, and non-acquiescence associated with independence, he concluded that there was 'little real defensible data to tie response styles to the criterion of independently measured behaviour.'

As a concession to the possibility of response bias the 'FALSE' column was put before the 'TRUE' column so that agreement with an item caused the subject to go beyond the nearest response category.

#### 6) The Progressive Matrices test

This test is made up of 5 sets of problems. Each set consists of 12 problems, the first of which are very simple and illustrate the logical process required to fill in the missing part of each pattern. Within each set the problem

get harder, and require more than one process of analysis to solve them. Also between the sets themselves the type of problem gets progressively harder as each new method of solution is based on, but more complex than, the method of the previous set.

The implicitness of the methods of solution helps to overcome educational differences though the use of the scoring sheet must be explained verbally by the experimenter. There are no set instructions for this because the explanation, especially for older subjects requires repetition and amplification. Each set has a letter: A,B,C,D and E, and each problem within it is numbered from 1 to 12. The scoring sheet has 5 columns headed with the code letters and numbered downwards from 1 to 12 corresponding to each of the problems. The subject is required to fill in the number of the correct piece of pattern in the box provided beside each of the column numbers.

The time limit was 20 minutes, since Heron and Chown 1967 report a correlation  $r = 0.92$  between the scores of the Matrices test given with a 20 minute and 40 minute time limit. It was also noted though that older women made significantly more use of the second 20 minutes than did older men, and this may effect the results of this research as well.

The scoring of the Matrices was from the answers given in Raven 1960 and the final score was the total number correct.

Decimal Tests The tests of ability on Decimal Currency were based on exercises from Keith 1968, which was designed for use in schools. An instruction sheet before the decimal tests said:-

"On the following pages there are several short tests on the use of Decimal Currency.

In each test please do as many items as you can in the time allowed.

Don't turn over between the tests until you are told.

The first example in each test has already been done for you, so that you will see what kind of answer is required."

7) Use of New Currency (Decimal Currency I)

This test was based on Keith 1968 p.7 exercise I. It consisted of 20 items. Each item consisted of an article and its price in £ p, and the subject had to write down the new coins needed to pay for it and the change expected. The instructions at the top of the sheet were:-

"Which new currency coins could you give for the following articles, and what change (if any) would you get?"

The first item, already answered for the subject, was:-

"A stamp costing  $4\frac{1}{2}$ p. - One 5p coin. One  $\frac{1}{2}$ p coin change."

8) Ability to convert from old currency to new currency  
(Decimal Currency II)

This test was based on Keith 1968 p.8, exercise 6. It consisted of 30 items, in each of which an article and its price in old currency were given, and the equivalent

decimal price required from the subject. The instructions at the top of the sheet were:-

"Please give the approximate price of the following articles in new currency, correct to the nearest new halfpenny."

The first item, already answered for them, was:-

'An 8/6d paperback book. 42 $\frac{1}{2}$ p'

9) The use of both currencies interchangeably  
(Decimal Currency III)

This test was based on Keith 1968 p.9, exercise 5.

It consisted of 20 items, in each of which an article and its price in new currency was given, and the subject had to say which old currency coins could be used to pay for it. The instructions at the top of the sheet were:-

"Which old currency coins would you use to pay for the following articles and what change (if any) would you be given? (The change will be in new currency)"

The first item already completed for them was:-

'A 25p magazine. Two florins and one shilling'

No change

10) Recognition of the new coins and their values  
(Decimal Currency IV)

This test was based on Keith 1968 p.6, exercise 5.

It consisted of 16 items. Each item was made up of two cardboard coins pasted side by side, with the one of smaller value first. Both coins were 'heads' side up so that values could only be judged by the size and colour of the cardboard replicas. For each pair of coins the subject

had to say how many of the first coin made up the value of the second coin.

The instructions and an example were given first on a separate sheet. They were as follows:-

"This next test is to find out how easily you can judge the values of the new coins. For each pair of coins presented on the next 2 pages, please write down how many of the first coin makes up the value of the second coin." For example:-

How many (2p coin) make up (50p coin)? answer, 25

The 16 items were presented on two sheets of card with eight pairs of coins on each card. The answer sheet was separate and underneath each card leaving sufficient overlap beyond the card for the subject to write his answers. On each card the words 'How many ..... make up?' were written in for the first pair of coins only.

There were 15 possible combinations of coins and these were randomly arranged on the two cards.

For the 4 decimal tests the time limit on each was one minute. This was rather a short period but the length of the test battery made it a necessity. Also it was not known how rapidly the subjects would complete the tests, and it was important not to have a ceiling effect.

The measure of improvement on the decimal tests was to be the gain in scores after different periods of time. This meant that the 4 decimal tests would have to be given twice to the same people, and therefore to prevent any bias from memory of the first test, a second set of tests were constructed.

This second set were identical in layout to the first set but tests I, II and III were made up of different items, while test IV was made up of two different random arrangements of the 15 possible combinations of coins.

The test booklets

The testing time needed to complete the tests made it advisable to put the Progressive Matrices test with the retesting of the decimal tests. This meant that both testing sessions would last for about half an hour.

Test booklet I

In this booklet the ability and personality tests numbered 1 to 5 above were presented in the order they have been given, and were followed by either the first or second set of decimal tests. The cover page of the booklet dealt with background information, the wording being:-

PLEASE FILL IN THE FOLLOWING INFORMATION:-

INITIALS FOR CODING \_\_\_\_\_

DATE OF BIRTH \_\_\_\_\_

SEX \_\_\_\_\_

OCCUPATION \_\_\_\_\_

ANY PREVIOUS EXPERIENCE WITH DECIMAL CURRENCY  
\_\_\_\_\_

The initials meant that the first and second testing-booklets could be matched for each subject, while at the same time making the subject feel that his answers were confidential.

The date of birth provided the age score needed for the analysis. The sex of the subject was also important for theoretical comparisons. Occupation was thought to be a useful piece of information for comparing the subject groups. Previous experience with decimal currency was explained to the subjects as meaning any periods of time in which they had lived abroad, or holidays abroad, and also any teaching courses they had been on to learn the use of the New Currency.

Because nearly all the tests were timed, efforts were made to ensure that subjects did not look ahead in the booklets. For this, every page, except the Hidden Faces pictures and the first two pages of the questionnaire had written on them:-

'DON'T TURN OVER UNTIL YOU ARE TOLD'

The same words were printed on three blank sheets that were inserted

- 1) between the £ s d and £ p test,
- 2) between the £ p and the Unusual Uses, and
- 3) between the Hidden Faces second picture and the rigidity questionnaire.

#### Test booklet II

This had the same cover sheet as the first booklet, so that the two booklets could be easily matched. Then followed the instruction sheet for the decimal tests and the set of four decimal tests which had not been used in the first booklet. When this had been completed the

subjects were handed out copies of the Progressive Matrices test booklets, in each of which was an answer sheet. They were asked to put their initials on this answer sheet so that this could be matched with the rest of Test Booklet II at the end of the test session. The Matrices answer sheet was not fixed to Test Booklet II because it would have made it rather awkward to write in while the Matrices booklet was also open in front of the subjects.

#### Decimal test design

For the first testing session with Test booklet I, 58 subjects had the first set of decimal tests, and 59 subjects had the second set of decimal tests. On the second testing session with Test Booklet II, 53 subjects in the groups which had previously had the first set of decimal tests, this time had the second set of decimal tests; and 55 of the subjects in the groups which had previously had the second set of decimal tests, this time had the first set of decimal tests.

This design should have cancelled out any differences in difficulty between the two sets of decimal tests. In describing the Decimal tests, reference was made to the importance of giving sufficient items so that even the most able could not finish in the given time. As a result of performance in the first test session it was found that the first three decimal tests were adequate in this respect, but that the Coin Recognition test would need more items if people improved much between the tests. For this reason



one card from each set was added behind the two cards of the other set in Test Booklet II, to give a total of 24 items. But in fact only one subject of the adult sample got as far as this third sheet, though 5 of the student sample did. (see Chapter 8)

#### Test administration

5 groups (in all 56 subjects) were tested and retested by S. Crouch and 3 groups (in all 46 subjects) were tested and retested by S.M. Chown. The ninth group was tested by J. Smith, and the Bedford College psychology students by S. Crouch. As the design of the study required that the 8 groups of the main design should be tested during the week of February 15 - 19, 1971 when the Decimal Currency changeover took place, the services of two testers were a physical necessity. It was hoped that the layout and written instructions in the test booklets would reduce the influence of different testers.

The testing was done in classrooms of Adult Education Institutes and the subjects therefore completed the booklets in an academic situation with the benefit of desks to write on.

It was regretted that the timing of the tests was so short, but this was necessary to make the test sessions of a manageable length. Chapter 1 of Section A dealt with the effect of speeded tasks on older people, and the tendency of older people not to respond when hurried. To offset this, care was taken by both testers to explain

the reasons for the time limits to the subjects before the testing started. They were told that time limits were important if scores of different people were to be compared, so they were urged to stop writing as soon as the experimenter asked them to, and not to start writing until they were told.

They were also told after the tests not to worry if they had not managed to do much, and that indeed in the decimal tests they would only be expected to have completed a few of the items. Emphasis was laid on the fact they they should do their best, but that it would not reflect badly on them if they were not so adept as their neighbours seemed to be, because different people were better at different things.

In general the design of the testing procedure was aimed at getting the best performance from subjects, especially the older ones, on a fairly wide range of abilities related to the hypotheses of this research. For this reason the decimal tests I, II and III involved prices for named articles such as a book or stamps rather than just different amount of currency, so that older people would find the tasks more related to everyday life, and would feel less overawed by the mathematical nature of the tests. The experimenters also aimed at establishing an informal rapport with the subject groups so that anxiety would be minimised and the number of people returning for the second testing session would be maximised.

Chapter 8    The Subject Sample and Testing Timetable

During the Autumn of 1970 contact was made with the principals and staff of several Institutes of Adult Education in the London area. As a result of these letters and interviews it was agreed that 7 classes would be asked if they were willing to take part in the research. These classes were studying social psychology and English literature, so it was hoped that the nature of the research might be of interest to some of them and result in a larger subject response.

In one institute it seemed that no one class was studying a suitable subject, but the principal suggested sending out letters to all the institute students so that any who wanted to take part, could do so. The author's letter (see Appendix VI) was distributed by the principal; and volunteers gave their names to their tutors. This gave a total of eight groups to be tested, the number of subjects in each group depending on the attendance rate of the subjects in both first and second testing sessions. A ninth group from an Adult Education Institute was recruited and tested by J. Smith.

Hutchinson 1970 reported a study that involved interviewing nearly five thousand people attending Institutes of Adult Education in England and Wales. Of those who were enrolled in non-work-related courses, up to two thirds belonged to the top three social classes, and had received a longer full-time education than the general population. There were also three times more

women than men and the total numbers attending decreased progressively with age. It is reasonable to assume then that the subject sample recruited will also be above average in social class and education, since the more-able will tend to co-operate more; and will be made up mostly of women and younger adults.

The first-year psychology students from Bedford College were also tested as a comparison group.

### Testing Timetable

It was thought that people would adapt fairly quickly to the new currency and therefore the measure of gain in ability would need to be done in the first few weeks after Decimalisation. The main design of the testing was to test all the groups in Decimal week, February 15th to 19th 1971, and then to test some of the groups in each of one, two and three weeks afterwards. The testing dates had to be fixed in advance because the test administration was to take place in class time, except for the volunteer sample. This meant that equal numbers could be assigned in each of the three retest weeks only from estimates of class attendance, and the extent to which attendance would fall off on the second testing session was not known.

Apart from this main design, two other groups were used to check the effect of practice on the Decimal tests. One of these groups was one of the class groups originally recruited. They were tested one week before Decimalisation and in Decimal Week. The other group was offered later by

another Institute teacher J. Smith and they were tested, by this teacher, in the first and third weeks after Decimalisation. The seven groups used in the main design will be referred to by code letters:- SI, PI, W, CLI, SA, FH and WMC. The two practice check groups will be referred to as PCI and PCII, in the order they have been described above.

All 9 groups, on the first testing occasion, were given Test Booklet I, and on the second testing occasion, Test Booklet II. Table I summarises the design of the testing timetable.

TABLE I TESTING TIMETABLE FOR THE ADMINISTRATION OF  
BOTH TEST BOOKLETS, TO ALL SUBJECT GROUPS

Testing Dates					
	February 8th-12th	February 15th-19th	February 22nd-26th	March 1st-5th	March 8th-12th
Monday	1 * Student group N=20 Set 2		1 * Student group N=21 Set I		
Tuesday		1 Group SI N=16 SetI		1 Group SI N=9 Set2	1 Group SI N=1 Set2
		1 Group PI N=12 SetI	1 Group PI N=12 Set2		
		2 Group W N=13 Set2		2 Group W N=15 SetI	
Wednesday		2 Group CLI N=21 SetI	3 Group PCII N=9 Set I		2 Group CLI N=20 Set2
					3 Group PCII N=12 Set2
Thursday	1 Group PCI N=13 Set2	1 Group PCI N=8 Set I			
		2 Group SA N=14 Set2	2 Group SA N=14 SetI		
		1 Group FH N=13 Set2		1 Group FH N=13 SetI	
Friday		1 Group WMC N=6 Set 2		1 * Student group N=20 Set2	1 Group WMC N=5 SetI

\* The psychology student group were also tested on January 22nd with Set I Decimal tests.

N = Number of subjects present at each testing session.

Testers 1 = S. Crouch

2 = S.M. Chown

3 = J. Smith

Set I = First version of Decimal tests

Set 2 = Second version of Decimal tests

SECTION C

Results

Chapter 9 Subject Response and Subject Groups for Analysis

The subject response in the classes was good, and only a few people declined to take part. However, in the Institute that distributed letters to its students, of one hundred letters given out only 30 people gave in their names as volunteers, and only half of these turned up for the first testing. Only half again turned up for the second testing so that in that one instance, the final completed booklets belonged to less than 10% of the contacted sample.

Table 2 gives the actual numbers of each group who were:-  
present for both testings - 'returners'  
present for the first testing only - 'non-returners'  
present for the second testing only - 'incomplete'  
or failing to complete the Test Booklet.

Total Returner Group

This group is made up of the subjects in the 7 groups of the main design who completed both Test Booklets I and II. The total N = 75.

This can be divided into three returner subgroups; with one group for each week that subjects were retested.

For retest week I, groups PI and SA, N = 21

For retest week II, groups SI, W and FH, N = 32

For retest week III, groups CLI and WMC, N = 22

(one subject from group SI was retested in week III instead of week II).

TABLE 2 SIZE STRUCTURE OF THE GROUPS DURING FIRST AND SECOND TESTINGS

Group codes and retest weeks	Returners		Non-returners		Incomplete	
	Men	Women	Men	Women	Men	Women
Groups retested after 1 week						
PI	4	5	9	1	2	3
SA	0	12	12	0	1	2
Groups retested after 2 weeks						
SI*	0	8	8	2	5	7
W	5	8	13	0	0	1
FH	5	7	12	0	1	1
Groups retested after 3 weeks						
CLI	6	10	16	3	1	4
WMC	1	4	5	0	0	1
Practice check groups						
PCI	1	6	7	1	3	4
PCII	2	6	8	0	1	1

\* One subject in group SI was retested after 3 weeks



### Non-Returner Group

This group is made up of the people who were only present for the first testing in both main design groups and the two practice-check groups. The reason for this inclusion is that, with no retest scores available, nothing can be said about the non-returners rate of improvement on the Decimal tests. It is only their personality and ability scores that are useful for comparison purposes, and since these are likely to be fairly constant over time, it is reasonable to include the practice-check subjects with those tested in Decimal week. This gives a total Non-returner group of  $N = 21$ .

### Incomplete Test Booklets

Some subjects turned up at the second testing but not at the first. If spare booklets were available they were also invited to take part. The number of such subjects was 19, and their Decimal test scores were used in some cases in the results for estimating mean Decimal scores over time.

Some other booklets were incomplete because people failed to fill in their age, or complete the rigidity questionnaire. The number of such booklets was 5. Again these booklets have been used whenever possible to help in the correlations between personality and ability tests, or Decimal tests over time.

Practice-check Groups

The people in the practice check groups who completed both Test Booklets numbered 15; 7 were in PCI and 8 in PCII.

Total subjects tested

From the numbers given in the sections above it can be seen that 135 different subjects were tested. The main design returners and the practice-check returners give a total of 90, which is two thirds of the total tested.

The main analysis will deal with the results from the Total Returner group, and the three retest-week groups within it. The Non-returners and Psychology student groups will be compared with the Total Returners separately.

Another group was also selected from the Total Returner group. This group was selected by matching subjects of the first retest week with subjects in the second and third retest weeks. The matching was done for age and Progressive Matrices test score. For age, subjects were matched within 5 years of each other, except in one instance where the subject of week I was 40, of week II was 45 and of week III was 35 years old. For the rest of the subjects used the matches were usually very close. On the Matrices score the subjects were matched within 6 points of each other. (see Table I, Appendix III)

This group then is a selection from the three Returner subgroups, and gives three groups of comparable age and abstract reasoning ability. It was possible to find thirteen

subjects from each week that would match with the other two groups, so that for the total Matched group  $N = 39$ , which is just over half of the Total Returner sample. This group also will be used in the main analysis.

Chapter 10      Statistics used in the Analysis

Since the scores of all the tests in the two batteries were normally distributed parametric significance tests have been used.

Related t - test (McNemar 1949, Chap. 12) This was used for comparisons of the first and second Decimal test scores within each of the three Returner subgroups.

Unrelated t - test (McNemar 1949, Chap. 12) This was used to test for significant differences on all of the Test Battery I variables between all the subjects who returned for the second testing and all those who did not.

One-way Analysis of Variance (McNemar 1949, Chap. 13) This was used to test the differences in scores between any of the three returner subgroups on any of the test variables; between the practice check groups on any of the four Decimal tests; and between the Total Returner group and the Matched Returner group on any of the test variables.

Two-way Analysis of Variance (McNemar 1949, Chap. 14) This was used to test the effect of age and duration of intertest interval on Decimal Test improvement for the Matched Returner sample.

Trend test using lamda coefficients For three age groupings, subjects were divided into high or low scorers on one of the Rigidity or Flexibility tests and then a Two-way Analysis of Variance computed on the raw scores of another Rigidity or Flexibility test. For example:-

Age groups: 20 to 29, 30 to 39, 40 to 58 years old

Unusual Uses groups: high scorers (7 or more), low scorers (6 or less). Hidden Faces raw scores as cell scores.

This division into age and ability gave different numbers in each cell, but the division of age and ability groups was adjusted to give the largest possible minimum cell total. When this was done the other cells were also reduced to this minimum cell number by random omissions of the extra scores. In this way the final cell total was 11, 12 or 14 for each of the 8 analyses used.

When the Two-way Analysis of Variance had been done the interaction sum of squares was divided into its quadratic and linear components using lamda coefficients. This showed any significant differences in the trends of one Flexibility or Rigidity variable with increasing age for high and low scorers on one of the other Rigidity or Flexibility tests. In this way it was hoped to focus on the greatest point of interaction between these various test measures and age.

Apart from the Interaction sum of squares, individual linear and quadratic sum of squares were computed for each high and low scoring group. For example the age trend shown by high scorers on the Unusual Uses test, in scores on the Rokeach-Paranoia subscale could be assessed as significantly or non-significantly quadratic or linear; independently of its difference from the trend of the low scorers on the Unusual Uses test.

Pearson Product Moment Correlation Coefficients (McNemar 1949, p.92) Correlation matrices were computed, using program BMD02D, "Correlation with Transgeneration" (Dixon 1970, p.49). Matrices were thus obtained for the

Total Returner group; the Matched Returner group; and the Non-Returner group. The group numbers were the same as given previously in Chapter 9 except that Practice Check Group I was included in the Total Returner matrix, since it was one of the original 8 groups recruited from Institutes of Adult Education; so that  $N = 81$ . The variables in the two Returner matrices were:-

Age:- with each decade coded as one number e.g. 16 to 25 years old coded as '1'

Sex:- men coded as '1', women coded as '2'

Previous experience with Decimal Currency:- living abroad for more than 6 months coded as '1'; holidays abroad or responses of 'yes' coded as '2'; and responses of 'No' or 'None' coded as '3'.

Progressive Matrices; £ s d; £ p; Combined Maths score; Unusual Uses; Hidden Faces; Gough Sanford Scale; Rokeach-Authoritarianism and Rokeach - Paranoia:- all entered the computations as raw scores.

Decimal test scores from the first occasion and from the second occasion; the difference in scores between these two occasions (referred to as 'Decimal Gain' scores); and the combined scores of the I New Currency and IV Coin Recognition tests for both testing occasions:- all these were entered as raw scores also.

Time variables; a linear improvement in Decimal ability was tested for by coding the retest weeks as '1', '2' or '3' in the order that they occurred. The Practice-check group (PCI) subjects were coded as being tested after '0' weeks; a quadratic improvement was tested for by coding

both retest weeks I and III as '1', and retest week II as '2'.

This gave a total of 28 variables in each of the two Returner matrices. Since the Non-Returners only completed Test Battery I their matrix had only 16 variables, coded in the same way as for the Returner groups. Using the full 28 variables another matrix was also computed for the Total Returner group plus the Psychology student group. This gave N = 99. Since the Psychology students were tested four times it was not possible to equate their rate of progress with that of the main sample, but for the purposes of a comparative correlation matrix the Psychology student scores from February 22nd were used as the Decimal week scores, and those of March 5th were used as the retest Decimal scores with the retest week being coded as '2'.

A further Product Moment Correlation Matrix was also computed for the Rigidity - Flexibility factors alone. This consisted of: Gough Sanford Rigidity Scale:- 21 items  
Rokeach - Authoritarianism subscale:- 10 items  
Rokeach-Paranoia subscale:- 11 items (one buffer item added)  
Age of each subject given to nearest year, not coded.  
Unusual Uses and Hidden Faces raw scores.  
Sex:- men coded '1', women coded '2' as in the other matrices.

For the three questionnaire scales, each item made up a separate variable, and each subject's responses were coded by a '1' for 'FALSE' and a '2' for 'TRUE'.

There was a total of 46 variables for this matrix. Since the Progressive Matrices score was not included it was possible to combine the scores of the Returners, Non-Returners and Psychology students for this analysis so that  $N = 110$ . By making the sample size as large as possible it was hoped to find some reliable Rigidity and Flexibility factors in the results.

Principal Component Analysis (Hotelling 1935) Using the computer, principal component analyses were carried out for each of the correlation matrices. (Thomson 1951). In each the principal axes were rotated orthogonally by Kaiser's Varimax procedure.

Regression analysis (Thomson 1951, Chap. 14) This analysis was done by the computer to measure the predictability of each of the first and second Decimal test scores from the background variables, which were:-  
Age; sex; previous experience with Decimal Currency;  
Progressive Matrices score; £ s d and £ p scores; combined Maths score; Unusual Uses; Hidden Faces; Gough Sanford Scale and the two Rokeach subscales.

The computer program used was the BMD02R Stepwise Regression (Dixon 1970, p.233), which 'computes a sequence of multiple linear regression equations in a stepwise manner'. The variable which is added at each step is the one which makes the greatest reduction in the error sum of squares. Only one analysis was needed for the scores of each of the four Decimal tests on the first testing occasion, but for the second testing occasion separate analyses were computed



for each of the three Returner subgroups, so that the predictative power of the background variables for each of the three weeks of the intertest interval could be known and compared.

Chapter 11    Comparability of the Returner Subject Groups

Before any gain in ability on the four Decimal Currency tests can be assessed, it must be known to what degree the three Returner Subgroups differed in their initial ability on the Decimal tests in Decimal week. For the Matched Returner group also it is necessary to know whether the process of matching 13 people in each of the retest weeks produced a Matched sample differing in ability from the Total Returner group from which they were selected.

Similarly, before any change in ability on the Decimal tests can be attributed to the background, and personality variables, it must also be known whether any of the comparison groups differed significantly from each other on any of these variables. The means scores on the background variables and the Decimal tests scores of Decimal week for all the Returner Groups are given in Table 3.

The largest comparative differences between the Returner Groups' scores were tested for significance by One-way Analysis of Variance. The results were:-

- 1) Age. The largest difference in mean age was between the subgroups retested in weeks I and II. The analysis gave  $F = 1.34$  which was not significant.
- 2) Sex. The largest difference was between the Matched Returners and the Returner subgroups of weeks II and III. The analysis gave  $F = 1.22$  which was not significant.

TABLE 3 MEAN SCORES OF THE RETURNER GROUPS ON THE BACKGROUND VARIABLES,  
AND THE FIRST OCCASION DECIMAL CURRENCY TESTS.

Background and Decimal variables	RETURNER GROUPS				
	TOTAL RETURNERS N = 81	MATCHED RETURNERS N = 39	RETESTED IN WEEK I N = 21	RETESTED IN WEEK II N = 32	RETESTED IN WEEK III N = 22
Age	38.58	36.30	36.13	39.85	39.77
Sex	1.73	1.82	1.80	1.68	1.68
Decimal Experience	2.20	2.15	2.38	2.21	2.04
Progressive Matrices	44.64	46.74	44.42	45.75	45.18
£ s d	6.22	6.15	5.90	6.37	6.72
£ p	6.09	6.56	6.38	6.03	6.22
Combined Maths	12.31	12.72	12.28	12.40	12.95
Unusual Uses	7.73	8.31	8.00	8.00	7.72
Hidden Faces	7.83	8.62	7.04	8.18	8.45
Gough Sanford	9.09	8.59	8.47	9.59	8.77

Continued/

TABLE 3 CONTINUED

Background and Decimal variables	RETURNER GROUPS					
	TOTAL RETURNERS	MATCHED RETURNERS	RETESTED IN WEEK I	RETESTED IN WEEK II	RETESTED IN WEEK III	RETESTED IN WEEK III
	N = 81	N = 39	N = 21	N = 32	N = 22	
Authoritarianism	3.67	3.26	2.76	4.15	4.00	
Paranoia	4.38	4.31	4.09	4.50	4.36	
New Currency I	2.69	3.15	3.36	2.72	2.27	
Conversion II	3.05	3.28	3.45	3.19	2.73	
Dual Currency III	0.99	1.13	1.14	1.00	0.91	
Coin Recognition IV	5.26	5.77	5.82	5.47	5.82	
Decimal I + IV	7.93	8.92	9.18	8.19	8.09	

- 3) Previous Experience with Decimal Currency. The largest difference was between the Returner Subgroups retested in Weeks I and III. The analysis gave  $F = 2.19$  which was not significant.
- 4) Progressive Matrices Test. The largest difference was between the Matched Returner Group and the Returner Subgroup retested in Week I. The analysis, however was computed on the scores of Returner Subgroups I and II because these two groups were composed of different subjects. The  $F$  value was  $0.127$  which was not significant,
- 5) £ s d test. The largest difference was between the Returner Subgroups retested in Weeks I and III. The analysis gave  $F = 1.26$  which was not significant.
- 6) £ p test. Since the largest difference was comparatively less than that of the £ s d test no test of significance was needed.
- 7) Combined Maths score. Since the Returner Groups did not differ significantly on either of the separate Maths score, no significance test for the Combined Maths score was needed. In fact the effect of combining the Maths scores was to greatly reduce the comparative differences between the groups.
- 8) Unusual Uses test. The largest difference on this test was comparatively much smaller than that of the Hidden Faces test discussed below. Since the mean scores of the two tests were similar the differences on the Hidden Faces test only were analysed.
- 9) Hidden Faces test. The largest difference was between the Matched Returner Group and the Returner Subgroup retested in Week I. Because of the comparative sizes of the groups,

and because the Returner Subgroup retested in Week III had a mean score not much below that of the Matched Returner Group, an analysis on this largest difference was not done. Instead an analysis of the three Returner Subgroups gave  $F = 1.105$  which was not significant.

10) Gough-Sanford Scale. The largest difference was between the Returner Subgroups retested in Weeks I and II. The analysis gave  $F = 1.22$  which was not significant.

11) Rokeach - Authoritarianism Subscale. The largest difference was between the Returner Subgroups retested in Weeks I and II. An analysis of the scores of all three Returner Subgroups gave  $F = 2.066$  which was not significant.

Since for both the Gough-Sanford and the Authoritarianism measures the same two Subgroups produced the largest difference an analysis was done on the combined scores of these two scales for Returner Subgroups I and II. The resulting  $F = 0.2753$  was larger than for either of the two scales analysed separately but was still not significant.

12) Rokeach - Paranoia Subscale. The largest difference was again between the Returner Subgroups retested in Weeks I and II, but the comparative size of the difference was too small to need testing for significance.

13) New Currency I. The largest difference was between the Returner Subgroups retested in Weeks I and III. The analysis gave  $F = 4.87$ , which was significant at the 5% level. Therefore the subjects retested after 3 weeks had been significantly worse in Decimal Week, on the New Currency I test than those retested after 1 week. A further analysis

on the scores of Returner Subgroups retested in Weeks I and II gave  $F = 1.32$  which was not significant, Therefore although the subjects retested after 2 weeks had a lower mean score in Decimal Week than those retested after 1 week they were not significantly lower.

14) Conversion II. The largest difference was again between the Returner Subgroups retested in Weeks I and III. But the analysis gave  $F = 1.80$  which was not significant.

15) Dual Currency III. The largest difference was again for the Returner Subgroups retested in Weeks I and III, but the analysis gave  $F = 0.68$  which was not significant.

16) Coin Recognition IV. The largest difference was this time between the combined means of the Returner Subgroups retested in Weeks I and III and the Total Returner Group. The comparative difference was too small to need testing.

17) Combined New Currency I and Coin Recognition IV scores. The largest difference was between the Returner Subgroup retested in Week I and the Total Returner Group, but the comparative difference was too small to need testing.

To summarise these One-way Analyses of Variance only the New Currency test showed an initial difference in ability among the Returner groups.

However, among the three Returner Subgroups a consistent trend of ability was found among the means of Table 3. If the means for the four Decimal Currency tests are combined then this trend becomes clearer:-

Returners retested after 1 week	=	13.77	combined mean
" " " 2 weeks	=	12.38	" "
" " " 3 weeks	=	11.73	" "

To test these combined means two analyses were computed; one for subjects of 37 years of age or less, and one for subjects of 38 years of age or more. For the young subjects  $F = 0.207$  which was not significant and for the older subjects  $F = 0.72$  which was also not significant. Therefore this trend, though consistent in direction was not a significant one.



Chapter 12 Improvement on the Decimal Currency Tests  
over Time

1) Practice Effect

Before the amount of improvement due to length of experience with the new currency can be estimated, it must be known how much of the increase in ability on the Decimal retests was due to the practice had on the first testing occasion. To check this effect, the two Practice Check Groups were used.

Firstly, Group PCI who were given their first Test Battery the week before Decimalisation; were matched on age and Progressive Matrices score with subjects from Groups CLI, FH, W and P who were given their first Test Battery in Decimal week. Since Group PCI were retested in Decimal week their retest Decimal scores could be compared with the first occasion Decimal scores of their matched partners. The number of matched subject pairs was 7.

Secondly, Group PCII were given their first Test Battery in the first week after Decimal week; so they were matched on age and Matrices points with subjects from Groups P and SA who were given their second Test Battery in the first week after Decimal week. Thus the first Decimal test scores of PCII could be compared with the second Decimal test scores of their matched partners. The number of matched subject pairs was 8.

In this way the effect of previous practice on the Decimal tests could be estimated for two different time exposures to Decimal Currency itself. The actual matching data for age and Matrices score is given in Table XVIII of Appendix III. The closeness of matching achieved was within 7 points on the Progressive Matrices test, and within 5 years of age.

For both Practice Check Groups and their matched partners a One-way Analysis of Variance was computed for their scores on each of the four Decimal tests. In no case were the differences significant (see Tables XIX and XX of Appendix III).

This means that the second test scores of Group PCI were no greater in Decimal week than the first test scores of the other groups, and similarly Group PCII were no worse on their first testing scores in Week I after Decimal week than the two groups who had their second testing at the same time. So for the purposes of this analysis any change in ability on the Decimal tests can be attributed only to actual improvement in using the New Currency. Table 4 gives the mean scores of the Practice Check groups and their matched partners on the Decimal tests.

## 2) Gain over time for the Matched Returner Group

The Matched Group of 39 subjects was made up of 13 subjects in each of the retest weeks. By omitting one subject from each week a Two-way Analysis of Variance was computed for each of the four Decimal tests. In each

TABLE 4 MEAN SCORES OF THE TWO PRACTICE-CHECK GROUPS AND  
THEIR MATCHED PARTNERS ON THE DECIMAL CURRENCY TESTS

Decimal Currency Tests	Practise Check I	Matches CLI, FH, W and P	Practise Check II	Matches in SA and P
	2nd test	1st test	1st test	2nd test
I New Currency	2.7	2.7	3.0	4.5
II Conversion	2.4	2.7	2.9	2.7
III Dual Currency	1.1	1.0	1.0	1.5
IV Coin Recognition	6.6	4.0	6.5	6.2

TABLE 5 MEAN GAIN SCORES ON THE FOUR DECIMAL CURRENCY TESTS  
OVER TIME, FOR TWO AGE GROUPS OF THE MATCHED  
RETURNER GROUP

	Age	<u>Mean Gain after</u>		
		1 week	2 weeks	3 weeks
I New Currency	Over 35	1.2	1.5	0.8
	Under 35	0.8	1.5	2.5
II Conversion	Over 35	-0.8	-0.5	-0.2
	Under 35	-1.0	-0.3	0.7
III Dual Currency	Over 35	0.3	0.7	0.2
	Under 35	0.7	-0.3	0.8
IV Coin Recognition	Over 35	1.7	2.8	3.0
	Under 35	5.7	2.8	1.2

Number of subjects contributing to each mean = 6

analysis the row variable was age, with one group of 20 to 35 years and another of 35 to 53 years; and the column variable was the length of time between the first and second Decimal testings, i.e. one, two or three weeks. The number of subjects in each such cell was 6, and the cell scores were the gain scores between the first and second testings. (Table 21, Appendix III)

For all four of the Decimal tests, neither age nor intertest interval proved to be significantly related to Gain. For IV Coin Recognition the interaction between age and intertest interval approached significance. The mean Gain scores of the Matched Returner Group are given in Table 5.

### 3) Gain over time for the Total Returner Group

Two-way Analyses of Variance were computed for Gain on each of the four Decimal tests. The variables were the same as for the Matched Group Analyses (see (2) above), except that subjects were divided by age into 'under 37 years' and 'over 38 years'. The cell total was 11. This was achieved by using all the subjects in Returner Subgroup III, random omissions of 10 of the subjects in Returner Subgroup II, and by the addition of data from a subject with incomplete personality tests in Returner Subgroup I.

The results of the Analyses were:-

for I New Currency and III Dual Currency neither age nor the intertest interval were significant variables.

for II Conversion the intertest interval was a significant variable,  $F = 3.378$   $p < 5\%$ . But this was not a simple linear trend of improvement with increasing exposure to Decimal Currency because the mean Gain scores for both of the first two retest weeks were negative.

for Coin Recognition IV age was an almost significant variable, with the younger subjects showing more improvement than the old. (Table 22, Appendix III)

The mean Gain scores for the Total Returner Group are given in Table 6. Since no subjects were omitted for the computation of these means the age division was changed to under 35 years and over 36 years to give a more equal division of numbers.

4) Intertest gain on the Decimal Currency tests for the three Returner Subgroups

For each of the three Returner Subgroups a Related - t test was computed using their first and second test scores, for each of the four Decimal Tests.

The results were that for all three Returner Subgroups the difference between their first and second scores on both I New Currency and IV Coin Recognition were significant; but the difference between their first and second scores on both II Conversion and III Dual Currency were not significant. The details of the results are given in Table 7.

TABLE 6 MEAN GAIN SCORES ON THE FOUR DECIMAL CURRENCY TESTS OVER TIME, FOR TWO AGE GROUPS OF THE TOTAL RETURNER GROUP

	Age	<u>Mean Gain after</u>		
		1 week	2 weeks	3 weeks
I New Currency	Over 36	1.50	1.31	1.82
	Under 35	0.60	0.94	1.64
II Conversion	Over 36	-0.67	-0.37	0.45
	Under 35	-0.40	-0.12	1.09
III Dual Currency	Over 36	0.17	0.44	0.82
	Under 35	0.40	0.12	0.36
IV Coin Recognition	Over 36	0.33	1.81	1.55
	Under 35	4.60	2.81	1.55
Subjects over 36 years		N = 12	N = 16	N = 11
Subjects under 35 years		N = 10	N = 16	N = 11

TABLE 7 RESULTS OF THE RELATED-t-TESTS ON THE FIRST AND SECOND DECIMAL CURRENCY TEST SCORES OF THE THREE RETURNER SUBGROUPS

Decimal Tests	Returner Subgroups tested after		
	1 week	2 weeks	3 weeks
I New Currency	t = 3.17 p < 1%	t = 3.86 p < 0.1%	t = 6.65 p < 0.1%
II Conversion	t = 1.63 NS	t = 0.80 NS	t = 1.06 NS
III Dual Currency	t = 1.22 NS	t = 1.47 NS	t = 1.80 NS
IV Coin Recognition	t = 3.07 p < 1%	t = 3.95 p < 0.1%	t = 2.38 p < 5%

Chapter 13 Relationships between the Decimal Currency Tests and the Background, Ability and Personality Variables

1) Pearson Product Correlation Matrix for the Total Returner Group (see Table 8). From the 'r' values given in Table 8 the significant relationships may be summarised thus:-

I New Currency

First and second test scores and the Gain score are all positively related to the Progressive Matrices test. Both the retest and Gain scores are positively related to the  $\bar{x}$  p score, and the retest score also relates to the Combined Maths score. Both the retest and Gain score are positively related to Unusual Uses, and both the first test and retest are negatively related to the Gough Sanford Scale. The retest score is also negatively related to the Rokeach-Paranoia Subscale.

II Conversion

Both first test and retest are positively related to the Progressive Matrices, and to the  $\bar{x}$  p score. The retest score is also positively related to Combined Maths. Both first test and retest are negatively related to sex, i.e. men scored higher; and the retest scores are negatively related to age. The first occasion score was negatively related to the Rokeach-Authoritarianism Subscale.

TABLE 8 PEARSON PRODUCT CORRELATION MATRIX FOR THE TOTAL RETURNER GROUP, VARIABLES RELATED ARE THE DECIMAL CURRENCY TEST SCORES AND THE BACKGROUND VARIABLES

N = 81 r = 0.22 is significant at the 5% level

	<u>Decimal Currency Tests</u>												<u>Gain Score</u>			
	<u>First Testing</u>				<u>Second Testing</u>											
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Age	-.19	-.16	-.16	+0.02	-.05	-.18	-.24	-.08	-.10	-.14	+0.00	-.10	+0.07	-.15		
Sex	+0.11	-.29	-.01	-.10	-.04	+0.07	-.26	+0.10	-.01	+0.02	-.05	+0.01	+0.09	+0.11		
Previous Decimal Experience	+0.15	+0.04	-.03	-.19	-.21	-.15	-.13	-.08	-.17	-.19	-.01	-.16	-.04	-.00		
s d score	+0.13	+0.14	+0.17	+0.25	+0.25	+0.20	+0.21	+0.18	+0.26	+0.28	+0.11	+0.11	+0.04	+0.04		
s p score	+0.18	+0.26	+0.19	+0.33	+0.33	+0.36	+0.31	+0.25	+0.45	+0.49	+0.24	+0.06	+0.07	+0.19		
Combined Maths	+0.17	+0.22	+0.20	+0.32	+0.32	+0.31	+0.28	+0.24	+0.38	+0.42	+0.19	+0.10	+0.06	+0.13		
Unusual Uses	+0.12	+0.14	+0.06	+0.35	+0.33	+0.29	+0.09	+0.11	+0.17	+0.25	+0.23	-.04	+0.06	-.18		
Hidden Faces	+0.06	+0.08	+0.09	+0.29	+0.26	+0.22	+0.06	+0.22	+0.12	+0.18	+0.21	-.02	+0.12	-.19		
Gough Sanford	-.40	-.20	-.10	-.14	-.26	-.44	-.18	-.14	-.14	-.28	-.09	+0.01	-.04	-.02		
Rokeach Authoritarianism	-.13	-.23	-.09	-.20	-.21	-.20	-.15	-.15	-.31	-.32	-.10	+0.08	-.05	-.17		
Rokeach - Paranoia	-.20	-.09	+0.13	-.18	-.22	-.31	-.08	-.14	-.25	-.32	-.16	+0.04	-.21	-.12		

Continued/



TABLE 8 CONTINUED

	<u>Decimal Currency Tests</u>													
	<u>First Testing</u>				<u>Second Testing</u>				<u>Gain Score</u>					
	I	II	III	IV	I	II	III	IV	I	II	III	IV		
Progressive Matrices	+0.47	+0.50	+0.34	+0.63	+0.69	+0.63	+0.45	+0.56	+0.61	+0.72	+0.25	-0.03	+0.21	+0.06
Linear Retest trend	-0.05	-0.05	+0.04	+0.18	+0.13	+0.03	+0.10	+0.05	-0.04	-0.02	+0.11	+0.16	+0.01	-0.26
Quadratic Retest trend	+0.10	+0.10	+0.09	+0.18	+0.18	+0.04	+0.02	-0.02	+0.06	+0.06	-0.07	-0.07	-0.10	-0.13

### III Dual Currency

Both first test and retest are positively related to the Progressive Matrices, and the retest scores are positively related to the  $\bar{x}$  p score and the Combined Maths.

### IV Coin Recognition

Both first test and retest scores relate positively to the Progressive Matrices and to all three Maths scores. The first test score relates positively to both Unusual Uses and Hidden Faces; and the retest scores relate negatively to both of the Rokeach Subscales.

### New Currency + Coin Recognition (I + IV)

Both first test and retest scores related positively to the Progressive Matrices, the three Maths scores and to Unusual Uses. The first test scores also related positively to Hidden Faces. The retest and first test scores both related negatively to the Gough-Sanford Scale, and the retest scores also related negatively to both of the Rokeach Subscales.

### 2) Pearson Product Moment Correlation Matrix for the Matched Returner Group (see Table 9)

From the 'r' values given in Table 9 the significant relationships may be summarised thus:-

#### I New Currency

Both first test and retest scores are positively related to sex, i.e. women scored higher. The retest scores

TABLE 9 PEARSON PRODUCT MOMENT CORRELATION MATRIX FOR THE MATCHED RETURNER GROUP.

VARIABLES RELATED ARE THE DECIMAL CURRENCY TESTS AND THE BACKGROUND VARIABLES

N = 39 r = 0.32 is significant at the 5% level

	Decimal Currency Tests												Gain Score						
	First Testing				Second Testing				I + IV				I	II	III	IV			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV			
Age	-.27	-.02	-.05	-.10	-.20	-.26	-.13	-.14	-.10	-.18	-.26	-.13	-.14	-.10	-.18	+.05	-.14	-.03	-.03
Sex	+.34	-.10	-.15	+.23	+.35	+.43	-.08	+.28	+.21	+.33	+.43	-.08	+.28	+.21	+.33	+.06	+.01	+.32	+.02
Previous Decimal Experience	-.08	-.05	+.01	-.22	-.21	-.08	-.19	-.09	-.27	-.25	-.08	-.19	-.09	-.27	-.25	+.00	-.19	-.07	-.11
£ s d score	-.02	-.10	+.00	+.05	+.03	+.22	+.17	+.20	+.19	+.23	+.22	+.17	+.20	+.19	+.23	+.29	+.33	+.17	+.19
£ p score	+.10	+.12	+.22	+.03	+.07	+.35	+.31	+.21	+.34	+.41	+.35	+.31	+.21	+.34	+.41	+.31	+.26	-.00	+.42
Combined Maths	+.04	+.01	+.12	+.05	+.06	+.31	+.26	+.23	+.29	+.35	+.31	+.26	+.23	+.29	+.35	+.33	+.32	+.09	+.33
Unusual Uses	-.07	-.05	+.06	+.17	+.11	+.10	+.03	-.04	+.10	+.12	+.10	+.03	-.04	+.10	+.12	+.22	+.08	-.05	-.05
Hidden Faces	-.21	-.02	+.03	+.12	-.00	+.06	+.05	+.03	-.05	-.02	+.06	+.05	+.03	-.05	-.02	+.35	+.09	+.01	-.19
Gough-Sanford	-.25	-.09	-.04	-.12	-.21	-.39	-.19	-.18	-.01	-.15	-.39	-.19	-.18	-.01	-.15	-.15	-.14	-.09	-.12
Rokeach-Authoritarianism	-.10	-.17	-.07	-.16	-.13	-.07	-.15	-.06	-.17	-.17	-.07	-.15	-.06	-.17	-.17	-.07	-.01	+.02	-.05
Rokeach-Paranoia	-.20	-.11	+.15	-.14	-.20	-.31	-.11	-.23	-.24	-.31	-.31	-.11	-.23	-.24	-.31	-.13	-.02	-.28	-.17

Continued/

TABLE 9 CONTINUED

	<u>Decimal Currency Tests</u>													
	<u>First Testing</u>				<u>Second Testing</u>				<u>Gain Score</u>					
	I	II	III	IV	I	II	III	IV	I	II	III	IV		
Progressive Matrices	+ .28	+ .40	+ .19	+ .51	+ .54	+ .52	+ .55	+ .50	+ .49	+ .59	+ .27	+ .27	+ .19	+ .07
Linear Retest trend	- .30	- .19	- .07	- .03	- .16	- .23	+ .12	- .04	- .14	- .20	+ .11	+ .36	+ .03	- .15
Quadratic retest trend	- .06	+ .04	- .04	+ .05	+ .01	- .03	+ .01	- .18	+ .09	+ .06	+ .04	- .03	- .14	+ .06

are positively related to the Progressive Matrices and the £ p score, while the Gain score is positively related to the Combined Maths score. The Gain score is positively related to Hidden Faces, while the retest scores are negatively related to the Gough-Sanford score.

## II Conversion

Both first test and retest scores are positively related to the Progressive Matrices, while the Gain scores are positively related to both the £ s d and the Combined Maths scores. The gain is also positively related to a linear trend in the retest weeks.

## III Dual Currency

The retest scores are positively related to the Progressive Matrices test, and the Gain scores are positively related to sex, i.e. women gained more.

## IV Coin Recognition

Both first test and retest scores are positively related to the Progressive Matrices, and both retest and Gain scores are positively related to the £ p test, while the Gain scores are also positively related to the Combined Maths score.

## New Currency + Coin Recognition (I + IV)

Both first test and retest scores are positively related to the Progressive Matrices and to sex, i.e. women scored higher. The retest scores are also positively related to the £ p and Combined Maths scores.

### 3) Stepwise Regression Analysis

Table 10 gives the significant predictors of the Decimal tests in Decimal week and the three retest weeks afterwards. To summarise this table it may be said that:

- a) the Progressive Matrices was a significant predictor in all but two out of the <sup>16</sup>~~20~~ instances, *on the four tests.*
- b) Age was a significant predictor on only three occasions
- c) Sex was a significant predictor twice for II Conversion test
- d) Previous Decimal experience was a significant predictor twice on the I + IV Combined score
- e) the Maths scores were significant predictors in only three instances
- f) the two Flexibility tests were significant predictors in <sup>4</sup>~~5~~ instances *out of 16.*
- g) the Rigidity Scales were significant predictors in 4 instances, *out of 16.*

### 4) Interrelationships within the Decimal Currency Tests

The Matrices for the Total Returner Group and Matched Returner Group are given in Table 11. From the 'r' values given in this table the significant relationships with the first and second testings and Gain scores of the Decimal tests may be summarised as:-

#### a) for the Total Returner Group

The four Decimal tests are all positively interrelated on both the first and second testings. Between the first and second testing scores only three out of a total 16 positive relationships are not significant. For each of

TABLE 10 RESULTS OF THE STEPWISE REGRESSION ANALYSIS.  
SIGNIFICANT PREDICTORS OF THE DECIMAL  
CURRENCY TEST SCORES

Testing Occasion	I New Currency	II Conversion	III Dual Currency	IV Coin Recognition	I + IV
Decimal Week	Matrices p < 0.1%	Matrices p < 0.1%	Matrices p < 2.5%	Matrices p < 0.1%	Matrices p < 0.1%
	Gough-Sanford p < 5%	Sex p < 1%	Paranoia p < 2.5%	Age p < 1%	Decimal Experience p < 2.5%
	Hidden Faces p < 5%				
Retest Week I after Decimal Week	Matrices p < 0.1%	Sex p < 1%	Matrices p < 0.1%	Matrices p < 1%	Matrices p < 0.1%
	Age p < 1%	Age p < 5%			£ s d p < 2.5%
		Unusual Uses p < 2.5%			Decimal Experience p < 5%
		Gough-Sanford p < 5%			
		Hidden Faces p < 2.5%			
Retest Week II after Decimal Week	Matrices p < 0.1%	Matrices p < 1%	Matrices p < 1%	£ p p < 0.1%	Matrices p < 0.1%
				Matrices p < 1%	£ p p < 1%
Retest Week III after Decimal Week	Gough-Sanford p < 1%	Matrices p < 2.5%	Matrices p < 2.5%	Matrices p < 0.1%	Matrices p < 0.1%
		Unusual Uses p < 5%		Hidden Faces p < 2.5%	Hidden Faces p < 2.5%





TABLE 11 CONTINUED

Decimal Currency Tests	Decimal Currency Tests												Gain Score				
	<u>First Testing</u>				<u>Second Testing</u>				<u>I +</u>				I	II	III	IV	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
<u>Second Testing</u>	I	II	III	IV	I	II	III	IV	I	II	III	IV	+ .31	+ .27	+ .01	+ .10	
	II				+ .30				+ .45	+ .50	+ .51		+ .13	+ .56	+ .28	+ .21	
	III				+ .28	+ .31				+ .24	+ .28		+ .10	+ .24	+ .60	- .06	
	IV				+ .39	+ .45	+ .38					+ .94	+ .07	+ .19	+ .05	+ .57	
	I + IV				+ .51	+ .57	+ .33	+ .72	+ .77		+ .68	+ .47	+ .40	+ .18	+ .25	+ .05	+ .51
<u>Gain Score</u>	I	II	III	IV	I	II	III	IV	I	II	III	IV	+ .15	- .07	+ .03		
	II				- .02	+ .49	+ .09	- .12	- .10				+ .03		+ .30	+ .03	
	III				- .04	- .01	- .57	+ .10	+ .06				+ .02	+ .13		- .02	
	IV				+ .02	+ .22	+ .01	- .30	- .22				- .12	- .14	+ .04		

the four Decimal tests the Gain score is negatively and significantly correlated to its own first occasion test scores; and positively and significantly correlated to its own second testing scores. Apart from these main trends, the Gain on I New Currency is positively related to the first occasion IV Coin Recognition scores; and the Gain on IV Coin Recognition is positively related to the II Conversion first testing scores.

b) for the Matched Returner Group

For the first occasion testing none of the interrelations between the four Decimal tests are significant, and in the second testing scores only two such correlations are significant. Also only 6 out of the 16 possible interrelations between the two testing sessions are significant. The same trends between each Gain score and its first and second testing scores are found as in the Total Returner group (a) above, but in 3 out the 8 instances the 'r' value does not reach significance.

Chapter 14 Relationships between the Background,  
Personality and Ability Variables

1) Pearson Product Moment Correlation Matrix (see Table 12)

From the 'r' values given in Table 12 the significant relationships may be summarised thus:-

a) for the Total Returner Group

The Progressive Matrices correlate positively with the three Maths scores and the two Flexibility tests; and negatively with age, and the three Rigidity scales. The three Maths scores are positively related to each other, as are also the three Rigidity scales, and the two Flexibility tests. Between these three groups of tests the  $\Sigma p$  score is positively related to the Unusual Uses test; and negatively related to the two Rokeach subscales. The Hidden Faces test is negatively related to the Gough-Sanford Scale; and Unusual Uses is negatively related to the two Rokeach subscales. Age is positively related to both Gough-Sanford and Rokeach-Authoritarianism, while the extent of previous Decimal Experience is negatively related to the Gough-Sanford Scale and Rokeach-Paranoia.

b) for the Matched Returner Group

The Progressive Matrices correlate positively with the  $\Sigma p$  and Combined Maths scores, and with Hidden Faces; and negatively with Gough-Sanford and age. The three Maths scores are positively related to each other. Between the groups of tests Hidden Faces is negatively related to the





Gough-Sanford scale. Age is positively related to the Gough-Sanford scale. Sex is negatively correlated with age and with Rokeach-Paranoia, i.e. the men subjects tended to be older than the mean age, and men had higher Paranoia scores. Sex is also positively related to the Progressive Matrices, i.e. men had lower scores. The extent of Previous Decimal Experience is negatively related to the Gough-Sanford Scale.

## 2) Trend tests for Age and Rigidity - Flexibility Interactions

These are the results of the Two-way Analyses of Variance and trend tests using lamda coefficients. The means from these analyses are given in Table 13.

a) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 56 years of age.

Unusual Uses variable was divided into subjects scoring '8 or more' and '7 or less' Uses.

Progressive Matrices raw scores were the cell scores; the number in each cell was 11.

The variance on Progressive Matrices score between the three age groups was significant beyond the 5% level, and the quadratic component of the Interaction between Age and Unusual Uses was also significant beyond the 5% level.

The subjects scoring high on Unusual Uses showed no change in Progressive Matrices ability with age, but the subjects scoring low on Unusual Uses showed an inverted quadratic decline in Progressive Matrices score that was significant, beyond the 1% level.

TABLE 13 MEAN SCORES FOR THE CELL GROUPS IN THE TWO-WAY  
ANALYSES OF VARIANCE ON AGE AND THE RIGIDITY-  
FLEXIBILITY INTERACTIONS

Cell Variable	Row Variable		Age Groups in Years		
			20-29	30-39	40 Plus
a) Progressive Matrices	Unusual Uses	8 or more	45.5	44.9	45.5
		7 or less	49.9	37.4	43.0
b) Hidden Faces	Unusual Uses	7 or more	9.3	8.1	9.5
		6 or less	9.4	6.8	6.1
c) Rokeach- Auth.ism.	Rokeach- Paranoia	5 or more	4.1	4.0	5.6
		4 or less	2.8	2.3	2.4
d) Gough- Sanford Scale	Unusual Uses	7 or more	8.2	8.2	10.5
		6 or less	7.0	9.6	11.4
e) Gough- Sanford Scale	Hidden Faces	9 or more	7.2	7.4	8.1
		8 or less	7.5	8.8	9.9
f) Hidden Faces	Rokeach- Auth.ism.	4 or more	9.6	6.6	6.7
		3 or less	8.6	6.8	10.0
g) Unusual Uses	Rokeach- Auth.ism.	4 or more	7.5	6.1	6.5
		3 or less	7.0	7.5	9.1
h) Hidden Faces	Rokeach- Paranoia	5 or more	9.86	5.5	8.36
		4 or less	8.3	7.86	9.0
i) Rokeach- Paranoia	Unusual Uses	8 or more	5.5	3.8	3.6
		7 or less	3.75	4.25	5.0

b) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 58 years of age.

Unusual Uses variable was divided into subjects scoring '7 or more' and '6 or less' Uses.

Hidden Faces raw scores were the cell scores; the number in each cell was 12.

The variance on Hidden Faces due to both Age and Unusual Uses scores was significant beyond the 2.5% level. The linear component of the Interaction between these two variables was also significant beyond the 2.5% level. While subjects scoring high on Unusual Uses did not show any change with age on the Hidden Faces test, the subjects scoring low on Unusual Uses showed a linear decline with age on Hidden Faces, significant beyond the 1% level.

c) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 49 years of age.

Rokeach - Paranoia variable was divided into subjects scoring '5 or more' and '4 or less'.

Rokeach - Authoritarianism raw scores were the cell scores; the number in each cell was 14.

The variance of Authoritarianism due to Paranoia scores was significant beyond the 0.1% level, but no other trends were significant.

d) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 58 years of age.

Unusual Uses variable was divided into subjects scoring '7 or more' and '6 or less' Uses.

Gough-Sanford Scale raw scores were the cell scores; the number in each cell was 12.



The variance on the Gough-Sanford scores due to Age was significant beyond the 1% level. While subjects scoring high on Unusual Uses did not increase their mean Gough-Sanford score until after 40 years of age, the subjects scoring low on Unusual Uses showed a linear trend with age of increasing Gough-Sanford score significant beyond the 1% level.

e) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 49 years of age.

Hidden Faces variable was divided into subjects scoring '9 or more' and '8 or less' Faces.

Gough-Sanford Scale raw scores were the cell scores; the number in each cell was 11.

In this analysis no variance nor trend was significant.

f) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 56 years of age.

Rokeach-Authoritarianism variable was divided into subjects scoring '4 or more' and '3 or less'.

Hidden Faces raw scores were the cell scores; the number in each cell was 14.

The variance on Hidden Faces due to Age was significant beyond the 1% level, and the linear component of the Interaction between Age and Authoritarianism was significant beyond the 1% level. The subjects scoring high on Authoritarianism showed a linear decline with Age on Hidden Faces score significant beyond the 2.5% level. The subjects scoring low on Authoritarianism showed an inverted quadratic

trend with Age on Hidden Faces score significant beyond the 2.5% level.

g) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 56 years of age.

Rokeach - Authoritarianism variable was divided into subjects scoring '4 or more' and '3 or less'.

Unusual Uses raw scores were the cell scores; the number in each cell was 14.

In this analysis no variance nor trend was significant.

h) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 50 years of age.

Rokeach - Paranoia variable was divided into subjects scoring '5 or more' and '4 or less'.

Hidden Faces raw scores were the cell scores; the number in each cell was 14.

The variance on Hidden Faces due to Age was significant beyond the 2.5% level. While the subjects scoring low on Paranoia did not change on Hidden Faces ability with Age, the subjects scoring high on Paranoia showed an inverted quadratic decline with Age on Hidden Faces ability that was significant beyond the 1% level.

i) The Age variable was divided into 20 to 29, 30 to 39 and 40 to 50 years of age.

Unusual Uses variable was divided into subjects scoring '8 or more' and '7 or less' Uses.

Rokeach - Paranoia raw scores were the cell scores; the number in each cell was 12.

The linear component of the Interaction between Age and Unusual Uses on the Paranoia scores was significant beyond the 1% level. While subjects scoring low on Unusual Uses showed an upward but non-significant linear trend on Paranoia with Age, the subjects scoring high on Unusual Uses showed a downward linear trend on Paranoia with Age that was significant beyond the 2.5% level.

The summary tables for these analyses are given in Table XXIII of Appendix III.

Chapter 15 Principal Component Analyses of the Complete  
Test Battery for the Total Returner and  
Matched Returner Groups

The Principal Component Analyses computed for the scores of the Total Returner and Matched Returner Groups provide a summary of the results given in Chapters 12, 13 and 14. The factors produced bring together the main relationships between all the Decimal test scores, and all the Background, Personality and Ability scores.

a) Orthogonal Rotated Components for the Total Returner  
Group (N = 81)

From the summary of the first 6 factors given in Table 14 it can be seen that the main factor involves the first and second testing scores of the I New Currency and IV Coin Recognition tests. High scores of these tests are loaded in the same direction as high scores on the Progressive Matrices and the two Flexibility tests; and predictably in the opposite direction to high scores on the three Rigidity Scales. The next three factors deal with the Decimal tests IV Coin Recognition, III Dual Currency and I New Currency separated out into their own factors. Among these three factors the only variable which is not a Decimal test score is the 'linear trend in retest weeks' which loads in the opposite direction to Gain scores on IV Coin Recognition. This means that with each succeeding week the Gain on IV Coin Recognition became smaller.

Factor 5 includes principally II Conversion and IV Coin Recognition scores, with a moderate loading on Progressive Matrices. Factor 6 deals solely with the two tests of mathematical ability.

b) Orthogonal Rotated Components for the Matched Returner  
Group N = 39

From Table 15 it can be seen that the main factor involves only Gain on I New Currency from among all the Decimal tests scores. High Gain scores load in the same direction as high scores on Progressive Matrices and the two Flexibility tests and in the opposite direction to high scores on the Gough-Sanford Scale and Rokeach - Paranoia. The second factor involves only the Maths tests. The third factor includes all the test scores of I New Currency and IV Coin Recognition, plus a moderate loading on the Progressive Matrices. The fourth factor consists solely of Gain on the III Dual Currency test. In the fifth factor high scores on both Unusual Uses and the Gough-Sanford Scale load in the same direction as increasing age. Also in this factor, sex has a moderate loading, with men being older and scoring higher on the other two variables.

Factor 6 shows that Gain on II Conversion did increase in a linear fashion with each succeeding retest week. The last three factors deal with the Decimal tests, IV Coin Recognition, I New Currency and II Conversion, separated out into their own factors.

TABLE 14. ORTHOGONAL ROTATED COMPONENTS OF THE WHOLE TEST BATTERY FOR THE TOTAL RETURNER GROUP

Factors	Test Variable	Loading
Factor 1	Retest I New Currency	-.680
	Progressive Matrices	-.636
	Retest I New Currency + IV Coin Recognition	-.610
	First test New Currency + IV Coin Recognition	-.556
	First test IV Coin Recognition	-.518
	Retest IV Coin Recognition	-.426
	Hidden Faces	-.421
	Unusual Uses	-.414
	Rokeach - Paranoia	+.631
	Gough-Sanford	+.621
	Rokeach - Authoritarianism	+.531
Factor 2	Gain on IV Coin Recognition	+.804
	First test IV Coin Recognition	-.449
	Linear trend in retest weeks	-.412
Factor 3	Gain on III Dual Currency	+1.155
	Retest III Dual Currency	+.513
	First test III Dual Currency	-.413
Factor 4	First test I New Currency	-.851
	First test I New Currency + IV Coin Recognition	-.520
	Gain on I New Currency	+.440
Factor 5	Retest IV Coin Recognition	+.728
	First test II Conversion	+.712
	Retest II Conversion	+.677
	Retest I New Currency + IV Coin Recognition	+.648
	First test IV Coin Recognition	+.542
	First test I New Currency + IV Coin Recognition	+.491
	Progressive Matrices	+.455
Factor 6	Combined Maths scores	+.990
	£ s d	+.808
	£ p	+.736

TABLE 15 ORTHOGONAL ROTATED COMPONENTS OF THE WHOLE TEST  
BATTERY FOR THE MATCHED RETURNER GROUP

Factors	Test Variable	Loading
Factor 1	Gain on I New Currency	-.623
	Hidden Faces	-.613
	Progressive Matrices	-.471
	Unusual Uses	-.441
	Gough-Sanford Scale	+.471
	Rokeach - Paranoia	+.422
Factor 2	Combined Maths score	-.982
	£ s d	-.870
	£ p	-.815
Factor 3	First test I New Currency + Coin Recognition	-.947
	First test IV Coin Recognition	-.916
	Retest IV Coin Recognition	-.826
	Retest I New Currency + IV Coin Recognition	-.823
	Progressive Matrices	-.504
	First test I New Currency	-.466
	Retest II Conversion	-.451
	Retest I New Currency	-.404
Factor 4	Gain on III Dual Currency	+.969
Factor 5	Age	-.618
	Unusual Uses	-.588
	Gough-Sanford Scale	-.491
	Sex	+.415
Factor 6	Gain on II Conversion	-.700
	Linear trend in retest weeks	-.600
Factor 7	Gain on IV Coin Recognition	+.837
	Retest IV Coin Recognition	+.491
Factor 8	First test I New Currency	+.794
	Retest I New Currency	+.543
Factor 9	First test II Conversion	-.726
	Retest II Conversion	-.711
	Retest III Dual Currency	-.432

Chapter 16 Analysis of the Rigidity-Flexibility Dimension

A Pearson's Product Moment Correlation Matrix was carried out on all the items of the three Rigidity Scales; the scores of the two Flexibility tests, and the Age and sex of the 110 subjects who completed all these tests (see Chapter 10).

The intercorrelations for the Gough-Sanford Rigidity Scale are given in Table 16. The intercorrelations for the Rokeach-Dogmatism Scale are given in Table 17. The intercorrelations between these two Rigidity Scales are given in Table 18, and the significant correlations summarised in Table 19. The correlations between the items of both the Rigidity Scales, and the four other variables, namely:- Age, Sex, Unusual Uses and Hidden Faces are given in Table 20.

A comparison of the correlation results of this study with those of S. Rubenowitz (1963) is given in Table 21. For the Gough-Sanford Rigidity Scale, Rubenowitz got 66 significant intercorrelations between items, while the present study resulted in 44; but in only 24 cases were the same coefficients significant in both studies. All the correlations were positive ones except for the correlations between items 5 and 18 in the present study and items 10 and 12 in the Rubenowitz study.

For the Rokeach Dogmatism Scale, Rubenowitz found 32 significant intercorrelations, and the present study found 14 such results; but in only 3 cases were the coefficients



significant in both studies. All the correlations were positive except for the correlation between items 13 and 16 in the Rubenowitz study.

The correlations between the remaining 4 test variables are given in Table 22, where it can be seen that the two Flexibility tests are positively related, and that men are significantly better than women on the Unusual Uses test.

The main trends from the correlation matrices are summarised in the Varimax Factor Matrix. The factors are presented in Table 23 with the questionnaire items written out in full. The Hidden Faces test and Age both show definite relationships with groups of questions from the Rigidity Scales, but the Unusual Uses test forms a factor on its own. Two items with moderate loadings have been included in the Unusual Uses factor but they are just below the 0.40 limit chosen for selecting the items in each factor. Sex has no high loading on any factor, but its highest loading +0.31 is on the Unusual Uses factor, i.e. men were better than women on the Unusual Uses test.

"The Gough-Sanford Rigidity Scale.

Items numbered as in Table 16."

1. I am always careful about my manner of dress.
2. I usually check more than once to be sure that I have locked a door, put out the light, or something of the sort.
3. I often become so wrapped up in something I am doing that I find it difficult to turn my attention to other matters.
4. I often find myself thinking of the same tune or phrases for days at a time.
5. I find it easy to stick to a certain schedule, once I have started on it.
6. I try to follow a programme of life based on duty.
7. I usually maintain my own opinions even though many other people may have a different point of view.
8. There is usually only one best way to solve most problems.
9. I am a methodical person in whatever I do.
10. I am often the last person to give up trying to do a thing.
11. I prefer to stop and think before I act, even on trifling matters.
12. I do not enjoy having to adapt myself to new and unusual situations.
13. I prefer work that requires a great deal of attention to detail.
14. I dislike to change my plans in the midst of an undertaking.
15. I think it is usually wise to do things in a conventional way.
16. I always finish tasks I start, even if they are not very important.
17. I have never done anything dangerous for the thrill of it.
18. I have a work or study schedule which I follow carefully.
19. I usually find that my own way of attacking a problem is best, even though it doesn't always seem to work in the beginning.
20. I believe that promptness is a very important personality characteristic.
21. I always put on and take off my clothes in the same order.

NOTE TO TABLE 16

CORRELATION COEFFICIENTS, WITH THEIR VALENCY SIGNS ARE GIVEN IN THE LOWER LEFT-HAND SECTION AND SIGNIFICANT CORRELATIONS ARE INDICATED BY THEIR SIGNIFICANCE LEVEL IN THE UPPER RIGHT-HAND SECTION

TABLE 16 PEARSON PRODUCT MOMENT CORRELATION MATRIX FOR THE '21' ITEMS OF THE GOUGH-SANFORD RIGIDITY SCALE USED IN THIS STUDY N = 110

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1																						
2	+0.07																					
3	-0.03	+0.03																				
4	+0.16	+0.11	+0.20																			
5	+0.22	+0.03	-0.08	+0.13																		
6	+0.12	+0.08	-0.05	+0.06	+0.37																	
7	+0.10	+0.03	+0.25	-0.02	-0.02	-0.02																
8	-0.08	+0.01	-0.06	-0.15	+0.07	+0.28	+0.06															
9	+0.05	+0.12	-0.13	-0.06	+0.21	+0.18	+0.09	+0.21														
10	+0.01	+0.09	+0.01	+0.22	+0.12	+0.16	+0.21	+0.03	-0.02													
11	+0.10	+0.20	+0.11	+0.04	+0.25	+0.20	-0.00	-0.03	+0.08	+0.02												
12	+0.08	+0.18	+0.25	+0.04	+0.17	+0.17	+0.06	+0.08	+0.18	+0.14	+0.34											
13	-0.01	+0.13	+0.14	+0.04	+0.18	+0.02	+0.17	+0.13	+0.25	+0.19	+0.17	+0.26										
14	+0.19	-0.10	+0.12	+0.07	+0.30	+0.07	+0.05	+0.07	+0.18	+0.04	+0.16	+0.31	+0.22									
15	+0.05	+0.17	-0.05	+0.04	+0.14	+0.33	+0.08	+0.16	+0.30	+0.11	+0.13	+0.19	+0.32	+0.21								
16	+0.19	+0.15	-0.14	-0.02	+0.43	+0.22	+0.12	+0.14	+0.31	+0.05	+0.12	+0.12	+0.11	+0.28	+0.23							
17	-0.06	+0.08	+0.17	+0.02	+0.02	+0.02	-0.07	-0.06	+0.07	-0.06	+0.12	+0.26	+0.14	+0.18	+0.11	+0.04						
18	+0.23	+0.19	-0.19	-0.02	+0.35	+0.32	+0.03	+0.15	+0.30	+0.02	+0.24	+0.12	+0.13	+0.17	+0.20	+0.41	+0.07					
19	+0.05	+0.09	+0.13	+0.11	+0.17	+0.15	+0.22	+0.14	+0.08	+0.12	+0.13	-0.03	+0.07	+0.09	+0.22	+0.16	+0.08	+0.04				
20	+0.16	+0.01	-0.15	+0.07	+0.38	+0.27	+0.13	+0.07	+0.14	+0.23	-0.02	+0.03	+0.11	+0.11	+0.25	+0.13	-0.05	+0.17	+0.13			
21	+0.11	+0.09	-0.15	-0.06	+0.17	+0.21	-0.06	+0.14	+0.27	+0.08	+0.13	+0.25	+0.19	+0.20	+0.29	+0.08	+0.02	+0.22	+0.14	+0.12		

\* significant negative correlation

ITEM NUMBERS OF THE GOUGH-SANFORD SCALE

The Rokeach Dogmatism Scale as used in this study.

Items numbered as in Table 17.

1. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.
2. In the history of mankind there have probably been just a handful of really great thinkers.
3. A group which tolerates too many differences of opinion among its own members cannot last for long.
4. There are two kinds of people in this world, those who are for the truth, and those who are against the truth.
5. Of all the different philosophies which exist in the world there is probably only one which is correct.
6. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
7. Most of the ideas which get printed today are not worth the paper they're written on.
8. My blood boils whenever a person stubbornly refuses to admit that he's wrong.
9. In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.
10. A person who gets enthusiastic about too many causes is likely to be a pretty 'wishy-washy' sort of person.
11. It is only natural for a person to have a guilty conscience.
12. It is better to be a dead hero than a live coward.
13. Man on his own is a helpless and miserable creature.
14. I have often felt that strangers were looking at me critically.
15. If given the chance I would do something of great benefit to the world.
16. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.
17. Most people just don't give a damn for others.
18. I wish I could find someone who would tell me how to solve my personal problems.
19. It is only natural for a person to be rather fearful of the future.
20. The main thing in life is for a person to want to do something important.
21. Its all too true that people just won't practise what they preach.

NOTE TO TABLE 17

CORRELATION COEFFICIENTS, WITH THEIR VALENCY SIGNS ARE GIVEN IN THE LOWER LEFT-HAND SECTION AND SIGNIFICANT CORRELATIONS ARE INDICATED BY THEIR SIGNIFICANCE LEVEL IN THE UPPER RIGHT-HAND SECTION

TABLE 17 PEARSON PRODUCT MOMENT CORRELATION MATRIX FOR THE 21 ITEMS OF THE ROKEACH DOGMATISM SCALE AS USED IN THIS STUDY (INCLUDES ONE BUFFER ITEM) N = 110

ITEM NUMBERS OF THE ROKEACH - DOGMATISM SCALE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1																						
2	+ .14																					
3	- .09 + .12	1%																				
4	+ .25 + .18 + .23		1%			0.1%		1%	5%												5%	
5	+ .14 + .05 + .05 + .34			1%																	5%	
6	+ .09 + .07 + .17 + .48 + .25				1%					5%											1%	
7	+ .21 + .13 + .16 + .03 + .03 - .03								5%													
8	+ .27 + .12 + .15 + .28 + .10 + .13 + .17								5%													
9	+ .20 + .12 + .18 + .23 + .17 + .08 + .21 + .23								5%													
10	+ .19 + .16 + .28 + .17 + .13 + .19 + .18 + .33 + .14																					
11	- .05 + .16 + .08 + .15 + .09 + .16 + .05 + .10 + .13 + .12																					
12	+ .18 - .06 - .02 + .15 + .12 + .18 - .09 + .09 + .09 - .04																					
13	+ .03 + .13 - .11 - .10 + .13 + .05 + .15 + .04 + .08 + .12																					
14	- .05 - .05 + .09 + .18 + .17 + .03 - .02 + .10 + .06 + .02																					
15	+ .15 + .07 + .02 + .08 + .08 + .09 - .01 - .02 - .06 - .05																					
16	- .14 - .12 + .14 + .02 + .11 + .06 + .16 + .24 + .06 + .12																					
17	+ .09 + .11 + .25 + .36 + .31 + .34 + .38 + .08 + .20 + .24																					
18	+ .07 + .12 + .08 + .18 + .12 + .17 - .01 + .19 + .07 + .19																					
19	- .16 - .06 + .08 + .16 + .06 + .18 - .08 + .00 + .08 - .11																					
20	+ .10 + .09 + .08 + .21 + .23 + .33 + .04 + .14 + .29 + .07																					
21	+ .08 + .18 + .19 + .10 + .07 + .16 + .17 + .27 + .27 + .21																					

ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE

PARANOIA

AUTHORITARIANISM

AUTHORITARIANISM

PARANOIA

156

TABLE 18 PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN THE ITEMS OF THE GOUGH-SANFORD RIGIDITY SCALE  
AND THE ROKEACH DOGMATISM SCALE. N = 110  
ITEM NUMBERS OF THE GOUGH-SANFORD SCALE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	+0.10	+0.11	+0.06	+0.09	+0.14	-0.01	+0.01	-0.03	+0.10	+0.15	+0.02	+0.05	+0.09	-0.07	+0.00	+0.05	+0.07	+0.07	+0.01	+0.06
2	+0.06	-0.16	-0.08	-0.11	-0.04	+0.02	-0.13	+0.17	-0.14	+0.06	-0.09	-0.16	+0.01	-0.08	+0.01	+0.05	-0.01	-0.05	+0.04	+0.11
3	+0.22	+0.08	-0.06	-0.07	+0.08	-0.01	+0.03	+0.01	-0.20	+0.00	+0.05	-0.15	+0.01	+0.08	+0.02	+0.12	-0.02	+0.24	+0.01	+0.05
4	+0.11	+0.12	+0.00	+0.09	+0.18	+0.17	-0.01	+0.26	+0.06	+0.05	+0.29	+0.11	+0.07	+0.17	+0.05	-0.01	+0.23	+0.08	+0.24	+0.17
5	+0.04	+0.06	-0.04	+0.07	+0.10	+0.01	+0.14	+0.10	+0.00	+0.10	+0.13	-0.05	+0.20	+0.22	+0.12	+0.06	+0.15	+0.11	+0.18	+0.15
6	+0.00	+0.14	-0.19	+0.06	+0.15	+0.28	-0.13	+0.14	+0.04	+0.16	+0.22	+0.10	+0.05	+0.14	-0.01	+0.06	+0.13	+0.28	+0.18	+0.10
7	+0.18	+0.19	+0.13	+0.02	-0.01	+0.04	+0.07	-0.01	+0.07	-0.11	+0.10	+0.07	+0.04	+0.17	+0.20	+0.18	+0.07	+0.07	+0.09	+0.04
8	+0.14	+0.08	+0.26	+0.13	+0.07	+0.10	+0.16	+0.08	+0.07	+0.06	+0.00	+0.04	+0.16	+0.06	+0.03	-0.01	-0.06	+0.21	+0.10	+0.09
9	+0.21	+0.04	+0.07	-0.09	+0.03	+0.06	+0.20	+0.04	+0.10	-0.01	+0.08	+0.12	+0.13	+0.18	+0.13	+0.03	+0.18	+0.08	+0.13	+0.18
10	+0.15	+0.00	+0.01	+0.13	+0.05	+0.19	+0.04	+0.10	+0.04	+0.17	+0.00	+0.16	+0.07	+0.17	+0.19	+0.24	+0.04	+0.05	+0.27	+0.13
11	+0.05	+0.01	+0.01	+0.00	+0.05	-0.02	-0.17	-0.00	-0.02	+0.04	+0.16	+0.09	+0.10	+0.20	+0.13	-0.07	+0.21	-0.13	+0.04	+0.01
12	+0.10	+0.09	+0.08	+0.10	+0.08	+0.22	+0.14	+0.07	-0.01	+0.20	+0.09	+0.05	+0.15	-0.02	+0.05	+0.04	+0.03	+0.15	+0.18	+0.23
13	+0.07	+0.05	+0.03	+0.07	-0.04	-0.03	+0.18	-0.12	-0.07	+0.06	+0.09	-0.05	+0.06	-0.06	-0.09	+0.04	-0.03	+0.06	-0.02	+0.13
14	+0.05	+0.06	+0.01	+0.18	-0.06	-0.07	+0.18	+0.11	-0.10	+0.01	+0.09	-0.09	+0.04	-0.15	-0.14	-0.06	+0.01	-0.07	+0.08	-0.11
15	+0.02	+0.01	-0.04	+0.17	+0.13	+0.13	+0.11	+0.12	+0.11	+0.20	-0.11	-0.08	+0.01	+0.01	-0.01	+0.04	-0.02	+0.15	+0.09	+0.14
16	-0.01	+0.30	+0.06	+0.13	-0.08	+0.02	+0.09	-0.02	+0.00	+0.09	-0.10	+0.10	+0.15	+0.05	+0.22	-0.06	+0.00	+0.05	+0.02	+0.01
17	+0.11	+0.14	+0.01	+0.15	+0.01	+0.02	+0.01	+0.06	+0.07	+0.14	+0.10	+0.10	+0.19	+0.14	+0.20	+0.08	+0.19	+0.10	+0.09	+0.14
18	+0.01	+0.18	+0.02	+0.16	-0.06	-0.00	+0.07	+0.06	-0.07	+0.14	-0.01	+0.08	+0.02	-0.04	-0.09	+0.03	+0.01	-0.01	+0.09	+0.04
19	+0.17	+0.13	-0.00	+0.00	+0.18	+0.08	+0.03	+0.06	+0.12	+0.02	+0.38	+0.26	+0.17	+0.13	+0.10	+0.15	+0.16	+0.24	+0.09	-0.10
20	+0.05	+0.20	-0.09	+0.02	+0.22	+0.32	+0.06	+0.23	+0.21	+0.05	+0.12	+0.05	+0.15	+0.10	+0.19	+0.14	+0.27	+0.15	+0.23	+0.21
21	+0.12	+0.03	-0.03	-0.15	-0.03	+0.13	+0.08	+0.09	+0.06	+0.02	-0.01	+0.01	+0.04	+0.20	+0.17	+0.01	+0.12	+0.08	+0.06	+0.15

ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE



TABLE 19 PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN THE ITEMS OF THE GOUGH-SANFORD RIGIDITY SCALE AND THE ROKEACH DOGMATISM SCALE WITH ONLY SIGNIFICANT CORRELATIONS RECORDED. N = 110

		ITEM NUMBERS OF THE GOUGH-SANFORD SCALE																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1																						
2	+5%																					
3	+5%																					
4																						
5																						
6																						
7																						
8																						
9	+5%																					
10																						
11																						
12																						
13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						
21																						

EACH SIGNIFICANT SCORE IS RECORDED BY ITS SIGNIFICANCE LEVEL AND THE VALENCY OF THE CORRELATION

ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE

TABLE 20 PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN a) THE GOUGH-SANFORD RIGIDITY SCALE AND ROKEACH DOGMATISM SCALE AND b) AGE, SEX, AND SCORES ON THE UNUSUAL USES AND HIDDEN FACES TESTS.

		ITEM NUMBERS OF THE GOUGH-SANFORD RIGIDITY SCALE																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		+ .08	+ .25	- .03	+ .06	+ .35	+ .32	- .02	+ .13	+ .29	+ .20	+ .17	+ .39	+ .07	+ .20	+ .17	+ .33	+ .03	+ .25	+ .11	+ .25	+ .20
Age	1%					1%				5%		0.1%		5%		5%	1%		1%		1%	5%
Unusual Uses		- .10	- .10	+ .10	- .03	+ .02	- .02	- .07	+ .00	- .15	+ .06	- .06	+ .04	- .13	+ .06	+ .03	- .16	- .24	- .18	- .07	- .05	- .09
																		5%				
Hidden Faces		- .19	- .24	+ .03	- .31	- .13	- .04	+ .01	+ .05	- .13	- .06	- .08	- .11	- .28	- .15	- .15	- .18	- .10	- .25	- .01	+ .02	- .04
		5%			1%						1%								1%			
Sex		+ .09	- .01	- .01	+ .02	+ .03	- .04	+ .02	- .05	- .02	- .04	- .01	- .08	+ .06	- .03	- .00	+ .00	+ .19	- .03	- .02	- .03	+ .03
																			5%			

Continued/

TABLE 20 CONTINUED

ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Age	+ .17	- .04	+ .02	+ .31	- .02	+ .26	+ .26	+ .08	+ .03	+ .13	- .06	+ .05	- .18	- .13	+ .13	+ .02	+ .17	+ .06	+ .04	+ .16	+ .07
Unusual Uses	- .23	- .16	- .04	- .26	- .19	- .03	- .05	- .23	- .07	- .11	+ .03	- .05	- .13	- .16	+ .03	+ .08	- .17	- .13	- .11	- .15	- .18
Hidden Faces	- .05	+ .13	+ .02	- .10	- .25	- .28	- .07	- .16	- .02	- .10	- .01	+ .10	+ .02	- .10	+ .01	- .17	- .18	- .21	- .25	- .09	+ .05
Sex	+ .10	+ .05	+ .11	+ .25	+ .02	+ .03	- .03	+ .03	+ .03	+ .05	- .02	+ .06	- .09	+ .13	- .09	- .21	+ .03	- .19	+ .11	+ .04	+ .09

CORRELATION COEFFICIENTS AND THEIR VALENCY SIGNS ARE GIVEN IN THE UPPER HALF OF EACH ROW, AND SIGNIFICANT CORRELATIONS ARE RECORDED BY THEIR SIGNIFICANCE LEVEL IN THE LOWER HALF OF EACH ROW.

TABLE 21 A COMPARISON OF THE PEARSON PRODUCT MOMENT  
CORRELATION MATRICES COMPUTED FOR BOTH THE  
GOUGH-SANFORD RIGIDITY SCALE, AND THE  
ROKEACH DOGMATISM SCALE BY S. RUBENOWITZ  
(1963) AND S. CROUCH (1972).

Only correlation coefficients of 5% significance or greater are recorded.

0 = Significant Rubenowitz Correlations From N = 115

+ = Significant Crouch Correlations From N = 110

Gough-Sanford Scale - Items '6' and '17' were not used by Rubenowitz.

Rokeach-Dogmatism Scale - 7 Items from the Authoritarianism Subscale, and 7 Items from the Paranoia Subscale were used by Rubenowitz.

		ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE														
		1	2	3	6	7	8	9	11	13	14	16	19	20	21	
ITEM NUMBERS OF THE ROKEACH DOGMATISM SCALE	1			0		+	+	+			0			0	0	
	2				0	0				0					0	
	3											0			0	
	6					0	0	0			0	0		+		
	7						0	+	0							
	8								+	0	0	+			⊕	
	9											0		+	+	
	11										0	0	0		⊕	
	13										+	0				
	14											0	+		0	
	16												0		0	
	19													0		
	20														⊕	
	21															

Continued/



TABLE 22 PEARSON PRODUCT MOMENT CORRELATION MATRIX  
FOR THE VARIABLES OF AGE, SEX, UNUSUAL USES  
AND HIDDEN FACES COMPUTED IN THE RIGIDITY-  
FLEXIBILITY ANALYSIS

N = 110

r = 0.19 is significant at the 5% level of confidence

	Age	Sex	Unusual Uses	Hidden Faces
Age		-.01	-.03	-.08
Sex			-.25	-.01
Unusual Uses				+.27
Hidden Faces				

TABLE 23 ORTHOGONAL ROTATED COMPONENTS OF THE RIGIDITY  
AND FLEXIBILITY VARIABLES

Test Variable	Loading
<u>Factor 1 - Perceptual Rigidity and Paranoia</u>	
Hidden Faces	+ .51
<u>Paranoia Subscale items:-</u>	
In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.	-.56
I wish I could find someone who would tell me how to solve my personal problems.	-.52
Most people just don't give a damn for others.	-.44
<u>Gough-Sanford item:-</u>	
I often find myself thinking of the same tune or phrase for days at a time.	-.41
<u>Factor 2 - Age and Behavioural Rigidity</u>	
Age	-.54
<u>Gough-Sanford items:-</u>	
I have a work or study schedule which I follow carefully.	-.61
I find it easy to stick to a certain schedule once I have started on it.	-.59
I always finish tasks I start, even if they are not very important.	-.58
I try to follow a programme of life based on duty.	-.56
I am a methodical person in whatever I do.	-.49
I think it is usually wise to do things in a conventional way.	-.45
I believe that promptness is a very important personality characteristic.	-.41
<u>Paranoia item:-</u>	
The main thing in life is for a person to want to do something important.	-.43

TABLE 23 CONTINUED

Test Variable	Loading
<u>Factor 3 - Narrow mindedness</u>	
<u>Paranoia item:-</u> Its all too true that people just won't practise what they preach.	-.52
<u>Authoritarianism items:-</u> In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.	-.45
A group which tolerates too many differences of opinion among its own members cannot last for long.	-.42
In the history of mankind there have probably been just a handful of great thinkers.	-.41
<u>Factor 4 - Fear of the Unknown</u>	
<u>Paranoia item:-</u> It is only natural for a person to be rather fearful of the future.	-.52
<u>Gough-Sanford items:-</u> I prefer to stop and think before I act, even on trifling matters.	-.49
I do not enjoy having to adapt myself to new and unusual situations.	-.47
I have never done anything dangerous for the thrill of it.	-.41
<u>Factor 5 - Unusual Uses</u>	
Unusual Uses	-.53
<u>Paranoia item:-</u> In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.	-.39
<u>Authoritarianism item:-</u> It is only when a person devotes himself to an ideal or cause that life becomes meaningful.	+.38



Chapter 17      The Non-Returner Subject Group

The test variables from Test Battery I for the Total Returner Group and the Non-Returner Group were compared by Unrelated t - tests. For the Maths Scores and Decimal tests only subjects given Test Battery I in Decimal Week were included in the analysis. This gave N = 75 for the Total Returners and N = 17 for the Non-Returners. For the remaining test variables the Practice Check Groups were also included in the analysis, which gave N = 90 for the Total Returner Group and N = 22 for the Non-Returner Group. A summary of the mean scores and t values obtained is given in Table 24.

From Table 24 it can be seen that the only significant difference between the two groups was on the Age variable. The reason for this is probably that the four 70 year old subjects from the S1 volunteer group who did not return, formed a larger proportion of the Non-Returner Group than the two 70 year old returners did in the Total Returner Group.

A Pearson's Product Moment Correlation Matrix for these test variables in the Non-Returner Group is given in Table 25. The significant correlation coefficients may be summarised thus:- Age was negatively related to the Decimal tests I, II and III, and positively related to the Gough-Sanford Rigidity Scale and to Sex, i.e. men were generally younger than the mean age. Sex was negatively related to Unusual Uses and to the Decimal tests II and IV and to I + IV, this means that men scored higher on these tests. Sex was

positively related to Rokeach-Authoritarianism which means that women scored higher on this test.

The Maths tests were all positively related to each other. The two Flexibility tests were positively related to each other, and to the Decimal tests IV and I + IV.

In the Rigidity Scales, Authoritarianism was negatively related to all the Decimal test scores, and the Gough-Sanford Scale was also negatively related to all the Decimal tests except II Conversion. The Gough-Sanford Scale and Rokeach-Authoritarianism were positively related to each other.

The Decimal test scores all correlated positively with each other.

Finally a Principal Component Analysis of the Non-Returner Group gave three orthogonal factors, summarised in Table 26. The first factor was loaded mainly on the Decimal tests with the Gough-Sanford Scale and Rokeach-Authoritarianism loading in the opposite direction. Age and Sex were also negatively related to the Decimal tests, i.e. men scored higher on these tests, while the two Flexibility tests were loaded in the same direction as the Decimal tests.

The second factor included the two Flexibility tests and negative loadings on Rokeach-Paranoia and the Gough-Sanford Scale. Previous Decimal experience was also negatively loaded, meaning that less foreign experience went with higher Rigidity Scale scores and lower Flexibility test scores.

The third factor consisted mainly of the three Maths scores but some lower loadings have been included in Table 26 to show which variables were most related to mathematical ability. These moderate loadings are for Age, IV Coin Recognition and Hidden Faces. All the variables were loaded in the same direction so that high scores were related on all the variables, including Age.

TABLE 24 COMPARISON OF THE TOTAL RETURNER GROUP AND  
THE NON-RETURNER GROUP ON THE VARIABLES OF  
TEST BATTERY I.

Means and t-values from the Unrelated t-tests

Test Variables	Mean scores of		t values and probabilities
	Total Returners	Non-Returners	
Age	38.28	44.81	2.07 p < 5%
Sex	1.73	1.82	0.09 NS
Previous Decimal Experience	2.15	2.09	0.32 NS
£ s d	6.41	7.47	1.90 NS
£ p	6.23	6.76	0.74 NS
Combined Maths	12.60	14.23	1.62 NS
Unusual Uses	7.87	6.36	1.76 NS
Hidden Faces	8.04	8.23	0.25 NS
Gough-Sanford	9.12	9.23	0.11 NS
Rokeach-Auth.ism	3.60	3.68	0.14 NS
Rokeach-Paranoia	4.38	3.95	0.92 NS
I New Currency	2.80	2.06	1.54 NS
II Conversion	3.16	3.12	0.07 NS
III Dual Currency	1.03	0.88	0.52 NS
IV Coin Recognition	5.68	5.88	0.18 NS
I + IV	8.61	7.94	0.52 NS

*N* values - see p. 166



TABLE 26 ORTHOGONAL ROTATED COMPONENTS OF THE VARIABLES  
OF TEST BATTERY I FOR THE NON-RETURNER GROUP

Factors	Test Variable	Loading
Factor 1	Decimal Currency I + IV	-.925
	I New Currency	-.867
	IV Coin Recognition	-.851
	II Conversion	-.837
	III Dual Currency	-.653
	Rokeach-Authoritarianism	+.731
	Gough-Sanford Rigidity Scale	+.576
	Age	+.573
	Sex	+.564
	Unusual Uses	-.491
Hidden Faces	-.366	
Factor 2	Rokeach-Paranoia	-.461
	Previous Decimal Experience	-.431
	Gough-Sanford Rigidity Scale	-.416
	Hidden Faces	+.597
	Unusual Uses	+.354
Factor 3	Combined Maths Score	+1.021
	£ s d	+.928
	£ p	+.870
	IV Coin Recognition	+.260
	Age	+.246
	Hidden Faces	+.243
	Decimal Currency I + IV	+.215

Chapter 18    The Psychology-Student Subject Group

There were 20 students who completed all the Background, Personality and Ability tests, and 17 who were present for all four sessions of the Decimal Currency testings. 6 other students were present for some of the Decimal Currency sessions and their scores have been included in the means of Table 28. Table 27 shows the mean scores on the other test variables, compared with the Total Returner Group. The Student Group is predictably higher on Progressive Matrices and much younger than the Total Returner Group. They are also lower on the Rigidity Scales and better on the Combined Maths score, but these differences are not very great. Table 28 shows that they improved on all the Decimal tests with each successive testing, but the greatest gains were after the Introduction of Decimal Currency on February 15th 1971.

Pearson Product Moment Correlation Matrix

The scores of the Psychology Student Group were added to those of the Total Returner Group and a Pearson's Product Moment Correlation Matrix computed, as described in Chapter 10. The resulting coefficients are given in Table 29. The significant relationships may be summarised thus:-

Age was negatively related to Progressive Matrices; to all the first and second testing Decimal test scores, and to gain on II Conversion. Age was also negatively

related to sex i.e. men were generally older than the mean age; and to foreign experience i.e. older people had been abroad more often. Age was positively related to the Gough-Sanford Scale and to Rokeach-Authoritarianism.

Progressive Matrices was positively related to all the Maths and Flexibility scores, to all the first and second Decimal test scores and to Gain on II Conversion and III Dual Currency. It was also positively related to a quadratic retest trend since the Psychology students were coded as being retested in Week II after Decimal Week. The Progressive Matrices were negatively related to the three Rigidity Scales.

The intercorrelations among the three Maths scores were all positive. Relationships with the other variables were as follows:-

£ s d was positively related to the first test of IV Coin Recognition; to Decimal tests I, II and IV retest scores, and to first and second I + IV scores.

£ p was positively related to all the Decimal first and second test scores and to Gain on tests I and IV. £ p was also positively related to Unusual Uses and negatively related to the two Rokeach Subscales. The Combined Maths score had the same relationships as the £ p test.

The two Flexibility tests were positively related and their relationships with the other test variables were as follows:-



Unusual Uses was positively related to the first test of IV Coin Recognition; to the retest and Gain scores of I New Currency and to both first and second scores of tests I + IV. Unusual Uses was negatively related to both the Rokeach Subscales and to sex, i.e. men scored more Uses.

Hidden Faces was positively related to the first scores on IV Coin Recognition and to the retest scores of I New Currency; and negatively related to the Gough-Sanford Scale and to Previous Decimal Experience, i.e. people who had been abroad more often found more Faces.

The three Rigidity Scales were all positively related to each other and their relationships with the other test variables were as follows:-

Gough-Sanford Scale was negatively related to the Decimal tests I and II first occasion testing, to I, II and II second occasion testing scores, and to both testings of I + IV scores.

Rokeach-Authoritarianism Subscale was negatively related to the Decimal tests II, IV and I + IV on the first testing and to all the second testing scores.

Rokeach-Paranoia Subscale was negatively related to the Decimal tests I New Currency and I + IV on both testing occasions and to the IV Coin Recognition retest scores. It was also positively related to Previous Decimal Experience i.e. people with higher Paranoia scores had not been abroad so often.

TABLE 27 MEAN SCORES ON THE BACKGROUND, PERSONALITY AND ABILITY VARIABLES, FOR THE PSYCHOLOGY STUDENT GROUP AND THE TOTAL RETURNER GROUP

Test Variables	Mean Scores of	
	Total Returners	Psychology Students
Age	38.58	20.70
Sex	1.73	1.95
Previous Decimal Experience	2.20	2.65
£ s d	6.22	6.50
£ p	6.09	6.85
Combined Maths	12.31	13.35
Unusual Uses	7.73	8.10
Hidden Faces	7.83	6.70
Gough-Sanford Scale	9.09	7.60
Rokeach-Authoritarianism	3.67	2.95
Rokeach-Paranoia	4.38	3.90
Progressive Matrices	44.64	55.65

TABLE 28 MEAN SCORES ON THE FOUR DECIMAL CURRENCY TESTS, OVER TIME FOR THE PSYCHOLOGY STUDENT GROUP

Decimal Currency tests	Testing Occasion in 1971			
	Jan. 22nd	Feb. 1st	Feb. 22nd	March 5th
I New Currency	2.45	3.35	4.75	5.85
II Conversion	1.75	3.60	3.60	6.25
III Dual Currency	0.45	1.45	2.10	3.25
IV Coin Recognition	5.00	6.40	10.15	14.20



The remaining correlations for the background variables were firstly, a negative relation between Sex and II Conversion first scores, i.e. women scored higher; and secondly a positive correlation between Previous Decimal Experience and a quadratic retest trend. This was because the student group had had little foreign experience and were coded as being retested in Week II after Decimal Week.

The remaining relationships were between the Decimal tests. For the first occasion test scores all four tests were positively related to each other, and all related positively to all four retest scores. Tests I, II and III first test scores each related negatively to their own Gain scores, while the first test on II Conversion was positively related to Gain on IV Coin Recognition, and first test IV Coin Recognition was positively related to Gain on III Dual Currency. The Psychology student scores also caused positive relationships between the first testings of I, II and IV Decimal tests and a quadratic retest trend.

The second testing Decimal scores were all positively related to each other, and each test was positively related to its own Gain score. Also the retest on II Conversion was positively related to Gain on III Dual Currency; retest on III Dual Currency was positively related to Gain on II Conversion; and retest IV Coin Recognition was positively related to Gain on III Dual Currency. Again positive relationships with a quadratic retest trend were found for retest scores of tests II, III and IV.

For the Gain scores, Gain on II Conversion was positively related to Gain on III Dual Currency, and Gain on IV Coin Recognition was negatively related to a linear retest trend i.e. gain was less after each retest week.

#### Varimax Principal Components Matrix

The results of the Orthogonal Rotation of the Principal Components Analysis are summarised in Table 30. The first factor involved all the Decimal test scores from both first and second testings. High Decimal scores loaded in the same direction as high scores on Progressive Matrices and in the opposite direction to Age. The second factor consisted of Gain on I New Currency and the loadings on the two Flexibility tests; and in the opposite direction, loadings on Paranoia and the Gough-Sanford Rigidity Scale.

Factor 3 was the negative linear Gain trend on IV Coin Recognition. Factor 4 consisted solely of the Maths scores and Factors 5, 6 and 7 consisted of each of the Decimal tests III, I and II separated out. Factor 6, the I New Currency first test loaded also on Sex, meaning that women scored higher.

TABLE 30 ORTHOGONAL ROTATED COMPONENTS OF ALL THE  
VARIABLES IN BOTH TEST BATTERIES FOR THE  
TOTAL RETURNER GROUP, PLUS THE PSYCHOLOGY  
STUDENT GROUP

Factor	Test Variable	Loading
Factor 1	Decimal I + IV first test	-.929
	Decimal I + IV retest	-.891
	IV Coin Recognition first test	-.851
	IV Coin Recognition retest	-.845
	Progressive Matrices	-.796
	II Conversion retest	-.708
	III Dual Currency retest	-.692
	I New Currency first test	-.654
	I New Currency retest	-.638
	II Conversion first test	-.610
	III Dual Currency first test	-.528
	Age	+.478
Factor 2	Gain on I New Currency	-.482
	Unusual Uses	-.475
	Hidden Faces	-.416
	Rokeach-Paranoia	+.462
	Gough-Sanford Scale	+.414
Factor 3	Gain on IV Coin Recognition	-.748
	Linear retest trend	+.421
Factor 4	Combined Maths scores	+.998
	£ s d	+.817
	£ p	+.734
Factor 5	Gain on III Dual Currency	+.946
	III Dual Currency first test	-.422
Factor 6	I New Currency first test	-.464
	Sex	-.463
Factor 7	Gain on II Conversion	-.768
	II Conversion retest	-.452

SECTION D

DISCUSSION

Chapter 19    The Adaptation to Decimal Currency

It seems that the subjects of this study adapted to the new currency within the first week of its introduction, because there were no significant differences between the Decimal Gain scores after each of the three retest weeks, but there were significant differences between the first and second testing scores of I New Currency and IV Coin Recognition for all three Returner Subgroups.

The differences between the first and second testings of the II Conversion and III Dual Currency tests did give larger 't' values with each succeeding retest week, and in the case of II Conversion changed from an initial loss in ability to a positive gain after three weeks. This suggests that the use of both currencies together took people a lot longer to adapt to, and that possibly significant gains would have developed after a few more months.

These results were not affected by any significant practice effect; but the fact that the Returner Subgroup retested in Week I was significantly better on I New Currency in Decimal Week than the Returner Subgroup retested in Week III, may have reduced a potential improvement trend with time on this test.

There are three Hypotheses related to the ability to adapt to Decimal Currency, these relating to age, flexibility and rigidity.

Hypothesis 1

The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur later</sup> ~~be slower~~ in older than younger age groups. This improvement will be proportionately greater on the two measures involving the use of both currencies together (the greater complexity causing more interference and confusion in older subjects) than in the two measures of new currency alone.

Graph 1 (Table 1, Appendix IV) shows that apart from subjects in their early twenties the older subjects were initially as good as younger subjects on the Decimal tests in Decimal Week. Also the lack of significant variance between the Gain scores after each of the three retest weeks was not altered by doing separate analyses for the younger and older halves of the Total Returner Group.

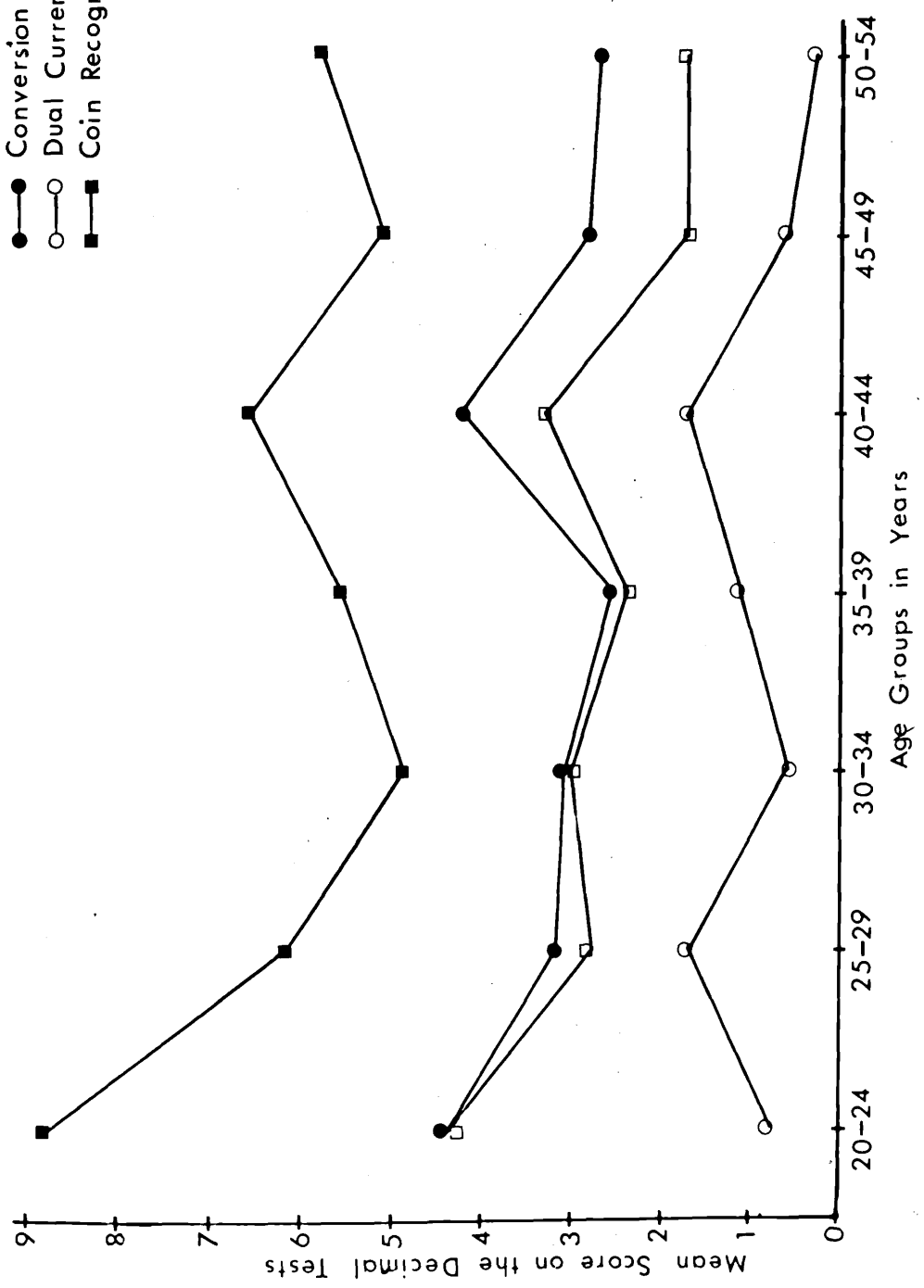
The majority of subjects were aged from 20 to 49 years, so for the purposes of some graphical representation these subjects' scores only have been used, divided into three age decades. In Graph 2 (Table 2, Appendix IV) the mean scores of the Decimal tests in each of the four testing weeks covered by this study show that the 30 to 39 year olds tend to score below both the 20 to 29 and 40 to 49 year old age groups, especially after the third retesting week. This tendency is shown most clearly in Graph 3 (Table 3, Appendix IV) where the four Decimal test scores are combined.



GRAPH 1      MEAN SCORES ON THE FOUR DECIMAL CURRENCY TESTS FROM THE FIRST TESTING  
OCCASION IN DECIMAL WEEK

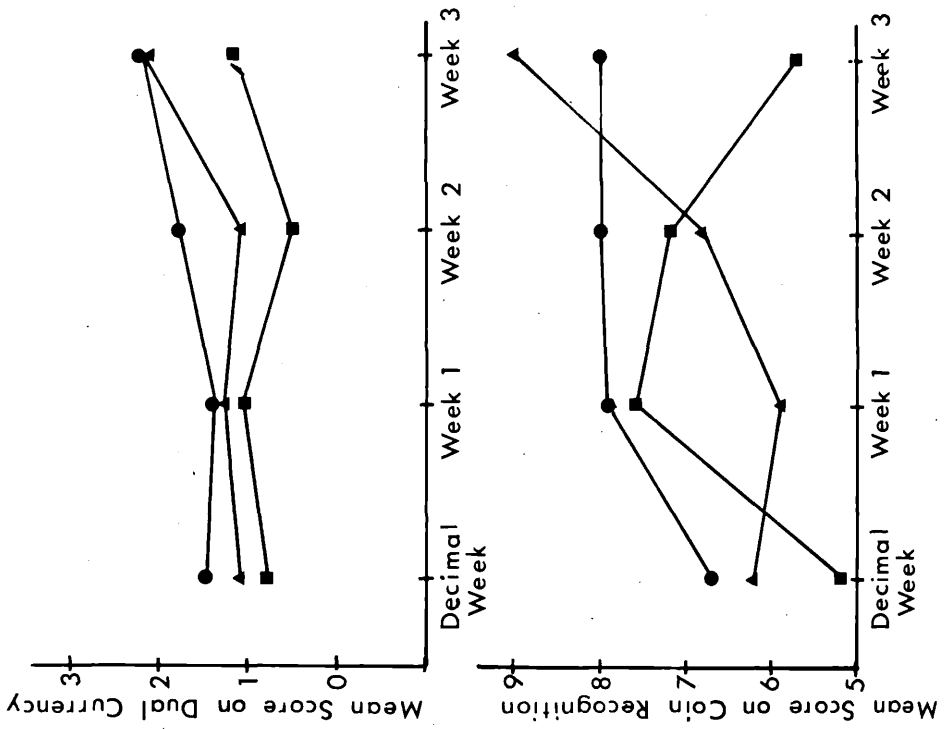
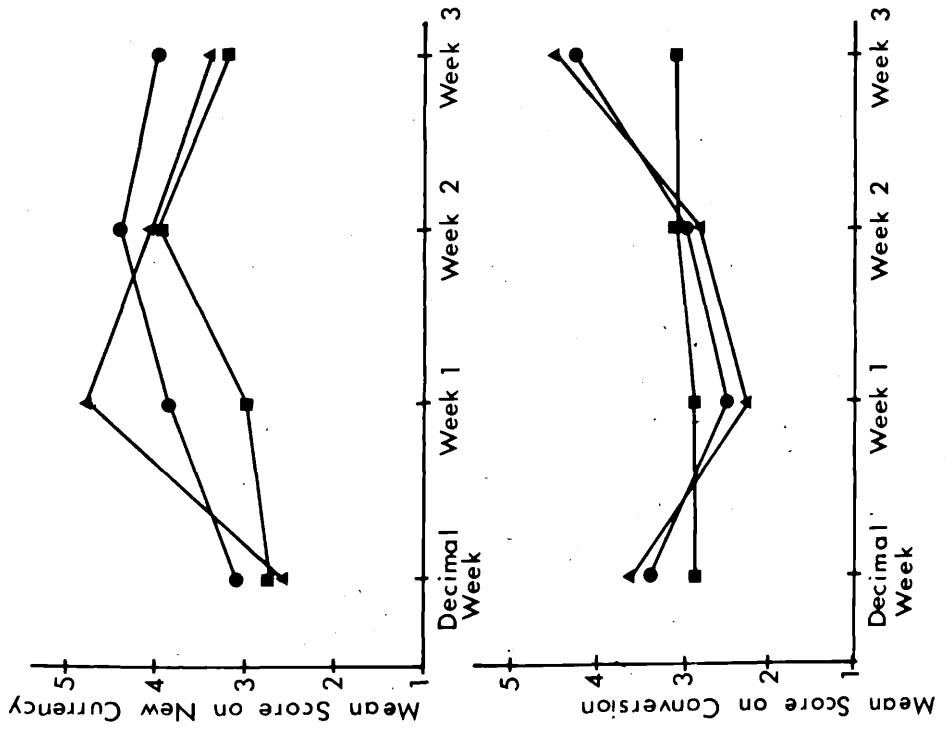
Scores taken from all the subjects who completed these tests; and divided into 7 age groups.

Key    □ — □ New Currency  
         ● — ● Conversion  
         ○ — ○ Dual Currency  
         ■ — ■ Coin Recognition



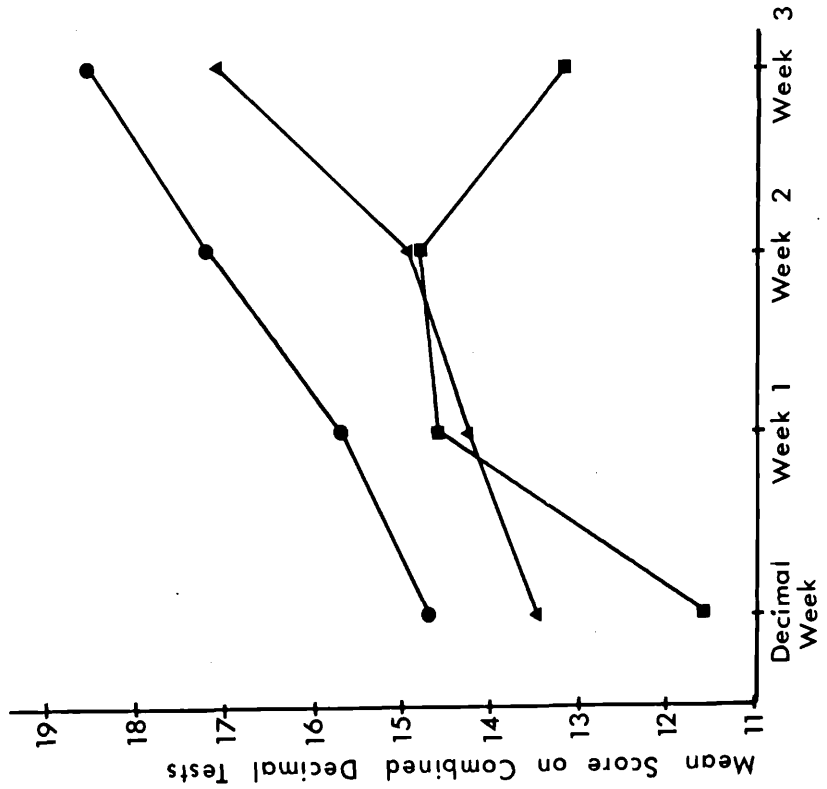
GRAPH 2 MEAN SCORES ON THE FOUR DECIMAL CURRENCY TESTS: OVER TIME: FOR THREE AGE GROUPS.

Key\_ ● 20-29 year-olds  
 ■ 30-39 " "  
 ▲ 40-49 " "



GRAPH 3  
MEAN SCORES ON THE FOUR DECIMAL CURRENCY TESTS COMBINED:  
OVER TIME: FOR THREE AGE GROUPS-

Key-  
● 20-29 year-olds  
■ 30-39 "  
▲ 40-49 "



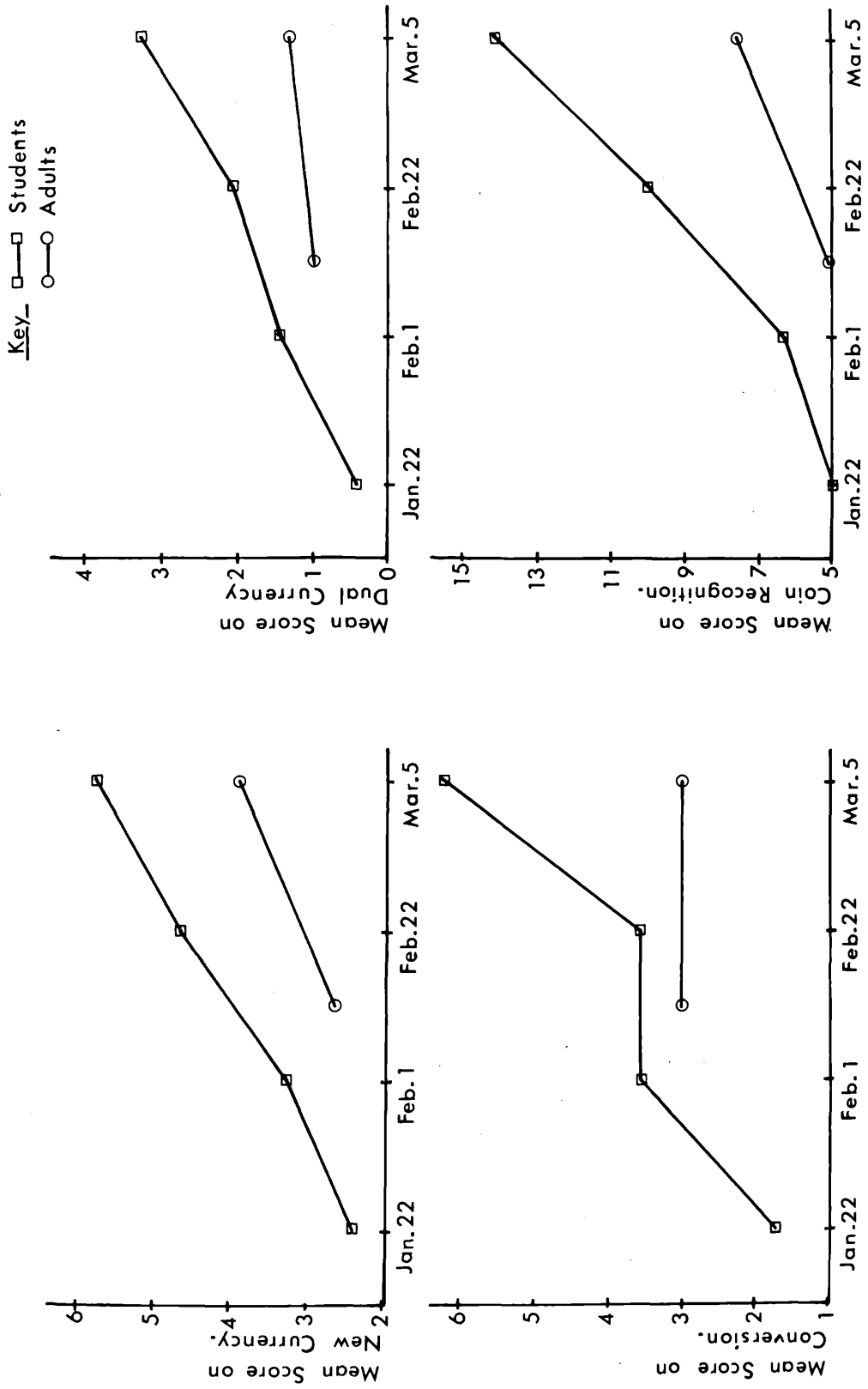
Also from Graph 3 it can be seen that the 20's and 40's show parallel scoring curves. Therefore the older group did score lower than the younger group, but their rate of improvement was not proportionately slower than the younger group.

There is, however, a disproportionate rate of improvement in the Psychology student sample as compared with the means of the Total Returner Group; shown in Graph 4 (Table 4, Appendix IV). This is probably due to their superior intelligence; youth, and previous practices on the Decimal tests, all of which make them unsuitable for any deeper scientific comparison with the adult subject group.

In Graph 5 (Table 5, Appendix IV) the mean Gain scores have been shown for subjects divided into under 35 years and over 36 years. From these means the only definite advantage that the younger group has, is on the IV Coin Recognition test during the first two retest weeks. Perhaps younger people were more able to adjust to the test layout and mathematical division processes required by this test.

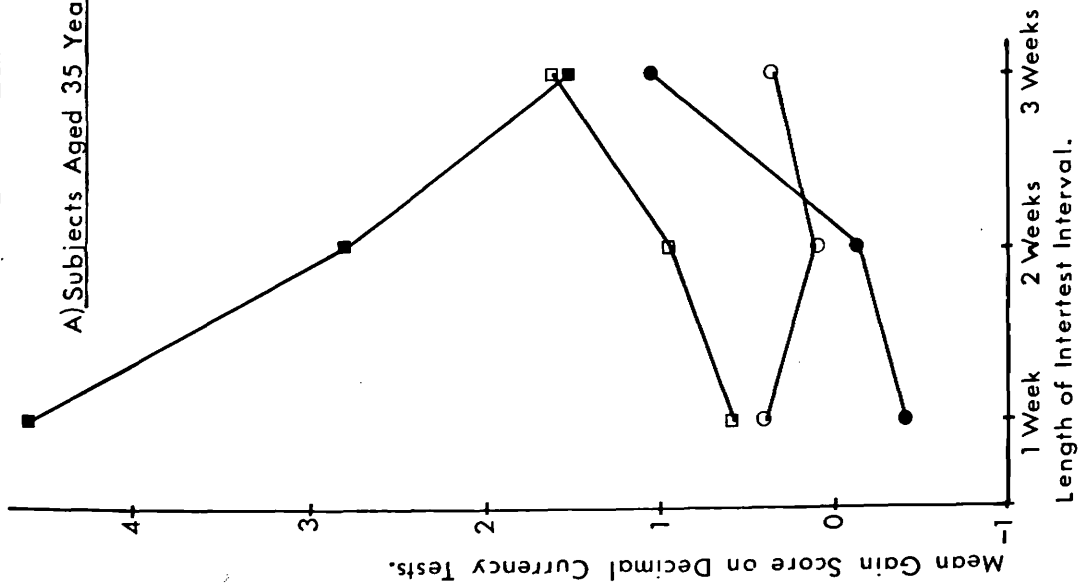
Also in support of Hypothesis 1 were some of the correlation coefficients (Table 8, Chapter 13). Age was significantly, negatively, related to the retest scores of II Conversion, showing that older people did, as predicted, have more trouble coping with the use of two sets of mathematical rules together. The I New Currency scores were also generally negatively related to Age, but not significantly so.

GRAPH 4 MEAN SCORES ON THE FOUR DECIMAL CURRENCY TESTS, OVER TIME, FOR THE PSYCHOLOGY-STUDENT SAMPLE AND THE ADULT RETURNER SAMPLE



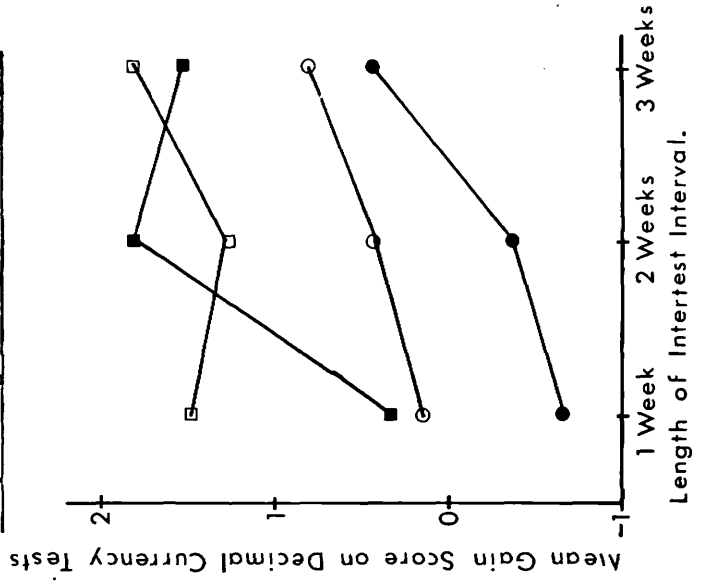
GRAPH 5 MEAN GAIN SCORE ON THE FOUR DECIMAL CURRENCY TESTS OVER TIME, FOR OLDER AND YOUNGER SUBJECTS.

A) Subjects Aged 35 Years and Less



Key  
 □ New Currency  
 ● Conversion  
 ○ Dual Currency  
 ■ Coin Recognition

B) Subjects Aged 36 Years and More



In the Stepwise Regression Analysis (Table 10, Chapter 13) Age was a significant predictor of the IV Coin Recognition scores in Decimal Week, and of the I New Currency and II Conversion scores in Retest Week I. This suggests that Age had its greatest relationship to performance within the first two weeks of the Introduction of Decimal Currency, and thus that older people were slower to adjust to the new system. The lack of Age relationships in the latter two Retest Weeks implies that with time pure chronological age was no longer such an effective variable, and therefore that the intellectual ability of the individual was a more long-term determinant of adaptability.

The statistical evidence for Hypothesis 1 was that firstly, age was negatively related to the ability to convert between the old and new currencies; and secondly, that age was a significant predictor of <sup>only</sup> <sup>on the retest,</sup> <sup>I New Currency and II Conversion</sup> ~~some of the Decimal~~ test scores in the early stages of the changeover, and of <sup>IV</sup> Coin Recognition in Decimal week.

#### Hypothesis 2

The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur sooner</sup> ~~be faster~~ among subjects scoring higher on the tests of abstract reasoning ability, regardless of the age of these subjects.

The results from the Matrices test gave greatest support to this hypothesis because in the Total Returner Group they were significantly and positively related to all the Decimal test measures on both testing occasions.

The largest coefficients were, however, for correlations with the two tests of new currency alone; whereas one might perhaps have expected logical ability to be more helpful in the more complex dual currency and conversion tests. (Table 8, Chapter 13).

The coefficients between the Matrices and the Decimal tests in the Matched Returner Group were not consistently significant, (Table 9, Chapter 13) perhaps because the process of matching subjects on intelligence had increased the comparative relationships of other factors. Also among the Gain scores only the coefficient for the Matrices and Gain on I New Currency in the Total Returner Group was significant.

In the Stepwise Regression Analysis (Table 10, Chapter 13) the Matrices proved to be the most important predicting variable of all the Decimal test scores except on three out of a total of 20 instances; and in six instances it was the only significant predicting variable.

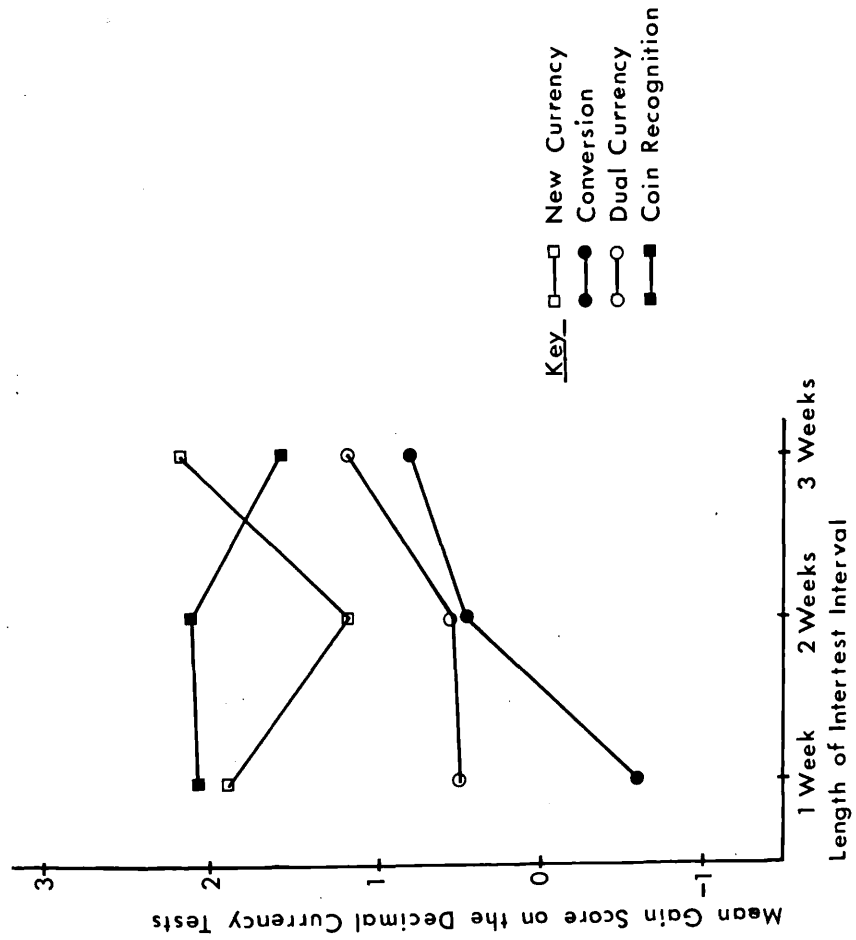
Graph 6 (Table 6, Appendix IV) gives the mean Gain scores on the Decimal tests for high and low scorers on the Matrices test. It can be seen that the higher intelligence group do have some scoring advantage, principally in the first two Retest Weeks, but on IV Coin Recognition it was the lower ability subjects who gained more during the first two weeks.

The two Flexibility tests, being taken also as measures of abstract thinking did not have such a generally advantageous relationship with the Decimal scores. In the

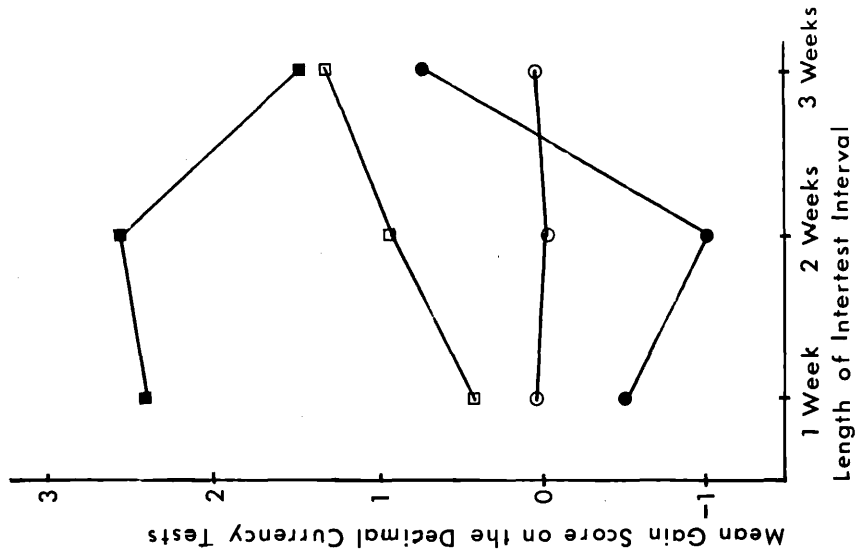


GRAPH 6 MEAN GAIN SCORE ON THE FOUR DECIMAL CURRENCY TESTS, OVER TIME, FOR HIGH AND LOW SCORERS ON THE PROGRESSIVE MATRICES TEST.

A) Subjects Scoring 47 or More Matrices Points.



B) Subjects Scoring 46 or Less Matrices Points.



Key □ New Currency  
● Conversion  
○ Dual Currency  
■ Coin Recognition

Total Returner Group both Flexibility tests were positively and significantly related to the IV Coin Recognition test in Decimal Week, suggesting that flexibility was important in adjusting quickly to either the new coinage or the test layout. (Table 8, Chapter 13). The Unusual Uses test was also significantly related to the retest and Gain scores of I New Currency, though when subjects were matched on age and intelligence it became the Hidden Faces test that was significantly related to Gain on I New Currency (Table 9, Chapter 13). Both results show that measures of flexibility were related to adaptation to the new currency.

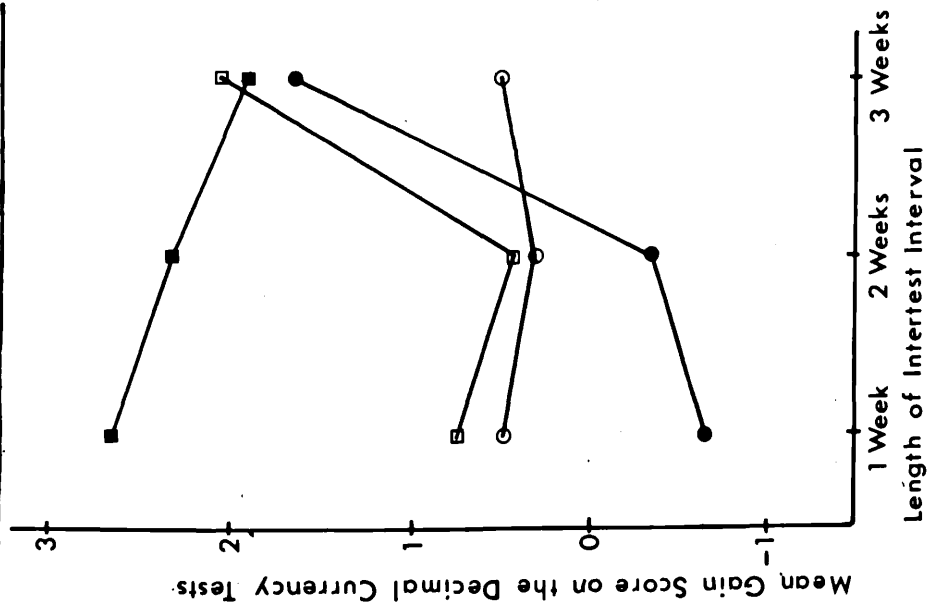
In the Stepwise Regression Analysis (Table 10, Chapter 13) the Unusual Uses test was a significant predictor of the II Conversion scores in Retest Weeks I and III; and the Hidden Faces test was a significant predictor on three occasions in three different weeks for all the Decimal tests except III Dual Currency.

Graph 7 (Table 7, Appendix IV) gives the mean Decimal Gain scores for high and low scorers on the Unusual Uses test. This shows the higher Gains of the more divergent thinkers on I New Currency in the early weeks of retesting; but it also shows the superiority of the less divergent thinkers on II Conversion in the Retest Week III, thus contradicting the hypothesised relationship.

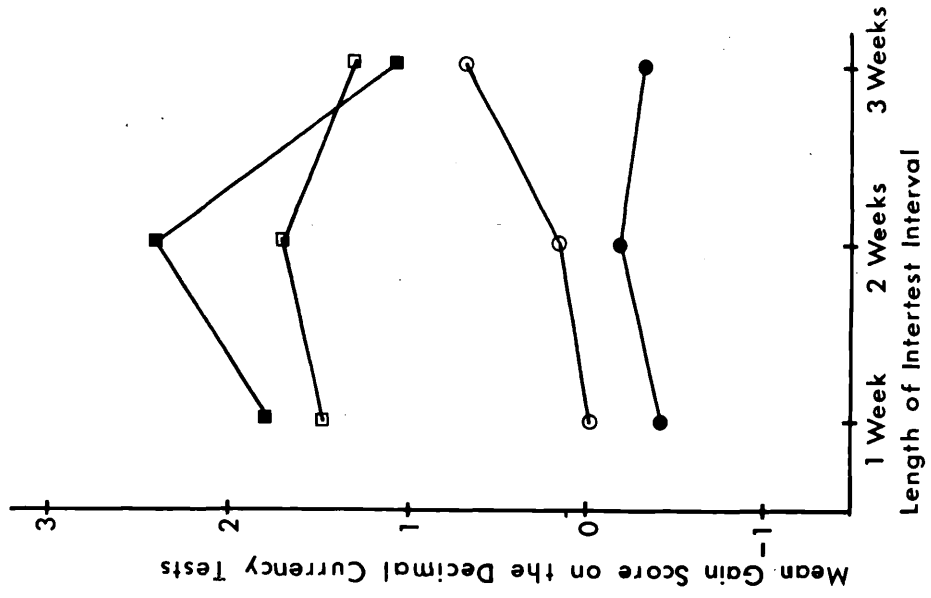
Graph 8 (Table 8, Appendix IV) gives similar means for high and low scorers on the Hidden Faces test. These curves show that for I New Currency and III Dual Currency a positive relationship existed between perceptual flexibility and

GRAPH 2 MEAN GAIN SCORES FOR THE FOUR DECIMAL CURRENCY TESTS, OVER TIME; FOR HIGH AND LOW SCORERS ON THE UNUSUAL USES TEST.

A) Subjects Scoring 7 or Less Unusual Uses



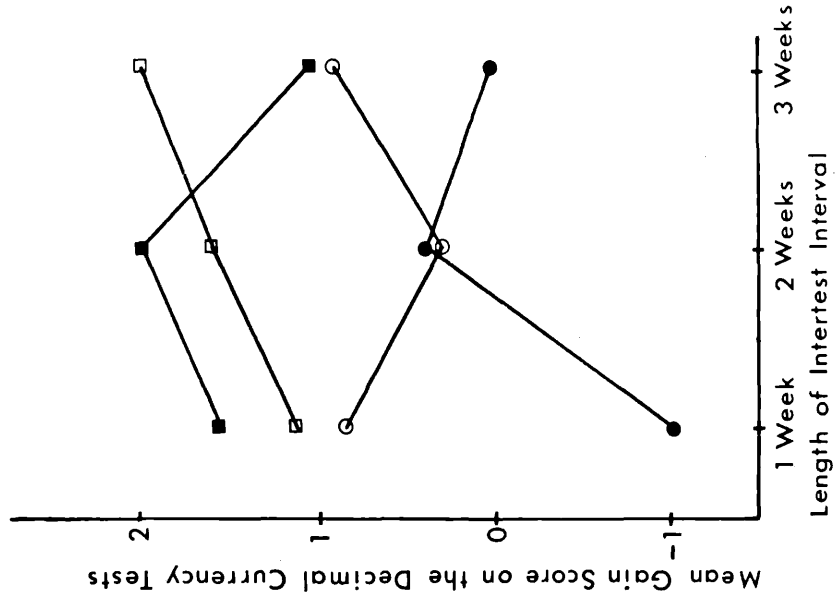
B) Subjects Scoring 8 or More Unusual Uses



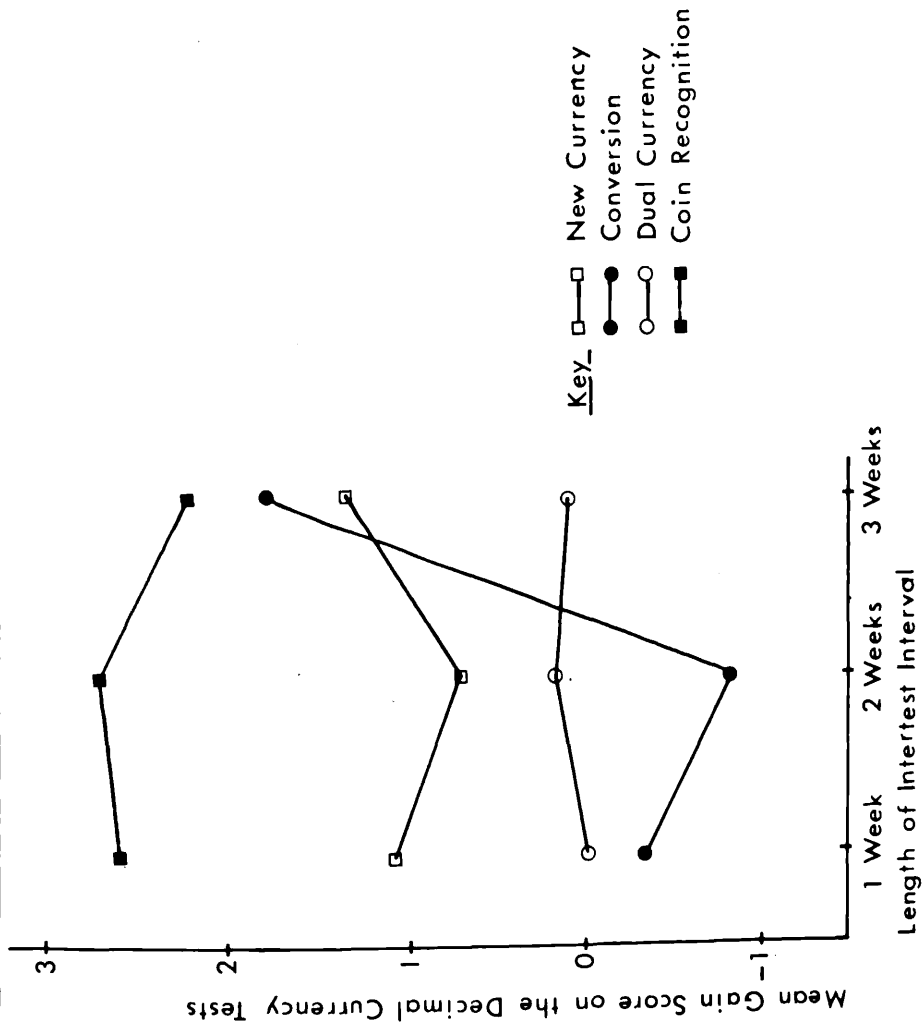
Key □ New Currency  
 ● Conversion  
 ○ Dual Currency  
 ■ Coin Recognition

GRAPH 8 MEAN GAIN SCORES FOR THE FOUR DECIMAL CURRENCY TESTS, OVER TIME; FOR HIGH AND LOW SCORERS ON THE HIDDEN FACES TEST.

B) Subjects Scoring 9 or More Hidden Faces



A) Subjects Scoring 8 or Less Hidden Faces



Key

- New Currency
- Conversion
- Dual Currency
- Coin Recognition

Decimal Gain, but on IV Coin Recognition and II Conversion the less flexible subjects showed more Gain, particularly in Retest Week III.

Therefore in support of Hypothesis 2 the ability measured by the Matrices test was the most important general factor related to adaptation, while the abilities measured by the two flexibility tests were more specialised in their relationships. In particular they related to IV Coin Recognition in Decimal Week, and to Gain on I New Currency. The relationship of the Unusual Uses test to the retest II Conversion scores implies that divergent thinking involves an ability to keep different ideas separate, while at the same time using them together.

### Hypothesis 3

The ~~rate of~~ improvement on the measures of Decimal Currency ability will <sup>occur later</sup> ~~be slower~~ among subjects scoring higher on the rigidity measures. The effect of behavioural rigidity will be at a maximum sooner than the effect of dogmatic thinking. (analytic rigidity operating before integrative rigidity).

The three rigidity measures; the Gough-Sanford Scale; the Authoritarianism and Paranoia Scales have mostly negative correlations with the Decimal test scores. This means that as rigidity scores get higher the Decimal scores get lower and therefore such relationships support the hypothesis. (Table 8, Chapter 13). For the Total Returner Group the Gough-Sanford Scale is significantly negatively

related to both the first and second test scores of I New Currency; Authoritarianism is similarly related to II Conversion in Decimal Week and the retest scores of IV Coin Recognition; and Paranoia is similarly related to the retest scores of I New Currency and IV Coin Recognition.

As would be expected from these correlations the combined I + IV Decimal scores are significantly related to the Gough-Sanford Scale in Decimal Week and nearly significant to both of the Dogmatism Subscale; while in the retest weeks this combined Decimal measure is significantly related to all three rigidity measures. Also in support of the hypothesis is the fact that the coefficients for the two Dogmatism Subscales are smaller than that for the Gough-Sanford Scale in Decimal Week but became considerably larger than that of the Gough-Sanford Scale in the retest weeks.

This means that behavioural rigidity was related to ~~adaptation to~~ <sup>copied with</sup> the new currency from the beginning of its usage, but that dogmatic thinking did not become significantly related till a week later, as predicted in Hypothesis 3. Also, the significant relationships of the rigidity scales are almost entirely with the two tests of new currency alone, so that high rigidity scorers were not at a disadvantage on the two tests involving the interchangeable use of both currencies.

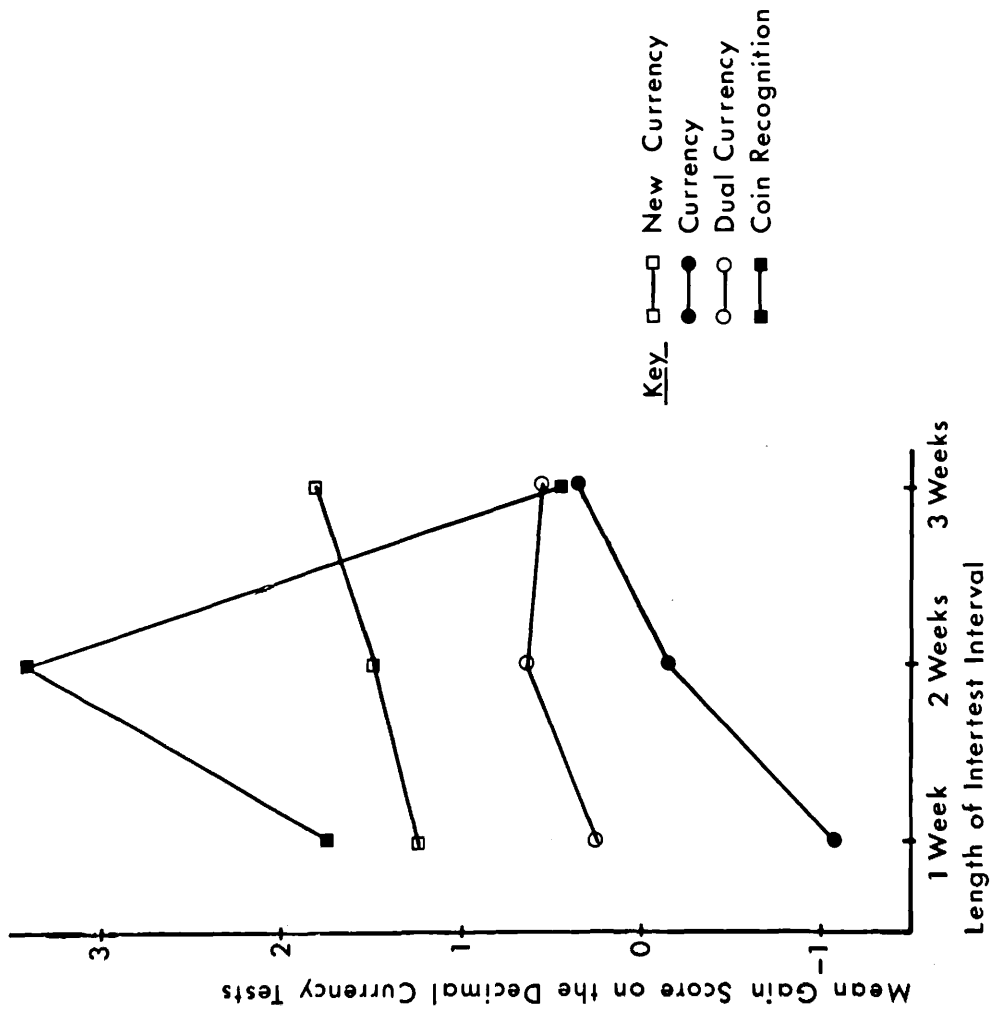
The Stepwise Regression analysis (Table 10, Chapter 13) gives the Gough-Sanford Scale as a significant predictor of the I New Currency scores in Decimal Week and in Retest Week III; and of II Conversion in Retest Week I, but in this instance only after the variance due to three other factors was removed. For the Dogmatism Subscale the only significant predictor was that of Paranoia on III Dual Currency in Decimal Week. This relationship may be a result of the test situation rather than a real relationship between Paranoid insecurity and ability. The reason for such a possibility is that the instructions for the III Dual Currency test seemed rather complex when first read, and had to be explained verbally to the subject groups before the testing began. Therefore the more Paranoid subjects may have been more overawed by the situation and felt that they would do badly before they began. Presumably the anxiety they felt may have had a more disadvantageous effect on their performance than in less insecure subjects.

Graph 9 (Table 9, Appendix IV) shows the mean Gain scores on the Decimal tests for high and low scorers on the Gough-Sanford Scale. These means do not provide any definite evidence for Hypothesis 3; in fact those for IV Coin Recognition suggest that the more rigid subjects made considerably larger Gains between the two testing occasions.

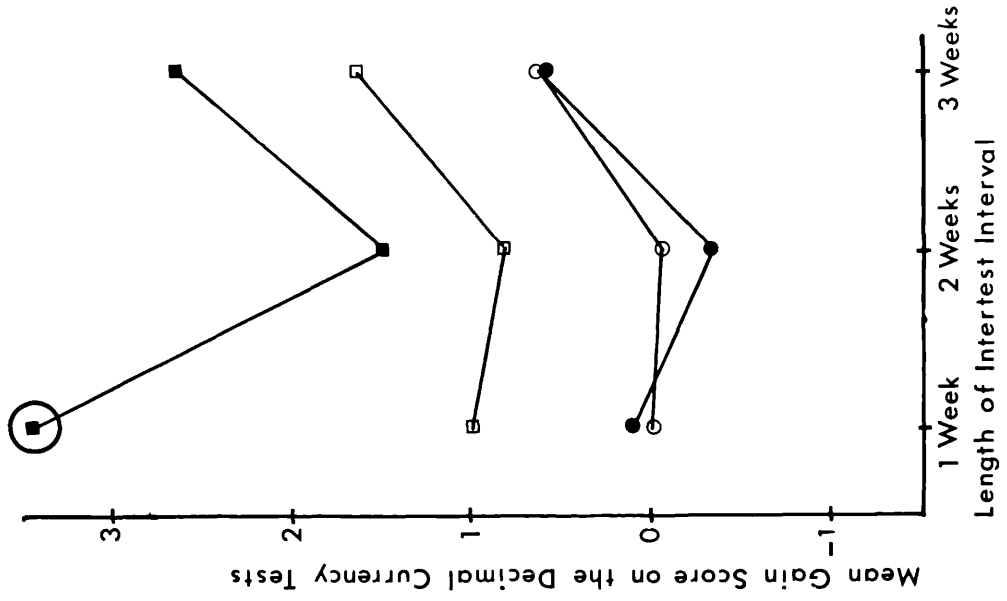
Graph 10 (Table 10, Appendix IV) shows the mean Decimal Gain scores for high and low scorers on Authoritarianism. These means give more support for the Hypothesis because the high scorers had lower mean Gains on I New Currency

GRAPH 9 MEAN GAIN SCORES FOR THE FOUR DECIMAL CURRENCY TESTS, OVER TIME; FOR HIGH AND LOW SCORERS ON THE GOUGH-SANFORD SCALE.

A) Subjects Scoring 8 or Less on Rigidity.



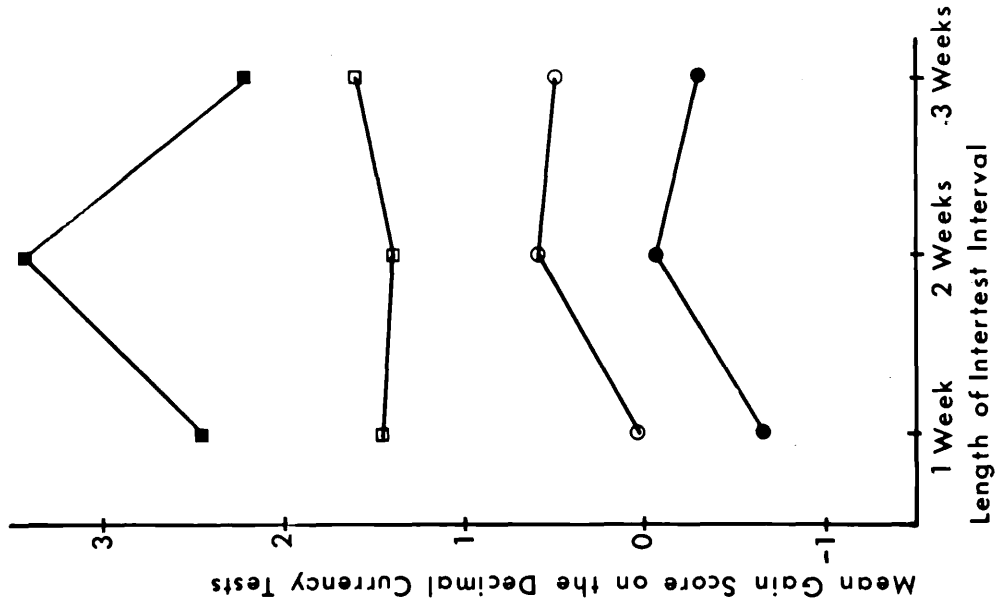
B) Subjects Scoring 9 or More on Rigidity.



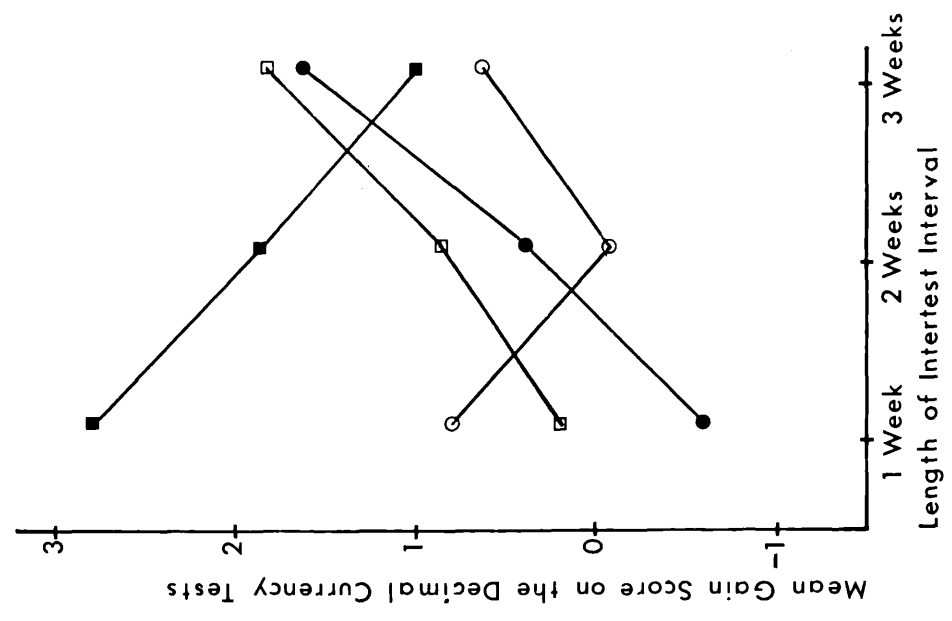


GRAPH 10 MEAN GAIN SCORE FOR THE FOUR DECIMAL CURRENCY TESTS, OVER TIME; FOR HIGH AND LOW SCORERS ON THE ROKEACH-AUTHORITARIANISM SUBSCALE.

A) Subjects Scoring 3 or Less on Auth.ism



B) Subjects Scoring 4 or More on Auth.ism



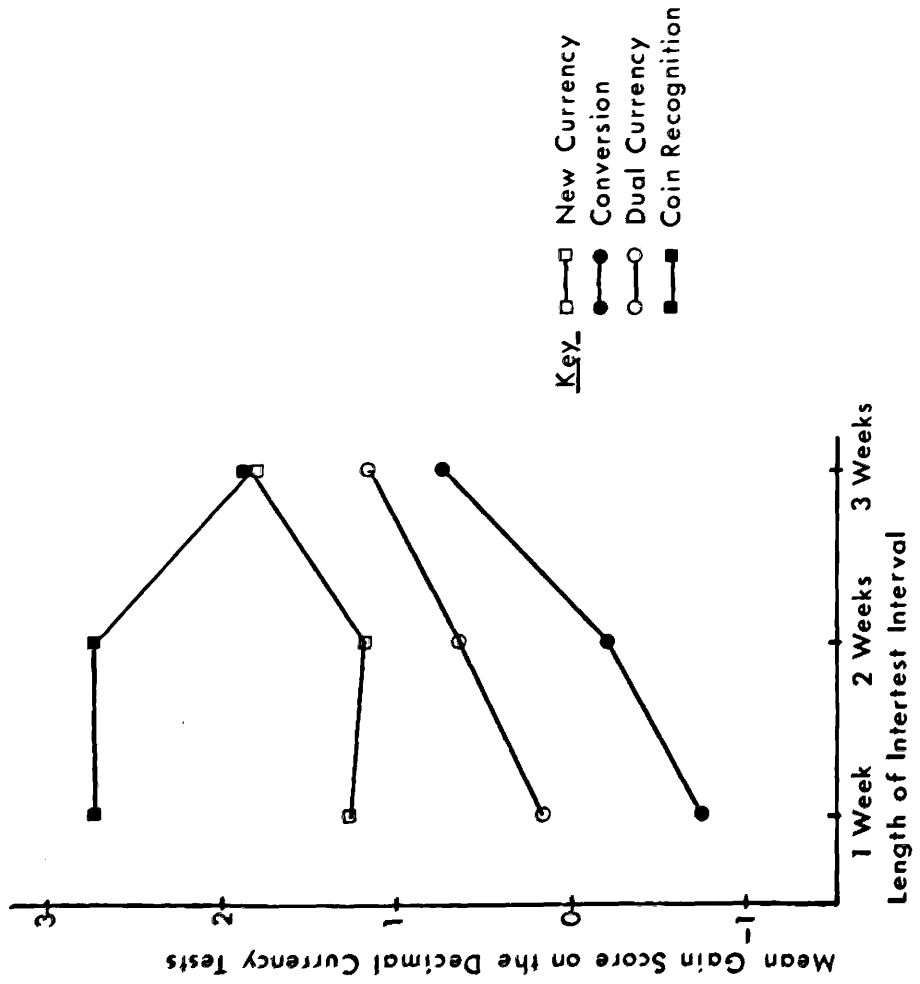
during the first two Retest Weeks and on IV Coin Recognition during the latter two Retest Weeks. The other two tests though tend to show a slight advantage to the high scorers, and thus again it is on the tests of new currency alone that this rigidity measure seems most related.

Graph 11 (Table 11, Appendix IV) shows the mean Decimal Gain scores for high and low scorers on Paranoia. The only large difference between the two sets of means is for III Dual Currency in the latter two Retest Weeks. Since the nature of this difference was in the hypothesised direction it was perhaps not just the test situation which made Paranoia a significant predictor of III Dual Currency in Decimal Week. Also the correlation between Paranoia and Gain on III Dual Currency was negative and nearly significant, whereas Gain on the other Decimal tests showed no correlation relationships with the three Rigidity Scales.

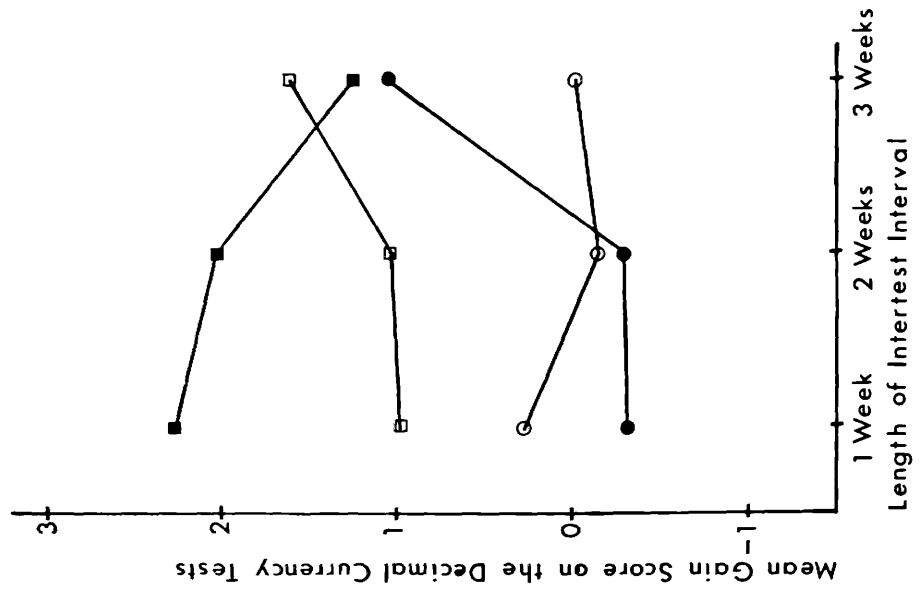
The significant evidence for Hypothesis 3 is firstly, a number of correlations between the three Rigidity Scales and the two tests of new currency alone, and predictive relationships between the Gough-Sanford Scale and I New Currency and II Conversion. Secondly, for the Dogmatism Subscales, Authoritarianism was related to II Conversion, and Paranoia to III Dual Currency. These relationships were all negative, as predicted, with high rigidity scorers having lower Decimal scores.

**GRAPH 11** MEAN GAIN SCORES FOR THE FOUR DECIMAL CURRENCY TESTS, OVER TIME, FOR HIGH AND LOW SCORERS ON THE ROKEACH-PARANOIA SUBSCALE.

**A) Subjects Scoring 4 or Less on Paranoia**



**B) Subjects Scoring 5 or More on Paranoia**



The Relationships of Decimal Adaptation to Other Variables

These other variables are ones included in the statistical analyses but not discussed above in relation to the Hypotheses.

Sex

The correlation coefficients showed significant negative correlations between Sex and both first and second test scores of II Conversion in the Total Returner Group (Table 8, Chapter 13). This means that men scored higher than women on these tests. In the Matched Returner Group, however, the only significant correlations were positive ones, showing that women were better than men on the first and second test scores of I New Currency; they gained more on III Dual Currency; and they were better on the combined I + IV Decimal scores on both testing occasions (Table 9, Chapter 13).

It must be remembered though that the Matched Returner Group had only seven men subjects, and the superiority of women in this group was probably due to their greater experience of small cash transactions when shopping. From the Total Returner Group, male superiority in the ability to convert was repeated in the Stepwise Regression Analysis (Table 10, Chapter 13) where Sex was a significant predictor of II Conversion in Decimal Week and Retest Week I. Perhaps men were naturally more proficient at mental manipulations of two mathematical systems while women needed more time to get the two systems clearly organised in their minds.

### Previous Decimal Experience

This variable had no significant correlations with the Decimal measures (Table 8, Chapter 13) but it was a significant predictor of the combined I + IV Decimal scores in Decimal Week and Retest Week I (Table 10, Chapter 13). Therefore previous experience with foreign Decimal currencies did help in the beginning with the evaluation and recognition of the new coinage.

### The Maths Tests

In the Total Returner Group both the £ s d and £ p tests were positively significantly correlated with the IV Coin Recognition test on both testing occasions. (Table 8, Chapter 13). This may have been because a general mathematical ability was more important in this test which required the division and multiplication of values, rather than their simple addition and subtraction. While both Maths tests also had significant positive relationships (i.e. high maths scores went with high Decimal scores) with the combined I + IV Decimal tests on both testing occasions, the £ s d test had no other significant relationships with the Decimal tests. The £ p test, though was significantly related to II Conversion in Decimal Week, and to all the Decimal tests in the Retest Weeks. These results were repeated to some extent in the Stepwise Regression Analysis (Table 10, Chapter 13) where the £ p test predicted the IV Coin Recognition scores and the combined I + IV Decimal scores in the Retest Week II, and £ s d predicted the combined I + IV Decimal scores in Retest Week I.

### Occupation

This information was asked for on the front cover of the test booklets, but unfortunately no use could be made of it because the brief answers of the subjects made any meaningful classification impossible. Therefore nothing can be said about the rate at which different occupational classes adapted to Decimal Currency.

### The Relationships between the Decimal Currency measures

In the Total Returner Group all four Decimal tests were positively and significantly related to each other on both testing occasions and the correlations between the two occasions testing scores were also significant or nearly so. These results were to be expected since all four tests were measuring usage of the same currency.

Among the Gain scores a consistent pattern emerged in that for each of the four Decimal tests its first occasion test score was significantly but negatively related to its own Gain score; while its second testing score was significantly but positively related to its own Gain score. (Table 11, Chapter 13). This means that subjects scoring high on the Decimal tests in Decimal Week made small Gains thereafter and ended up with lower than average retest scores; while subjects scoring low in Decimal Week made large Gains thereafter and ended up with higher than average retest scores.

The reason for this may be that the more able subjects did not prepare in advance for Decimalisation, feeling that they could cope when it happened. As a result they were not very proficient at first but made good progress later on. Less-able people might have made more effort to master the new currency before February 1971, and therefore were comparatively better on the Decimal tests in Decimal Week, but did not make much progress afterwards.

#### Principal Component Analysis

The analysis for the Total Returner Group summarised the main observations discussed above. (Table 14, Chapter 15).

The first factor had its highest loading on the retest scores of I New Currency. This test proved to be the most important measure of people's adaptation to the new currency. The second loading was for the Progressive Matrices, which proved to be the most important ability correlate of Decimal adaptation. The next two variables were Paranoia and the Gough-Sanford Scale, both of which loaded in the opposite direction to the first two variables.

This suggests that the most important factors inhibiting adaptation were firstly fear, and secondly resistance to change. The more Paranoid subjects viewed the new currency as a threat, because if they could not cope with it then they would suffer in everyday commercial activities; and the more habit-bound subjects rejected the new currency because it meant learning a whole new set of rules and developing new thinking habits.

The rest of this first factor consisted of loadings on IV Coin Recognition, and, loading in the opposite direction, the Authoritarianism score. The Flexibility tests had lower loadings, in the same direction as the Decimal tests. This first factor supports Hypotheses 2 and 3, in that all three rigidity scales loaded against the new currency measures and all three abstract thinking tests loaded with the new currency measures. The other factors were mostly composed of the Decimal tests separated out into their own factors. The most important perhaps being Factor 2 in which the Gain score and retest score of IV Coin Recognition load in the opposite direction to both first test IV Coin Recognition score and a linear retest trend. This means that gains on this test were largest after one week and for some reason became smaller with each succeeding week.

It is important that Age did not load highly on any factor, and this emphasizes again the lack of evidence for Hypothesis 1.

To conclude this chapter, it seems that the ability to adapt to Decimal Currency was related primarily to logical abstract ability, or what is colloquially termed 'intelligence'. The degree to which people feel themselves and their way of life threatened were important inhibiting factors, but authoritarian attitudes were much less important. Divergent thinking and perceptual flexibility were also related, but in a more specialised manner, to the Decimal Measures.



Age, as such was not really a related variable; the capabilities of each individual being more important determinants of his power to adapt, than his chronological age.

Chapter 20 Age and the Personality and Ability Variables

In this study the three age decades from 20 to 50 years were each represented by more than 20 subjects in the Total Returner Group, but the following older three age decades had only 14 subjects altogether. Therefore the age trends reported in the results, and discussed here concern primarily young and middle-aged adults.

Hypothesis 4

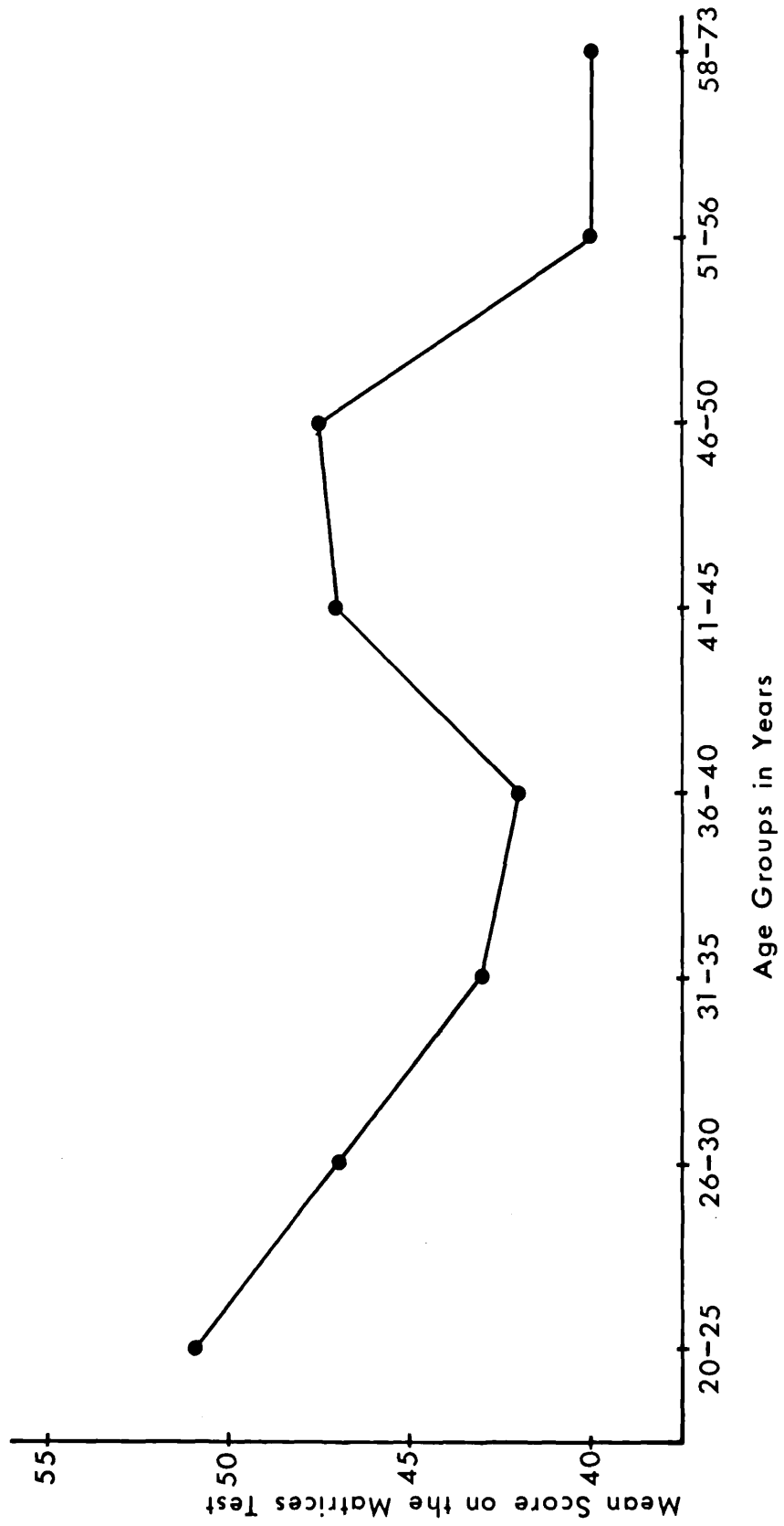
Older age groups will show lower mean scores on the tests of abstract ability than will younger age groups. The means for age groups on divergent ability will decline at a slower rate because its ability is measured by a verbal test, and verbal ability holds up with age.

In the Total Returner Group the correlation coefficient between Age and the Matrices test was significant and negative, so that older people had lower scores. (Table 12, Chapter 14). The correlations between Age and the two flexibility tests were, however, not significant; and in the case of Unusual Uses the correlation was positive so that older people did better on this test. These results show only logical reasoning to decline in the hypothesised manner.

Despite the correlation coefficient it can be seen from Graph 12 (Table 12, Appendix IV) that the 40 to 50 year olds of this study were equal in Progressive Matrices ability to subjects in their late 20's. Perhaps this was

GRAPH 12 MEAN SCORES ON THE PROGRESSIVE MATRICES TEST FOR EIGHT AGE GROUPS.

Means computed from all the subjects who completed the Matrices Test.



because it was only people of superior ability who in their late middle-age wished to undertake a course at an Institute of Adult Education. The sharp drop in Matrices test score in the over 50's suggests that they were a more average sample of the population, and it is likely that they attended courses for social contact rather than for intellectual gain.

If the exceptional scores of the 40's are omitted, then the other age groups do show a steady decline in abstract ability with age; the steepest part of the decline occurring in the 20 to 35 year old age groups. It must be noted, though that the mean scores of all the age groups were above the average of the general population, and that this aging curve may apply only to people of this level of intelligence.

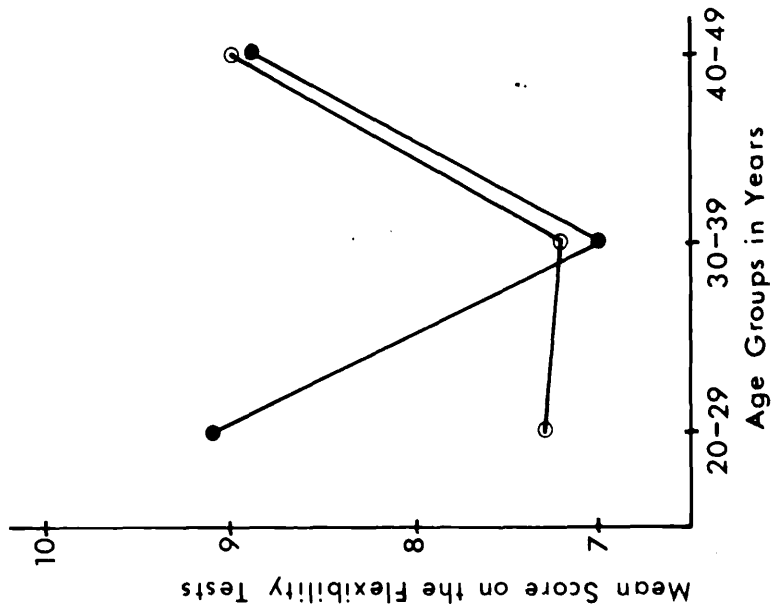
Graph 13(a) (Table 13(a), Appendix IV) gives the mean scores of the two flexibility tests for the three main age decades. On both tests the 30's score an average of approximately 7 points while the 40's score an average of 9 points. Therefore the difference between these two groups does <sup>not</sup> support Hypothesis 4. The 20's however have similar scores to the 30's on Unusual Uses, but scores similar to the 40's on Hidden Faces.

The reason for this may be that after 30 years of age abilities are more related to a general intelligence level as measured by the Progressive Matrices test. The means of the 30's and 40's on the Flexibility tests would then

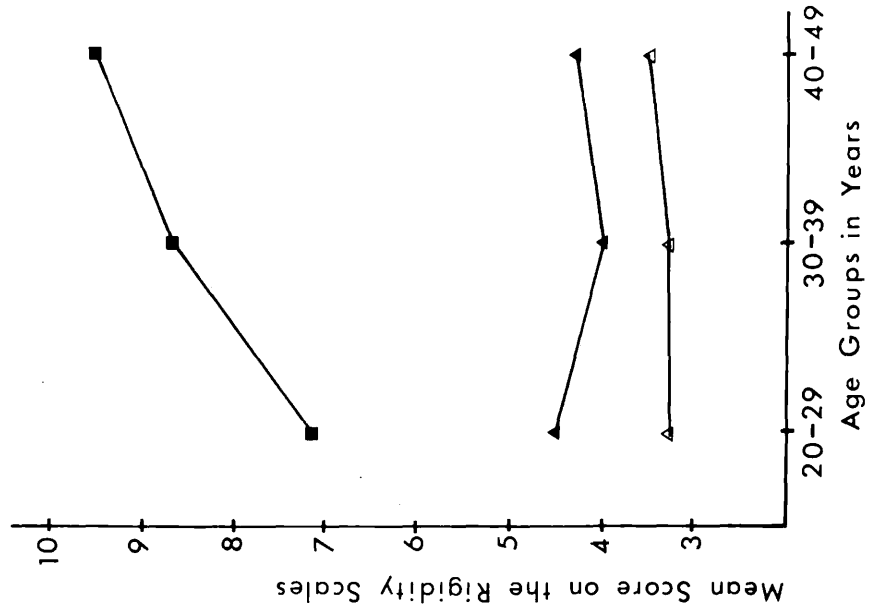
GRAPH 13 MEAN SCORES ON THE TWO FLEXIBILITY TESTS, AND THE THREE RIGIDITY SCALES: FOR THREE AGE GROUPS.

A)The Flexibility Tests

- Key ○—○ Unusual Uses  
 ●—● Hidden Faces  
 ■—■ Gough-Sanford  
 ▲—▲ Authoritarianism  
 △—△ Paranoia



B)The Rigidity Scales



be a reflection of this general level and not of chronological age. The difference in the two Flexibility scores of the 20's would perhaps be due to a greater independence of abilities. The Hidden Faces test, being a perceptual measure, would benefit from the physical youth of the nervous system of the 20 year olds; whereas the Unusual Uses test, being a cognitive measure, would be related more to logical ability and since the 20 year olds had Matrices test scores little higher than those of the 40 year olds they were at a comparatively lower percentile ability level for their age.

Whether this explanation is valid or not the means of the two Flexibility tests give no support to Hypothesis 4, while the means for the Progressive Matrices test give qualified support.

#### Hypothesis 5

Older age groups will show higher rigidity scores than younger age groups, but the age trends will be different for the three measures. Behavioural rigidity will increase most, while Authoritarianism and Paranoia will increase only if abstract ability declines.

The correlation coefficients between Age and both the Gough-Sanford Scale and Authoritarianism are significant and positive in the Total Returner Group (Table 12, Chapter 14). This means that older people did have higher rigidity scores, especially on the Gough-Sanford Scale. The correlation between Age and Paranoia was also positive but not significant.

The mean scores of the Rigidity Scales for the three main age decades are shown in Graph 13(b) (Table 13(b), Appendix IV). These means show that neither Authoritarianism nor Paranoia are measurably different in subjects aged 20 to 49 years; while the means on the Gough-Sanford Scale do increase in a linear fashion over this period. This distinction supports Hypothesis 5, because behavioural rigidity does increase most with age; and the two measures of dogmatic thinking do not increase until after 50 years of age when the scores of abstract logic decline. It is important to make the distinction between the Authoritarian attitudes which result from dogmatic thinking and which increase significantly with Age; and the Paranoid insecurity which perpetuates dogmatic thinking.

Since the insecurity does not increase significantly with age it could be that dogmatism has different causes in young and old. In young people it could be the result of a real attitude - rigidity caused by a fear of the world and of other people, whereas in older people it would result more from a cerebral inability to cope so effectively with situations, and thus a reliance on more uncompromising attitudes.

#### Hypothesis 6

The three measures of abstract ability (Matrices, Unusual Uses and Hidden Faces) will each be negatively related to the three Rigidity measures, (the Gough-Sanford Scale, Authoritarianism and Paranoia); but the correlation between Dogmatism and the two tests of convergent and

divergent thinking will be greater than that between the Gough-Sanford Scale and these thinking tests; while the correlation between perceptual flexibility (Hidden Faces) and the Gough-Sanford Scale will be greater than that between perceptual flexibility and Dogmatism.

In the Total Returner Group the Matrices test was significantly and negatively correlated to all three rigidity measures (Table 12, Chapter 14), while the two Flexibility tests were both negatively correlated to the three rigidity measures but not all significantly so. (i.e. high abstract ability scores went with low rigidity scores). The measure of divergent thinking (Unusual Uses) was significantly related to both the dogmatism measures (Authoritarianism and Paranoia) but not to the Gough-Sanford Scale, and this difference is in the Hypothesised direction.

However, for the measure of convergent thinking (the Matrices test) the coefficient with the Gough-Sanford Scale was larger than with either of the two Dogmatism Scales (Authoritarianism and Paranoia) and therefore this difference is opposed to the hypothesis.

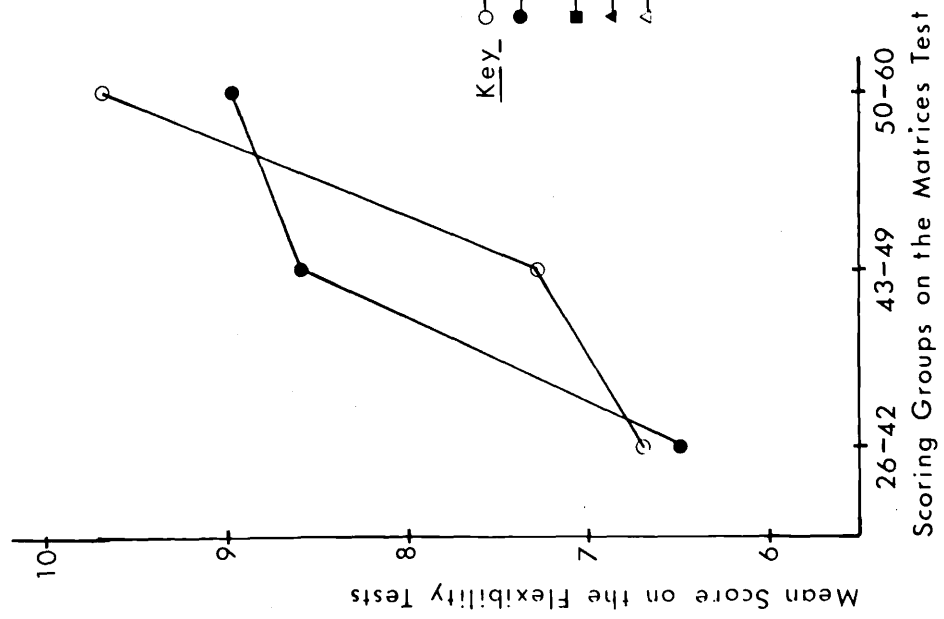
The Hidden Faces test was significantly and negatively related to the Gough-Sanford Scale but not significantly to either of the Dogmatism Scales, thus giving strong support to the Hypothesis.

Graph 14(b) (Table 14(b), Appendix IV) shows the mean rigidity scores for three scoring groups on the Matrices test. All three rigidity scales show linear declines in mean score

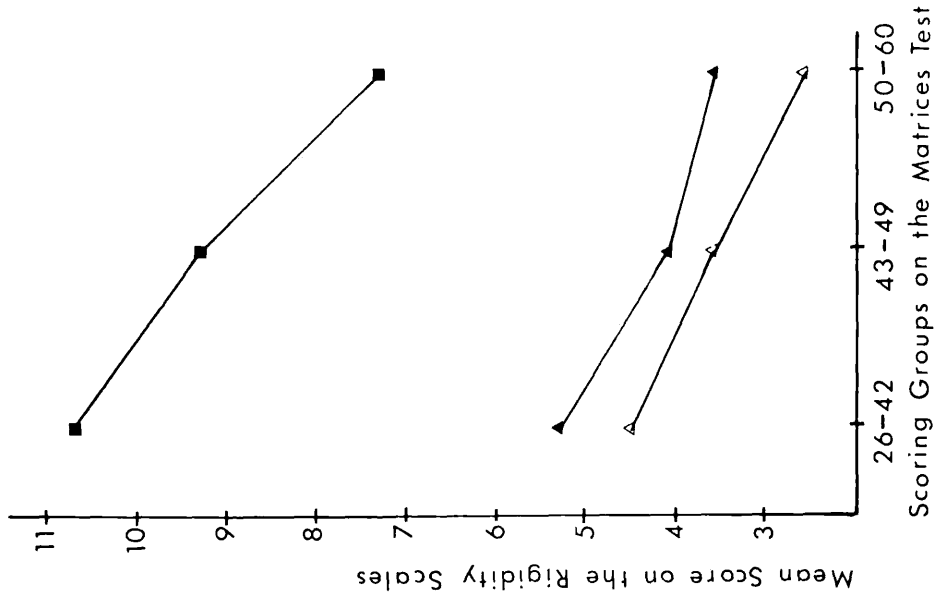


GRAPH 14 MEAN SCORES ON THE TWO FLEXIBILITY TESTS, AND THE THREE RIGIDITY SCALES: FOR THREE SCORING GROUPS ON THE MATRICES TEST.

A) The Flexibility Tests



B) The Rigidity Scales



as the mean Matrices score goes up, with the Gough-Sanford decline being the most steep. Graph 16(a) (Table 16(a), Appendix IV) gives the mean rigidity scores for five scoring groups of the Unusual Uses test. All three rigidity measures show slow irregular declines as divergent thinking improves, with perhaps the sharpest drop in rigidity scores being between people who scored 4 or less and those who scored 5 or more Unusual Uses.

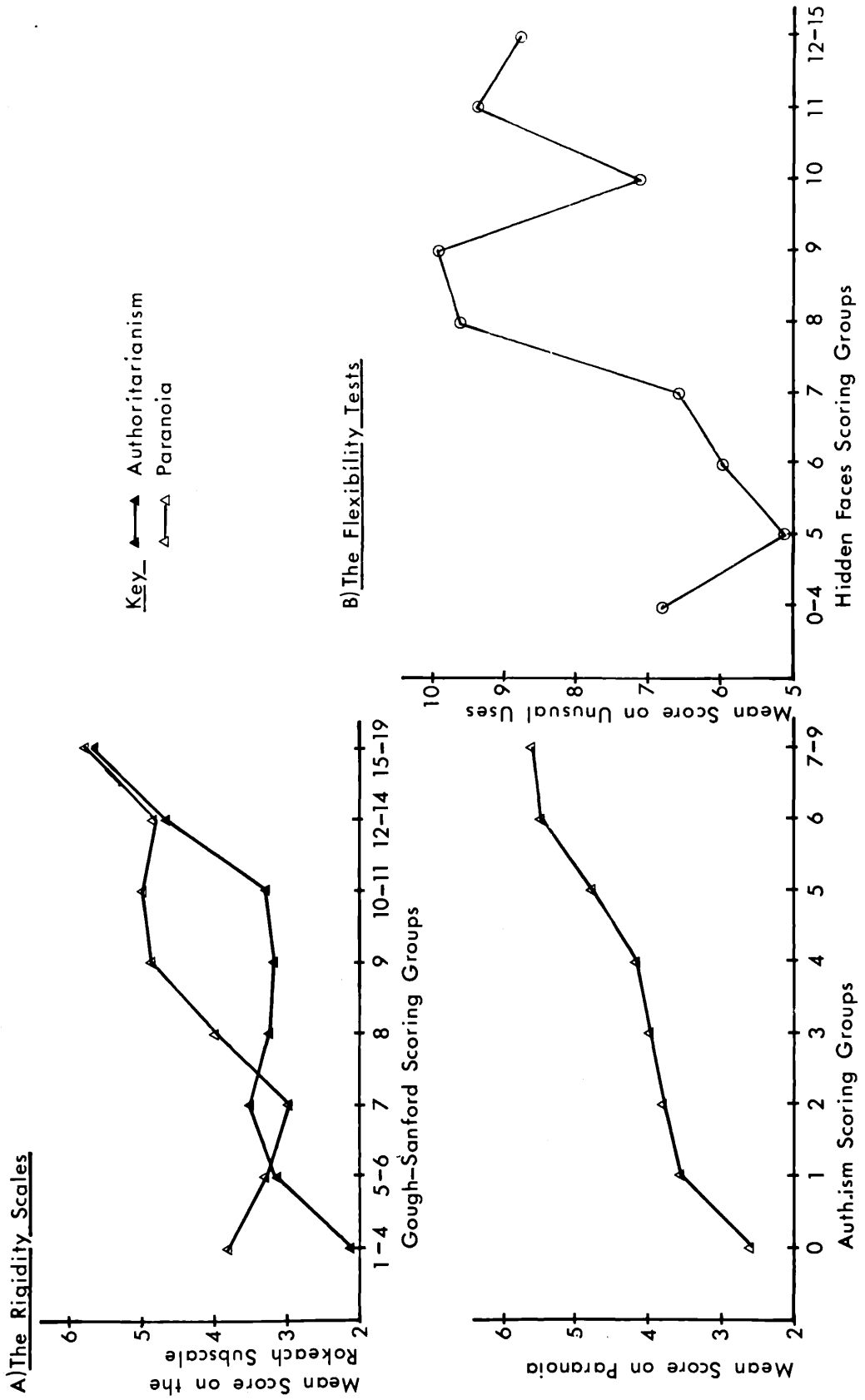
Similar rigidity means are shown for 5 scoring groups of the Hidden Faces test in Graph 16(b) (Table 16(b), Appendix IV). These means show a sharp decline in behavioural rigidity (the Gough-Sanford Scale) as perceptual flexibility increases (Hidden Faces), but almost negligible changes on dogmatic thinking (Authoritarianism and Paranoia).

Therefore in support of Hypothesis 6 the perceptual flexibility measure (Hidden Faces) was most negatively correlated with behavioural rigidity (Gough-Sanford), and divergent thinking (Unusual Uses) was most negatively correlated with dogmatic thinking (Authoritarianism and Paranoia). The Matrices test though was strongly, negatively, *(and higher than expected to the Gough-Sanford)* correlated to all three rigidity measures, showing how rigidity of beliefs and habit is inconsistent with the logical abstract manipulation of new information.

### Hypothesis 7

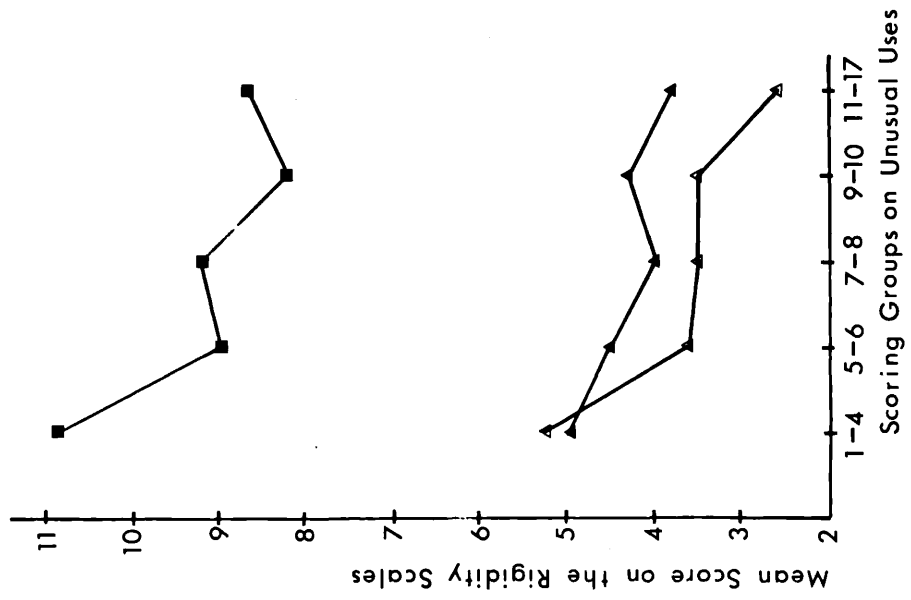
The three abstract ability measures will correlate positively and significantly among themselves but very high scorers on the Matrices test will score relatively low on the Unusual Uses test, and conversely high scorers

GRAPH 15 MEAN SCORE RELATIONSHIPS WITHIN THE THREE RIGIDITY SCALES; AND BETWEEN THE TWO FLEXIBILITY TESTS.

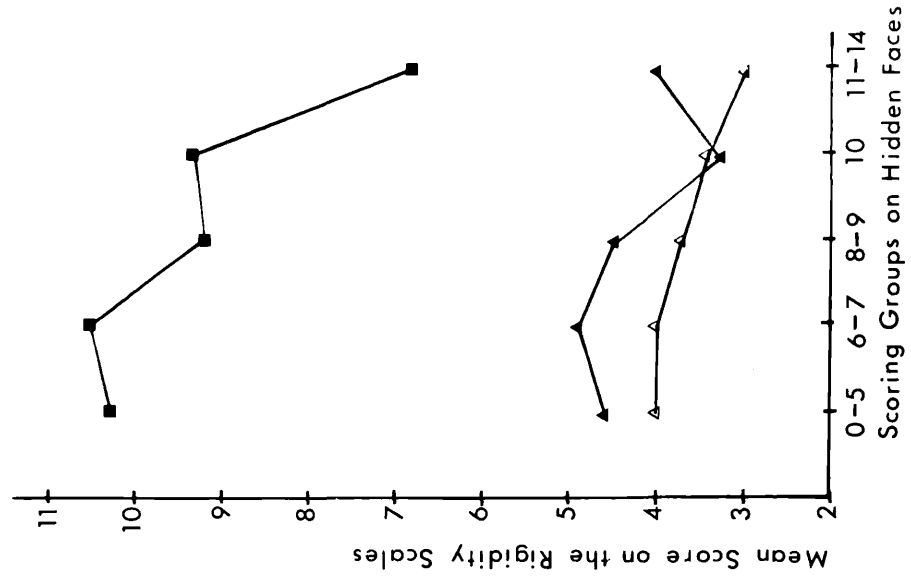


GRAPH 16 MEAN SCORE ON THE THREE RIGIDITY SCALES, FOR FIVE SCORING GROUPS OF EACH OF THE TWO FLEXIBILITY TESTS.

A) Unusual Uses



B) Hidden Faces



Key ■ Gough-Sanford  
▲ Authoritarianism  
△ Paranoia

on Unusual Uses will score relatively low on the Matrices test. Women will be more perceptually field dependent than men, (i.e. have lower mean scores on the Hidden Faces test).

In the Total Returner Group the Matrices test is significantly and positively correlated to both of the Flexibility tests, and the two Flexibility tests are similarly related to each other, so that high scores on one test went with high scores on another, (Table 12, Chapter 14). Graph 14(a) (Table 14(a), Appendix IV) shows the mean scores on the two Flexibility tests for three scoring groups of the Matrices test. Both Flexibility tests show strong increases as Matrices ability increases. For the Hidden Faces test the largest mean difference is between people scoring 42 or less and 43 or more Matrices points, whereas for the Unusual Uses test the largest mean difference is for people scoring 49 or less and 50 or more Matrices points.

Presumably the Hidden Faces test, being more perceptual benefits less from very high levels of logical ability, while on divergent thinking the extra logical ability seems to release many more avenues of thought. There is no evidence here that very high Matrices scores depress the Unusual Uses score.

Graph 15(b) (Table 15(b), Appendix IV) gives the mean Unusual Uses score for 9 scoring groups of the Hidden Faces test. Although the scores on both tests tend to increase together the correlation is far from linear.

Subjects in their 20's who scored below average on the Unusual Uses test had higher mean Matrices scores than subjects scoring above average on Unusual Uses. (In the 30's and 40's this situation was changed, and subjects scoring higher on Unusual Uses scored higher on Matrices as well.) This provides some support for the Hypothesis, since extreme convergers were relatively poor divergers, (Table 13, Chapter 14); but the difference in mean Matrices score was not statistically significant, (Appendix V).

In support of Hypothesis 7 the three abstract ability measures were all positively correlated but there was no significant evidence that very high scores inhibited other scores. Also the two Flexibility tests were each more related to Matrices ability than they were to each other. Thus the two types of flexibility seem more a reflection of general intelligence than of a general Flexibility factor. Also the correlations between Sex and Hidden Faces were very small showing that there was no sex difference on field dependence, (Table 12, Chapter 14, and Table 22, Chapter 16).

#### Hypothesis 8

The three rigidity measures will correlate positively and significantly among themselves, but subjects scoring very high on Authoritarianism will score relatively low on Paranoia because they are the least able to admit to personal weakness.

In the Total Returner Group the three rigidity measures are all correlated positively and significantly, i.e. high scores on one scale went with high scores on another (Table 12, Chapter 14). Graph 15(a) (Table 15(a), Appendix IV) shows the mean scores of the rigidity scales for scoring groups on the other rigidity scales. From these means it can be seen that the Authoritarianism scale is more consistently related to the Gough-Sanford Scale than is Paranoia. The area of closest correlation is among extremely high rigidity scorers who score very high on all three scales.

It is interesting that as the Gough-Sanford score increases from low to above-average, the Paranoia mean climbs steadily as well, while the Authoritarianism score remains unchanged. Thus the actual agreement with Authoritarian views does not alter until both behavioural rigidity and paranoid insecurity are quite high.

The mean scores of Paranoia for Authoritarianism scoring groups show a steady upward trend as Authoritarianism increases. The high Authoritarianism scorers had the highest Paranoia mean score and therefore gave no support to the second part of Hypothesis 8.

The first clause of Hypothesis 8 was supported by the correlation coefficients between the three rigidity scales.

Chapter 21      The Non-Returner Group

The only variable on which the Non-Returners differed significantly from the Total Returner Group was Age; the Non-Returners being on average six and a half years older than the Total Returner Group. However the most important variable has been shown to be the Progressive Matrices score, and since the Non-Returners did not complete Test Battery II, nothing can be said about their intellectual comparability.

Among the Non-Returners it was women who tended to be older, the correlation coefficient between Age and Sex being significant, (Table 25, Chapter 17). Age was also significantly correlated to the Gough-Sanford Scale, with older subjects scoring higher, but not to the two Dogmatism Scales (Authoritarianism and Paranoia). The correlations between Age and the Decimal tests I, II and III were all significant and negative, so that the greater age of the Non-Returners revealed an age decrement in <sup>coping</sup> ~~adaptability~~ during Decimal Week that the comparative youth of the Total Returner Group did not. As in the Total Returner Group the Decimal test most strongly related to Age was II Conversion, and therefore, as hypothesised, older people found the more complex task more difficult.

Bearing in mind that the Non-Returner women were generally older than the men, the correlations being Sex and both Unusual Uses and Authoritarianism were significant. The correlation valencies were such that the women subjects scored lower on Unusual Uses and higher on Authoritarianism than the men. There were also significant correlations between Sex



and II Conversion and IV Coin Recognition, such that men again scored higher on these tests, The higher scores of men on II Conversion had been apparent in the Total Returner Group as well.

Also like the Total Returner Group the Non-Returners had significant correlations between both of the Flexibility tests and IV Coin Recognition; the more flexible subjects scoring higher on this test. In the Non-Returners the Rigidity Scales were much more strongly related to the Decimal tests of Decimal Week than they were in the Total Returner Group. For in the Non-Returners Authoritarianism was significantly and negatively related to all four Decimal Tests, and the Gough-Sanford Scale was significantly and negatively related to all but II Conversion. As in the Total Returner Group Paranoia had only negligible correlations with the Decimal tests, but unlike the Total Returner Group Paranoia was also non-significantly related to the two other rigidity measures.

In the Non-Returners it seems that the older female subjects were more authoritarian, less flexible and less ~~adaptable to~~ <sup>able to cope with</sup> Decimal Currency than the younger male subjects. The older subjects, regardless of sex, were also higher on behavioural rigidity as measured by the Gough-Sanford and less adaptable. The lack of support found for Hypothesis 1 in this study seems largely due to the majority of younger adults in the total sample. The age changes discussed in Section A were shown in experimental work using comparison groups differing often by 40 or 50 mean years of age, and

the findings of this study also suggest that no widespread decrease in adaptability is apparent until people have reached their 60's, in samples of above-average ability.

The distinction found between behavioural rigidity and authoritarian attitudes on the one hand and paranoid insecurity on the other, re-emphasises an explanation offered earlier that rigidity may have different causes. Indeed in this Non-Returner sample their greater age has shown that older people can be more habit-bound and more dogmatic without showing any increase in underlying insecurity.

This suggests that older people who are rigid in behaviour and beliefs are so because of a decreased intellectual ability to appraise information, and not because of personality factors such as anxiety and fear of other people.

Chapter 22

Concluding Summary

Of the three hypothesised sources of rigidity; from the natural aging process, from abstract reasoning and from attitudes, the most effective single variable was logical reasoning ability as measured by the Progressive Matrices test. This ability did decline with age in the predicted direction but in this sample the 40's decade were as able as the 20's decade, with the 30's being a much more average-ability group in between, and since the majority of subjects were aged between 20 and 49 years this quadratic ability trend precluded some of the hypothesised aging trends.

The adaptation to Decimal Currency was measured by the difference between the first and second testing scores on the four Decimal tests, but this also did not work out as predicted. Firstly, there was no difference between the Gains made after each of the three retest weeks but on the I New Currency and IV Coin Recognition tests the second testing scores were significantly greater than the Decimal Week scores and therefore adaptation must have occurred primarily in Decimal Week.

Secondly the Gain scores themselves were smaller if the original Decimal Week scores were great, yet people with larger Gain scores finished up with higher retest scores. This must mean that subjects did not all begin at the same level of Decimal proficiency and thus it was not really statistically possible to compare their raw gain scores. Thirdly for the IV Coin Recognition test

there was a significant linear decrease in Gain score with each succeeding retest week, perhaps because motivation decreased as the new currency became old news.

Despite these two important sampling factors there was some statistical evidence for the hypotheses. Age itself was effective during the first two weeks after Decimalisation and older people had greater difficulty converting between the two currencies. From the abstract reasoning measures the Matrices test was the most important predictor of Decimal scores, but even this test was not widely related to actual gain scores. Perhaps the Matrices score was related to test-taking attitude, with the more-able subjects making more use of the test layout and time limits.

Of the two flexibility tests the Unusual Uses was related to ability to convert and both tests (Hidden Faces as well) were related to the two tests of new currency alone. In the rigidity scales the relationships were again primarily with the two tests (I and IV) of new currency alone, but Paranoia was also predictive of some III Dual Currency scores.

During the first fortnight of Decimalisation previous Decimal experience did help in adapting to the new coins and their values, and men found it easier to convert between the two currencies than did women.

The adaptation to Decimal Currency was most effectively measured in this study by the I New Currency and IV Coin Recognition tests, and adaptation was most rapid in subjects

of high logical ability and low Paranoia and Gough-Sanford rigidity scores.

For the Rigidity-Flexibility dimension the most important general findings were that for the flexibility tests both Unusual Uses and Hidden Faces were more related to Matrices ability than they were to each other, and only the Matrices ability declined with age. In the rigidity measures the Gough-Sanford Scale and Authoritarianism were more related to each other than was either related to Paranoia. The Gough-Sanford type of behavioural rigidity showed increases from 30 years on but Authoritarianism did not increase appreciably till the late 50's and 60's. Paranoia was not age related.

Between the two sets of measures high Matrices scores correlated with low scores on all three rigidity scales, but the Unusual Uses test was related only to Dogmatism, and the Hidden Faces was related only to the Gough-Sanford Scale. Thus there was evidence for a distinction between perceptual and cognitive rigidity factors, or as Rokeach (1960) termed them 'analytic' and 'integrative' rigidity.

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Appendix I

Pilot Studies

The tests used in this study were tried out on volunteer subjects, known personally to the examiner, to work out the best time limits for each test, and to find out any handicaps in the administration procedure.

Spontaneous Flexibility

The Unusual Uses test was thought to be the best measure of this, but another test was also tried. This test was to find all the objects possible in a certain class, and had been used by Chown 1961. The instructions were written at the top of the test sheet and were:-

"Write down as many words as you can think of beginning with the letter "M"."

The time given was one minute.

The Unusual Uses test also had instructions at the top of the sheet and these were:-

"Write down as many uses as you can think of for a PAIR OF SCISSORS."

This was tried with a 5 and 10 minute limit.

On the pilot sample of 10 people aged from 14 to 65 years it was found that, with two exceptions, high scores on one test went with high scores on the other, and low scores on one with low scores on the other. The mean score for the 'm' words test was 10.7 words, and the mean score on the Unusual Uses for scissors test was 8.2 uses with a 5 minute time limit.

Using a 10 minute time limit on a small student sample the mean Unusual Uses score was 18.7, so considering their higher average intelligence the effect of doubling the time limit was to double the number of uses given. Since the test battery would require the maximum theoretical coverage in the minimum time, it was decided to use only the Unusual Uses test with a 5 minute limit. It was hoped that this test would measure divergent thinking rather than divergent associations.

#### Mathematical ability

The test for this was also taken from Chown 1961. The test was headed 'SIGNS' and the instructions following were: "Do as many of the following as quickly as you can." There followed two columns of 25 calculations, for example:-

$$3 + 2 - 5 =$$

$$(6 + 2) \times 2 =$$

From this test, with a time limit of 2 minutes, a student sample of 14 subjects aged 14 to 25 years scored a mean of 31 correct, while a sample of 6 subjects aged 29 to 65 years scored a mean of 9 correct. The main reason for the difference was that the students knew the meaning of the signs and brackets automatically, while the over 30's did not know or had forgotten the signs. The signs and brackets were explained to the older subjects before they began, but this meant that they had to learn the signs as well as use them, which made the task far more difficult. This test was therefore abandoned.



A second set of mathematical tests was devised. Since older people use maths mainly in monetary matters it was decided to put these tests in currency form. In this way ability to compute both £ s d and Decimal Currency could be assessed at the same time. The first test sheet had 36 items in batches of 9, the first batch being addition, and the next subtraction sums. The second two batches were also addition followed by subtraction, but few subjects got as far as that in the time allowed. The items were set out thus:-

" <u>add</u> in these	£	s	d	£	s	d	
examples"	20	17	4	45	4	7	etc.
	<u>22</u>	<u>15</u>	<u>7</u>	<u>61</u>	<u>0</u>	<u>9</u>	
	<hr/>			<hr/>			

It was hoped that as the figures to compute were put under each other in the conventional manner of shopping lists etc, and the method of computation was stated beside them, then older people would be at less disadvantage. Having the items in batches of 9 requiring the same type of calculation meant that most subjects only had to change set once, a factor shown to be important in aging.

The numbers used in these sums were taken from random figure tables, working straight through the figure columns but using only those figures which came within the confines of shillings and pence. The second test sheet was laid out similarly to the first, but the amounts had been converted to decimal currency correct to the nearest new halfpenny. The £ p signs and decimal point were omitted though, so that no connection with the new currency would be apparent.

The examples looked as follows:-

2 0 8 7	4 5 2 3
<u>2 2 7 8</u>	<u>6 1 0 4</u>
_____	_____

The instructions written at the top of both sheets were:-

"Do as many of the following sums as you can.

Please work as quickly as you can."

It was hoped that if the Decimal tests were administered twice, then on the second presentation of the £ p test, the decimal point could be put in. Then any change in ability produced by the implicit relationship of the sums to the new currency could be measured, by relating the gain on this test to the gain on the repeat test of the £ s d items.

The time limit for each test sheet was one minute. This allowed everyone to do at least one sum, but prevented the mathematically more able from reaching the end of the sheet.

#### Pilot sample A

This sample consisted of young women aged 18 to 29 years, most of whom had had a college education. They were given the Wesley Rigidity Inventory untimed, and the Hidden Faces test, using the full booklet with  $2\frac{1}{2}$  minutes for each test picture. The mean score on the Hidden Faces test was 18 correct faces. On scoring the Wesley Rigidity Inventory the items were divided into the 3 factors found by Chown 1960, and into the Gough-Sanford as used by Rokeach 1960 (except for the item:-

'I never miss going to church', which was considered inappropriate for testing the general public, and was also the only item pertaining to religion in the test. The lack of religious or political inferences in the Wesley was taken to be one of its virtues.)

The mean scores of this group on the Wesley Rigidity Inventory were as follows:-

Chown factor (1) methodicality	= 5.8 (from 10 items in inventory)
(2) dogmatism	= 4.5 (from 11 items in inventory)
(3) liking for habit	= 1.7 (from 6 items in inventory)
Gough-Sanford Scale of Rigidity	= 8.8 (from 21 items in inventory)

Since Chown 1960 found a high intelligence loading on factor (2) and a high age loading on factor (3) the low mean scores for this sample are to be expected. An average score on the Gough-Sanford would appear to be approximately 9.

The subject sample was divided into half according to their scores on the Wesley factor (2). The mean score on the Hidden Faces test for the two half samples were:-

High scorers on Wesley (2)	= 17.4 faces	difference between means = 1.2
Low scorers on Wesley (2)	= 18.6 faces	

A similar division using the Gough-Sanford Scale gave:-

High scorers on Gough-Sanford	= 16 faces	difference between means = 4.0
Low scorers on Gough-Sanford	= 20 faces	

These results indicate that the Gough-Sanford is likely to correlate higher with the Hidden Faces test than Wesley factor (2). This would support Rokeach's theory that rigidity affects the analysis of perceptual while dogmatism affects integration.

Pilot sample B

This sample was taken from a college hall of residence. It consisted of 12 female students aged 18 to 22 years. They were given the Wesley Rigidity Inventory untimed; the Cattell Anxiety Scale untimed, and the Unusual Uses for Scissors test with a 5 minute time limit. This time the word 'unusual' was included in the instructions.

The resulting mean scores were:-

Wesley factor (1) = 5.6

(2) = 5.4

(3) = 2.5

Gough-Sanford Scale = 9.0

Cattell Anxiety Scale = 39.2

Unusual Uses test = 9.8

Factors (2) and (3) were higher in this group than the previous one. The sample was again divided in half according to their Wesley factor (2) scores. The means on the other tests were then:-

High scorers on Wesley (2) = 35 on Cattell Anxiety Scale

Low scorers on Wesley (2) = 43.5 on Cattell Anxiety Scale

High scorers on Wesley (2) = 8.2 on Unusual Uses

Low scorers on Wesley (2) = 11.3 on Unusual Uses

This indicates that the more dogmatic subjects were less able to think divergently and admitted to fewer anxiety feelings. When the sample was divided into high and low anxiety groups the mean scores on Unusual Uses were:-  
High anxiety scorers = 10.2 Uses  
Low anxiety scorers = 9.3 Uses

Thus the indication that the more divergent thinkers were more introspective was reduced by this type of division.

Pilot sample C

This was a group of 20 candidates for admission to the College Psychology department, aged from 18 to 35 years. They were given the Wesley Rigidity Inventory and the adapted version of the Rokeach Dogmatism Scale, both untimed. The mean scores for the sample were:-

Wesley factor (1)	=	4.5
(2)	=	5.3
(3)	=	1.8
Gough-Sanford Scale	=	8.4
Rokeach - authoritarianism	=	3.5
paranoia	=	4.3

A division was made of the sample according to their Gough-Sanford scores. And these were then related to their mean Rokeach scores:-

High scorers on Gough-Sanford	=	3.9	on	authoritarianism	subscale
Low scorers on Gough-Sanford	=	3.1	on	authoritarianism	subscale
High scorers on Gough-Sanford	=	5.1	on	paranoia	subscale
Low scorers on Gough-Sanford	=	3.5	on	paranoia	subscale

These figures show that the Gough-Sanford scale has a more definite relationship with the paranoia factor than the authoritarianism factor. In Pilot sample B it was the high scorers on Wesley (2) that scored lower on Cattell Anxiety. If this was because they were more defensive, then perhaps the difference on paranoia in sample C is due to the subtlety of the paranoia questions making the subject feel he is not giving anything away by answering 'TRUE'. To check this a similar division was made using scores on Wesley factor (2), the means were:-

High scorers on Wesley factor (2) = 4.8 on authoritarianism  
subscale

Low scorers on Wesley factor (2) = 2.3 on authoritarianism  
subscale

High scorers on Wesley factor (2) = 5.2 on paranoia subscale

Low scorers on Wesley factor (2) = 3.4 on paranoia subscale

In this case the difference between the authoritarianism means is even more extreme than the difference between the paranoia means. Comparing the two sets of means, it can be seen that while the Wesley factor (2) discriminates to some extent among scores on the whole Rokeach dogmatism scale, the Gough-Sanford does so only with the Paranoia scale. This supports Chown's interpretation of factor (2) as dogmatic thinking, and it supports Rokeach's distinction that rigidity and dogmatism are different variables.

The Wesley Rigidity Inventory has 39 items, of these:-

Chown's (1960) factor (1) is made up of items numbered:-

1,3,15,19,20,22,32,36,37 and 38

factor (2) is made up of items numbered:-

2,4,5,6,8,13,16,23,28,29 and 34

factor (3) is made up of items numbered:-

7, 9, 17, 18, 31 and 39

The Gough-Sanford Scale is made up of items numbered:-

1,2,3,4,6,8,9,11,12,14,16,19,21,

26,27,28,32,35 and 39

Therefore the Gough-Sanford contains 5 items of Chown's (1960) factor (1), 6 items of factor (2), 2 items of factor (3).

From all three pilot studies it can be seen that the mean score tends to be less than half the total items in each scale. Since all three samples have been young and of above-average intelligence it would be expected that their rigidity scores would be low, but the range within the scale is sufficiently great for discriminations to be made.

#### Hidden Faces test

From the pilot study work 3 pictures were chosen as being most satisfactory for quality of reproduction and from quantity of subjects' responses. A fourth picture was used as an Instruction Picture with 5 Hidden Faces in it ringed in heavy line.

Appendix II

First Attempt at a Subject Sample

The original plan was to recruit one subject sample from people who were attending courses on Decimal Currency at Institutes of Adult Education, and then compare their rate of improvement after the Decimal changeover with that of a sample of the general population who had not had this extra coaching.

From October 1969 contact was made by letter (Appendix VI) with the lecturers in charge of the Decimal Currency courses in two Institutes of Adult Education in North London. The author also enrolled in one course herself so that she could experience first-hand the topics covered in a Decimal Currency Course. With the co-operation of the principal and vice-principal of the Institutes, letters were circulated in April 1970 to these people who had attended these courses. This letter explained the purpose of the research and what it involved, and asked for volunteers. A similar letter, slightly adapted, was handed out by the author to the class in which she was enrolled.

From one institute, out of 30 letters which were sent out to past pupils only 7 received answers, and of these only 3 people turned up for testing on the arranged day in June 1970.

Of the other institute, most of the class members agreed to take part when asked in a group, but only 7 turned up for testing at the arranged time. Of the class that the author



attended 7 people were tested, some at their place of work, and others in their homes.

The testing procedure consisted of telling subjects the aim of the research, and explaining how important it was to obey the instructions about timing, that is not to start writing until told to, and to stop writing when told. They were also encouraged to do their best and not to worry if they could not manage any of the tasks. They were asked to put their initials on each test to avoid confusion.

The Wesley Rigidity Inventory was given first untimed. This was followed by the two maths test; the £ s d first and the decimal sums next, with a minute for each test. Next was the 4 picture version of the Hidden Faces test with  $2\frac{1}{2}$  minutes for each picture. Then followed the untimed Rokeach questionnaire. The Unusual Uses test was next with a 5 minute limit, followed by the Cattell Anxiety Scale. On this scale the subjects were asked to fill in their initials, sex, age and previous experience with decimal currency. This experience included the number of lectures on Decimal Currency that they had attended, and any holidays abroad or time spent living abroad. The test session was finished with the Progressive Matrices having a 20 minute time limit.

To summarise, this first testing proved very unsatisfactory. The initial response rate was low, and the length of the test session was arduous for both examiner and subjects alike. Of the 15 subjects tested, one was openly hostile, and four were unavailable to

complete the tests. The percentage of these that would have been likely to return for the Decimal tests in February 1971 would have been very small, so that the whole procedure was regarded as extra pilot work, and a fresh plan for the main experimental work was made in the Autumn of 1970.

The results of this pilot sample are represented by mean scores in Table 31. Briefly, this Table shows that the Progressive Matrices score declines most drastically after 35 years of age, while Unusual Uses and Hidden Faces show curvilinear trends but in opposite directions. The rigidity scales are generally higher than in the student pilot sample of Appendix I, except in the Rokeach scale which has low mean scores in the under 35 year olds. The anxiety scale also has a curvilinear trend, with the middle-aged being most admitting of anxiety feelings. The maths test show that the youngest group are better at decimal calculations than £ s d, but the older groups do not have a clear preference. The sample was too small for statistical tests.

TABLE 31 MEAN SCORES ON THE VARIABLES OF THE TEST  
BATTERY GIVEN TO THE DECIMAL CURRENCY  
COURSE SUBJECT-SAMPLE. MEANS COMPUTED  
FOR THREE AGE GROUPS

	<u>AGE GROUPS IN YEARS</u>		
	20 - 35	40 - 55	58 - 67
Progressive Matrices	43.5	35.0	32.2
Unusual Uses	7.2	6.6	7.5
Hidden Faces	5.7	7.6	5.0
Wesley Factor (1)	7.2	8.4	8.0
(2)	5.7	5.4	7.9
(3)	2.0	2.2	2.8
Gough-Sanford Scale	13.7	14.8	16.2
Rokeach-authoritarianism	2.2	6.8	4.7
-paranoia	2.0	4.4	6.2
Cattell Anxiety	18.0	33.0	27.3
Maths - £ s d	10.2	12.0	11.8
- Decimal	12.5	12.3	11.0

N = 10 to 15

Appendix III

Statistical Tables for the Results given in Section C

Table I Details of the Matched Returner Group

	<u>Matched trios - subjects retested in</u>					
	Week I		Week II		Week III	
	Matrices Score	Age	Matrices Score	Age	Matrices Score	Age
	55	20	56	24	50	23
	44	32	44	31	45	32
	51	43	54	44	50	40
	52	47	54	45	52	50
	51	26	50	28	51	26
	44	28	46	29	45	25
	60	30	56	27	56	27
	52	35	52	31	51	32
	45	38	46	33	42	34
	38	40	42	45	40	35
	40	41	40	43	40	40
	45	42	44	42	48	44
	28	53	30	49	34	52
Mean	47.2	36.5	47.2	36.5	46.5	35.4

Subgroup for each retest week has  $N = 13$

Total Group has  $N = 39$

Tables II to XVII Summary Tables of the One-Way Analyses of Variance referred to in Chapter 11

Table II Reference - page 113

The Variance of Age in the Returner Subgroups of Weeks I and II

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	187.35	1	187.35	1	51	1.34 NS
Within	7108.2	51	139.38			
Total	7295.55	52				

Table III Reference - page 113

The Variance of Sex in the Matched Returner Group and the Combined Returner Subgroups of Weeks II plus III

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	0.41	1	0.41	1	52	1.22 NS
Within	17.40	52	0.335			
Total	17.81	53				

Table IV Reference - page 116

The Variance of Previous Decimal Experience in the Returner Subgroups I and III

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	5.44	1	5.44	1	41	2.19 NS
Within	101.63	41	2.48			
Total	107.07	42				

Table V Reference - page 116

The Variance of Progressive Matrices Score in the Returner Subgroups I and II

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	12.90	1	12.90	1	51	0.127 NS
Within	5170.02	51	101.373			
Total	5182.92	52				

Table VI Reference - page 116

The Variance of the  $\xi$  s d Score in the Returner Subgroups I and III

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	8.14	1	8.14	1	41	1.26 NS
Within	267.93	41	6.49			
Total	276.07	42				

Table VII Reference - page 116

The Variance of the Hidden Faces Score in the three Returner Subgroups

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	24	2	12	2	72	1.105 NS
Within	782	72	10.86			
Total	806	74				

Table VIII Reference - page 114

The Variance of the Hidden Faces Score in the Total Returner and Matched Returner Groups

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	9.7	1	9.7	1	113	0.893 NS
Within	1227.3	113	10.858			
Total	1237	114				

Table IX Reference - page 117

The Variance of the Gough-Sanford Scale Score in the Returner Subgroups I and II

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	18.60	1	18.60	1	51	1.22 NS
Within	776.12	51	15.22			
Total	794.72	52				

Table X Reference - page 117

The Variance of the Authoritarianism Score in the three Returner Subgroups

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	25	2	12.5	2	72	2.066 NS
Within	436	72	6.05			
Total	461	74				

Table XI Reference - page 117

The Variance of the Combined Gough-Sanford and Authoritarianism Scores in the Returner Subgroups I and II

Source	Sum of Squares	df	Mean Squares	$v_1$	$v_2$	F ratio
Between	82	1	82	1	51	2.753 NS
Within	1519.3	51	29.78			
Total	1601.3	52				

Table XII Reference - page 117

The Variance of the I New Currency Scores of Decimal Week in the Returner Subgroups I and III

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	13	1	13.0	1	42	4.87
Within	112	42	2.67			$p < 5\%$
Total	125	43				

Table XIII Reference - page 118

The Variance of the I New Currency Scores of Decimal Week  
in the Returner Subgroups I and II

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	5.42	1	5.42	1	52	1.32 NS
Within	213.56	52	4.11			
Total	218.98	53				

Table XIV Reference - page 118

The Variance of the II Conversion Scores of Decimal Week  
in the Returner Subgroups I and III

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	7.66	1	7.66	1	41	1.80 NS
Within	174.50	41	4.26			
Total	182.16	42				

Table XV Reference - page 118

The Variance of the III Dual Currency Scores of Decimal Week  
in the Returner Subgroups I and III

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	0.85	1	0.85	1	41	0.68 NS
Within	51.06	41	1.24			
Total	51.91	42				

Table XVI Reference - page 119

The Variance of the Combined Decimal Currency Scores of Decimal  
Week in the subjects of the three Returner Subgroups who were  
aged 37 years or less

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
Between	14	2	7.0	2	37	0.207 NS
Within	1252	37	33.8			
Total	1266	39				



Table XVII Reference - page 119

The Variance of the Combined Decimal Currency Scores of  
Decimal Week in the Subjects of the three Returner  
Subgroups who were aged 38 years or more

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
Between	67	2	33.5	2	33	0.72 NS
Within	1534	33	46.48			
Total	1601	35				

Table XVIII

Age and Matrices Matching for the Two Practice - Check Groups

	Practice - check Group I		Matched subjects from Groups CLI, FH, W and P		Practice - check Group II		Matched subjects from Groups SA and P	
	Matrices	Age	Matrices	Age	Matrices	Age	Matrices	Age
	37	28	39	29	48	24	55	20
	48	29	46	29	49	28	51	26
	41	31	39	31	26	27	28	31
	32	33	31	33	44	28	44	28
	33	37	29	37	32	36	29	37
	46	47	48	44	51	41	51	43
	40	61	40	56	45	44	45	42
Mean	39.57	38.0	38.86	37.0	42.88	34.25	44.38	34.25

Table XIX Reference - page 121

Summary of the One-Way Analyses of Variance for the Four Decimal Currency Tests; between the Second-Occasion Scores of Practice-Check Group I and the First-Occasion Scores of their Matched Partners

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
<u>I New Currency</u>						
Between	0.0	1	0.0	1	12	0.0 NS
Within	31.0	12	2.583			
Total	31.0	13				
<u>II Conversion</u>						
Between	0.29	1	0.29	1	12	0.09 NS
Within	39.14	12	3.26			
Total	39.43	13				
<u>III Dual Currency</u>						
Between	0.07	1	0.07	1	12	0.077 NS
Within	10.86	12	0.905			
Total	10.93	13				
<u>IV Coin Recognition</u>						
Between	23.15	1	23.15	1	12	1.528 NS
Within	181.71	12	15.14			
Total	204.86	13				

Table XX Reference - page 121

Summary of the One-Way Analyses of Variance for the Four  
Decimal Currency Tests; between the First-Occasion Scores  
of Practice - Check Group II and the Second-Occasion  
Scores of their Matched Partners

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio
<u>I New Currency</u>						
Between	5.06	1	5.06	1	14	2.635 NS
Within	26.88	14	1.92			
Total	31.94	15				
<u>II Conversion</u>						
Between	0.06	1	0.06	1	14	0.015 NS
Within	54.38	14	3.88			
Total	54.44	15				
<u>III Dual Currency</u>						
Between	1.00	1	1.00	1	14	0.87 NS
Within	16.00	14	1.14			
Total	17.00	15				
<u>IV Coin Recognition</u>						
Between	0.25	1	0.25	1	14	0.01 NS
Within	269.50	14	19.24			
Total	269.75	15				

Table XXI Reference - page 121

Summary of the Two-Way Analyses of Variance on the Gain Scores of the Four Decimal Currency Tests; with Age and Intertest Interval as the Two Test Variables, in the Matched Returner Group

Source	Sum of Squares	df	Mean Square	v <sub>1</sub>	v <sub>2</sub>	F ratio
<u>I New Currency</u>						
Age	1.78	1	1.78	1	30	0.937 NS
Time Interval	2.89	2	1.44	2	30	0.758 NS
Interaction	6.89	2	3.44	2	30	1.810 NS
Error	57.0	30	1.90			
Total	68.56	35				
<u>II Conversion</u>						
Age	0.69	1	0.69	1	30	0.20 NS
Time Interval	8.21	2	4.10	2	30	1.20 NS
Interaction	1.57	2	0.78	2	30	0.20 NS
Error	101.83	30	3.39			
Total	112.30	35				
<u>III Dual Currency</u>						
Age	0.0	1	0.0	1	30	0.0 NS
Time Interval	0.89	2	0.44	2	30	0.2 NS
Interaction	4.67	2	2.33	2	30	1.4 NS
Error	49.0	30	1.63			
Total	54.56	35				
<u>IV Coin Recognition</u>						
Age	4.69	1	4.69	1	30	0.57 NS
Time Interval	15.05	2	7.52	2	30	0.9 NS
Interaction	53.39	2	26.69	2	30	3.26 NS
Error	245.17	30	8.17			
Total	318.3	35				

Table XXII Reference - page 123

Summary of the Two-Way Analyses of Variance for the Gain Scores of the Four Decimal Currency Tests; with Age and Intertest Interval as the Two Test Variables, in the Total Returner Group

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio
<u>I New Currency</u>						
Age	5.0	1	5.0	1	60	2.083 NS
Time Interval	7.0	2	3.5	2	60	1.458 NS
Interaction	0.0	2	0.0	2	60	0.0 NS
Error	146.0	60	2.4			
Total	158.0	65				
<u>II Conversion</u>						
Age	9.0	1	9.0	1	60	2.432 NS
Time Interval	25.0	2	12.5	2	60	3.378 p<5%
Interaction	0.0	2	0.0	2	60	0.0
Error	224.0	60	3.7			
Total	258.0	65				
<u>III Dual Currency</u>						
Age	0.0	1	0.0	1	60	0.0 NS
Time Interval	2.0	2	1.0	2	60	0.526 NS
Interaction	2.0	2	1.0	2	60	0.526 NS
Error	105.0	60	1.9			
Total	109.0	65				
<u>IV Coin Recognition</u>						
Age	36.0	1	36.0	1	60	3.956 NS
Time Interval	5.0	2	2.5	2	60	0.275 NS
Interaction	48.0	2	24.0	2	60	2.637 NS
Error	546.0	60	9.1			
Total	635.0	65				

Table XXIII Reference - Chapter 14

Summary Tables of the Two-Way Analyses of Variance on the  
Age and Rigidity - Flexibility Interactions, with Trend  
Tests using Lamda Coefficients

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio	
<u>a) Cell scores are Progressive Matrices - Reference - page 141</u>							
Unusual Uses	56.380	1	56.380	1	60	0.884	NS
Age	471.758	2	235.879	2	60	3.701	p<5%
Interaction:-	399.019	2	199.509	2	60	3.130	NS
linear	131.272	1	131.272	1	60	2.060	NS
quadratic	267.758	1	267.758	1	60	4.201	p<5%
Error	3823.818	60	63.73				
Total	4750.985	65					

Linear trend:-

8 + Uses	0.0	1	0.0	1	60	0.0	NS
7 - Uses	262.545	1	262.545	1	60	4.119	p<5%

Quadratic trend:

8 + Uses	2.182	1	2.182	1	60	0.034	NS
7 - Uses	606.060	1	606.060	1	60	9.510	p<1%

b) Cell scores are Hidden Faces - Reference - page 143

Unusual Uses	42.014	1	42.014	1	66	6.778	p < 2.5%
Age	50.225	2	25.112	2	66	4.051	p < 2.5%
Interaction:-	37.553	2	18.776	2	66	3.029	NS
linear	36.750	1	36.750	1	66	5.929	p < 2.5%
quadratic	0.694	1	0.694	1	66	0.111	NS
Error	409.083	66	6.198				
Total	538.875	71					

Linear trend:-

7 + Uses	0.166	1	0.166	1	66	0.027	NS
6 - Uses	66.666	1	66.666	1	66	10.756	p<1%

Quadratic trend:

7 + Uses	14.222	1	14.222	1	66	2.294	NS
6 - Uses	6.722	1	6.722	1	66	1.084	NS

Table XXIII Continued

Source	Sum of Squares	df	Mean Square	U <sub>1</sub>	U <sub>2</sub>	F ratio
c) Cell scores are - Authoritarianism - Reference - page 143						
Paranoia	61.715	1	61.715	1	78	14.087 p < 0.1%
Age	2.167	2	1.083	2	78	0.247 NS
Interaction:-	3.070	2	1.535	2	78	0.350 NS
linear	3.018	1	3.018	1	78	0.688 NS
quadratic	0.059	1	0.059	1	78	0.013 NS
Error	341.715	78	4.381			
Total	408.667	83				
Linear trend:-						
5 + Paranoia	1.750	1	1.750	1	78	0.399 NS
4 - Paranoia	1.286	1	1.286	1	78	0.293 NS
Quadratic trend						
5 + Paranoia	1.440	1	1.440	1	78	0.328 NS
4 - Paranoia	1.238	1	1.238	1	78	0.282 NS
d) Cell scores are the Gough-Sanford Scale - Reference - page 143						
Unusual Uses	2.722	1	2.722	1	66	0.205 NS
Age	139.194	2	69.597	2	66	5.254 p < 1%
Interaction:-	22.528	2	11.264	2	66	0.850 NS
linear	13.437	1	13.437	1	66	1.014 NS
quadratic	9.506	1	9.506	1	66	0.718 NS
Error	874.167	66	13.245			
Total	1038.611	71				
Linear trend:-						
7 + Uses	32.666	1	32.666	1	66	2.466 NS
6 - Uses	117.042	1	117.042	1	66	8.836 p < 1%
Quadratic trend						
7 + Uses	10.888	1	10.888	1	66	0.822 NS
6 - Uses	1.125	1	1.125	1	66	0.085 NS



Table XXIII Continued

Source	Sum of Squares	df	Mean Square	v <sub>1</sub>	v <sub>2</sub>	F ratio	
e) Cell scores are the Gough-Sanford Scale - Reference - page 144							
Hidden Faces	24.243	1	24.243	1	60	2.257	NS
Age	29.576	2	14.788	2	60	1.377	NS
Interaction:-	6.302	2	3.151	2	60	0.293	NS
linear	5.777	1	5.777	1	60	0.538	NS
quadratic	0.485	1	0.485	1	60	0.045	NS
Error	644.364	60	10.739				
Total	704.485	65					
linear trend:-							
9 + Faces	4.5	1	4.5	1	60	0.419	NS
8 - Faces	30.727	1	30.727	1	60	2.861	NS
Quadratic trend							
9 + Faces	0.545	1	0.545	1	60	0.051	NS
8 - Faces	0.061	1	0.061	1	60	0.005	NS
f) Cell scores are Hidden Faces - Reference - page 144							
Auth.ism.	13.762	1	13.762	1	78	1.640	NS
Age	83.882	2	41.941	2	78	4.998	p < 1%
Interaction:-	65.809	2	32.904	2	78	3.921	p < 5%
linear	62.161	1	62.161	1	78	7.408	p < 1%
quadratic	3.720	1	3.720	1	78	0.443	NS
Error	654.500	78	8.391				
Total	817.953	83					
Linear trend:-							
4 + Auth.ism	57.143	1	57.143	1	78	6.810	p < 2.5%
3 - Auth.ism	12.893	1	12.893	1	78	1.536	NS
Quadratic trend							
4 + Auth.ism	23.048	1	23.048	1	78	2.747	NS
3 - Auth.ism	56.678	1	56.678	1	78	6.754	p < 2.5%

Table XXIII Continued

Source	Sum of Squares	df	Mean Square	$v_1$	$v_2$	F ratio	
<u>g) Cell scores are Unusual Uses - Reference - page 145</u>							
Auth.ism	28.583	1	28.583	1	78	2.601	NS
Age	14.214	2	7.107	2	78	0.646	NS
Interaction:-	33.739	2	16.869	2	78	1.535	NS
linear	33.018	1	33.018	1	78	3.004	NS
quadratic	0.719	1	0.719	1	78	0.065	NS
Error	857.214	78	10.990				
Total	933.750	83					
Linear trend:-							
4 + Auth.ism	6.036	1	6.036	1	78	0.549	NS
3 - Auth.ism	32.143	1	32.143	1	78	2.925	NS
Quadratic trend							
4 + Auth.ism	7.440	1	7.440	1	78	0.677	NS
3 - Auth.ism	2.333	1	2.333	1	78	0.212	NS
<u>h) Cell scores are Hidden Faces - Reference - page 145</u>							
Paranoia	4.762	1	4.762	1	78	0.468	NS
Age	92.215	2	46.107	2	78	4.535	p < 2.5%
Interaction:-	54.309	2	27.154	2	78	2.671	NS
linear	17.158	1	17.158	1	78	1.688	NS
quadratic	37.148	1	37.148	1	78	3.654	NS
Error	793.0	78	10.166				
Total	944.286	83					
Linear trend:-							
5 + Paranoia	15.75	1	15.75	1	78	1.549	NS
4 - Paranoia	3.571	1	3.571	1	78	0.351	NS
Quadratic trend							
5 + Paranoia	121.440	1	121.440	1	78	11.946	p < 1%
4 - Paranoia	5.762	1	5.762	1	78	0.567	NS

Table XXIII Continued

Source	Sum of Squares	df	Mean Square	$\nu_1$	$\nu_2$	F ratio	
i) Cell scores are the Paranoia Scale - Reference - page 145							
Unusual Uses	0.014	1	0.014	1	66	0.003	NS
Age	4.111	2	2.050	2	66	0.524	NS
Interaction:-	31.445	2	15.722	2	66	4.020	p < 2.5%
linear	30.084	1	30.084	1	66	7.693	p < 1%
quadratic	1.362	1	1.362	1	66	0.348	
Error	258.083	66	3.9103				
Total	293.653						
Linear trend:-							
8 + Uses	22.042	1	22.042	1	66	5.637	p < 2.5%
7 - Uses	9.375	1	9.375	1	66	2.397	NS
Quadratic trend							
8 + Uses	4.014	1	4.014	1	66	1.026	NS
7 - Uses	0.125	1	0.125	1	66	0.032	NS

Appendix IV

Tables of the Mean Scores Graphically Represented in Section D.

Table I Means for Graph 1, page 182

Mean Scores of the Four Decimal Currency Tests from the First Testing Occasion in Decimal Week for Seven Age Groups.

		Age Groups in Years						
		20-24	25-29	30-34	35-39	40-44	45-49	50-54
I	New Currency	4.4	2.8	3.0	2.4	3.3	1.7	1.7
II	Conversion	4.4	3.2	3.1	2.6	4.25	2.8	2.7
III	Dual Currency	0.8	1.7	0.6	1.15	1.7	0.6	0.3
IV	Coin Recognition	8.8	6.2	4.9	5.6	6.6	5.1	5.8
Group size	N =	5	19	21	13	12	11	6

Table 2 Means for Graph 2, page 183

Mean Scores on the Four Decimal Currency Tests over Time, for Three Age Groups

		Testing Occsion				
	Age Groups	Decimal Week	Retest Week I	Retest Week II	Retest Week III	
I	New Currency	20-29	3.1	3.9	4.4	4.0
		30-39	2.7	3.0	4.0	3.2
		40-49	2.6	4.8	4.0	3.4
II	Conversion	20-29	3.4	2.5	3.0	4.3
		30-39	2.9	2.9	3.1	3.1
		40-49	3.6	2.3	2.9	4.5
III	Dual Currency	20-29	1.5	1.4	1.8	2.2
		30-39	0.8	1.1	0.5	1.2
		40-49	1.1	1.3	1.1	2.2
IV	Coin Recognition	20-29	6.7	7.9	8.0	8.0
		30-39	5.2	7.6	7.2	5.7
		40-49	6.2	5.9	6.8	9.0
Group size	N	20-29	24	8	10	12
		30-39	34	14	8	9
		40-49	23	12	11	9

Table 3 Means for Graph 3, page 184

Mean Scores of the Four Decimal Currency Tests Combined  
over Time, for Three Age Groups

		Testing Occasion			
		Decimal Week	Retest Week I	Retest Week II	Retest Week III
Age Groups	20 - 29	14.7	15.7	17.2	18.5
	30 - 39	11.6	14.6	14.8	13.2
	40 - 49	13.5	14.3	14.8	17.1

Table 4 Means for Graph 4, page 186

Mean Scores of the Four Decimal Currency Tests, over Time  
for the Psychology Student Group and the Total Returner Group.

		Psychology Students				Total Returner Group	
		Testing Occasions					
		Jan. 22	Feb. 1	Feb. 22	Mar. 5	Feb. 15-19	Combined Retest Weeks
I	New Currency	2.45	3.35	4.75	5.85	2.69	3.99
II	Conversion	1.75	3.6	3.6	6.25	3.05	3.01
III	Dual Currency	0.45	1.45	2.1	3.25	0.99	1.36
IV	Coin Recognition	5.0	6.4	10.15	14.2	5.26	7.68

Table 5 Means for Graph 5, page 186

Mean Gain Scores on the Four Decimal Currency Tests, over Time, for Two Age Groups.

	Gain after		
	1 week	2 weeks	3 weeks
<u>Subjects aged 35 years or younger</u>	N = 10	N = 16	N = 11
I New Currency	0.60	0.94	1.64
II Conversion	-0.40	-0.12	1.09
III Dual Currency	0.40	0.12	0.36
IV Coin Recognition	4.60	2.81	1.55
<u>Subjects aged 36 years or older</u>	N = 12	N = 16	N = 11
I New Currency	1.50	1.31	1.82
II Conversion	-0.67	-0.37	0.45
III Dual Currency	0.17	0.44	0.82
IV Coin Recognition	0.33	1.81	1.55

Table 6 Means for Graph 6, page 190

Mean Gain Scores on the Four Decimal Currency Tests, over Time for High and Low Scorers on the Progressive Matrices Test.

	Gain after		
	1 week	2 weeks	3 weeks
<u>Subjects scoring 47 or more Matrices</u>			
<u>points</u>	N = 10	N = 15	N = 10
I New Currency	1.90	1.20	2.20
II Conversion	-0.60	0.47	0.80
III Dual Currency	0.50	0.53	1.20
IV Coin Recognition	2.10	2.13	1.60
<u>Subjects scoring 46 or less Matrices</u>			
<u>points</u>	N = 12	N = 17	N = 12
I New Currency	0.42	0.94	1.33
II Conversion	-0.50	-1.00	0.75
III Dual Currency	0.08	0.00	0.08
IV Coin Recognition	2.42	2.59	1.50

Table 7 Means for Graph 7, page 192

Mean Gain Scores for the Four Decimal Currency Tests, over Time, for High and Low Scorers on the Unusual Uses Test.

	Gain after		
	1 week	2 weeks	3 weeks
<u>Subjects scoring 7 or less Uses</u>	N = 12	N = 15	N = 12
I New Currency	0.75	0.47	2.08
II Conversion	-0.66	-0.33	1.67
III Dual Currency	0.50	0.33	0.50
IV Coin Recognition	2.67	2.33	1.92
<u>Subjects scoring 8 or more Uses</u>	N = 10	N = 17	N = 10
I New Currency	1.50	1.71	1.30
II Conversion	-0.40	-0.18	-0.30
III Dual Currency	0.00	0.18	0.70
IV Coin Recognition	1.80	2.41	1.10

Table 8 Means for Graph 8, page 193

Mean Gain Scores on the Four Decimal Currency Tests, over Time, for High and Low Scorers on the Hidden Faces Test.

	Gain after		
	1 week	2 weeks	3 weeks
<u>Subjects scoring 8 or less Faces</u>	N = 15	N = 17	N = 9
I New Currency	1.07	0.71	1.33
II Conversion	-0.33	-0.82	1.78
III Dual Currency	0.00	0.18	0.11
IV Coin Recognition	2.60	2.71	2.22
<u>Subjects scoring 9 or more Faces</u>	N = 7	N = 15	N = 13
I New Currency	1.14	1.60	2.00
II Conversion	-1.00	0.40	0.07
III Dual Currency	0.86	0.33	0.92
IV Coin Recognition	1.57	2.00	1.07

Table 9 Means for Graph 9, page 197

Mean Gain Scores for the Four Decimal Currency Tests, over Time, for High and Low Scorers on the Gough-Sanford Rigidity Scale.

		Gain after		
		1 week	2 weeks	3 weeks
<u>Subjects scoring 8 or less rigidity</u>				
	<u>points</u>	N = 12	N = 14	N = 11
I	New Currency	1.25	1.50	1.82
II	Conversion	-1.08	-0.14	0.36
III	Dual Currency	0.25	0.64	0.55
IV	Coin Recognition	1.75	3.43	0.45
<u>Subjects scoring 9 or more rigidity</u>				
	<u>points</u>	N = 9	N = 18	N = 11
I	New Currency	1.00	0.83	1.64
II	Conversion	0.11	-0.33	0.64
III	Dual Currency	0.00	-0.05	0.64
IV	Coin Recognition	3.55	1.50	2.64

Table 10 Means for Graph 10, page 198

Mean Gain Scores on the Four Decimal Currency Tests, over Time, for High and Low Scorers on the Authoritarianism Scale.

		Gain after		
		1 week	2 weeks	3 weeks
<u>Subjects scoring 3 or less rigidity</u>				
	<u>points</u>	N = 16	N = 15	N = 10
I	New Currency	1.44	1.40	1.60
II	Conversion	-0.56	-0.07	-0.30
III	Dual Currency	0.06	0.60	0.50
IV	Coin Recognition	2.44	3.47	2.20
<u>Subjects scoring 4 or more rigidity</u>				
	<u>points</u>	N = 5	N = 17	N = 12
I	New Currency	0.20	0.88	1.83
II	Conversion	-0.60	0.41	1.67
III	Dual Currency	0.80	-0.06	0.66
IV	Coin Recognition	2.80	1.88	1.00



Table 11 Means for Graph 11, page 200

Mean Gain Scores on the Four Decimal Currency Tests, over Time, for High and Low Scorers on the Paranoia Scale.

	Gain after		
	1 week	2 weeks	3 weeks
<u>Subjects scoring 4 or less rigidity</u>			
<u>points</u>	N = 11	N = 15	N = 11
I New Currency	1.27	1.20	1.82
II Conversion	-0.73	-0.20	0.73
III Dual Currency	0.18	0.66	1.18
IV Coin Recognition	2.73	2.73	1.82
<u>Subjects scoring 5 or more rigidity</u>			
<u>points</u>	N = 10	N = 17	N = 11
I New Currency	1.00	1.06	1.64
II Conversion	-0.30	-0.29	1.09
III Dual Currency	0.30	-0.12	0.00
IV Coin Recognition	2.30	2.06	1.27

Table 12 Means for Graph 12, page 208

Mean Scores on the Progressive Matrices Test for Eight Age Groups.

	Age Groups in Years							
	20-25	26-30	31-35	36-40	41-45	46-50	51-56	58-73
Matrices mean score	51	47	43	42	47	47.5	40	40
Subjects in each group N =	8	23	20	16	14	11	8	8

Table 13 Means for Graph 13, page 210

Mean Scores on the Two Flexibility Tests and the Three Rigidity Scales for Three Age Groups

	Age Groups in Years		
	20 - 29	30 - 39	40 - 49
a) Unusual Uses mean score	7.3	7.2	9.0
Hidden Faces mean score	9.1	7.0	8.9
b) Gough-Sanford Rigidity Scale	7.2	8.7	9.5
Rokeach-Authoritarianism Scale	4.5	4.0	4.3
Rokeach - Paranoia Scale	3.3	3.3	3.5
Subjects in age groups N =	30	34	26

Table 14    Means for Graph 14, page 214

Mean Scores on the Two Flexibility Tests and the Three Rigidity Scales for Three Scoring Groups on the Progressive Matrices Test.

	Progressive Matrices Scoring Groups		
	Points 20 - 42	43 - 49	50 - 60
a) Unusual Uses	6.7	7.3	9.7
Hidden Faces	6.5	8.6	9.0
b) Gough-Sanford Rigidity Scale	10.7	9.3	7.3
Rokeach-Authoritarianism Scale	5.3	4.1	3.6
Rokeach - Paranoia Scale	4.5	3.6	2.6
Subjects in Matrices Groups N =	32	29	29

Table 15    Means for Graph 15, page 216

Mean Score Relationships within the Three Rigidity Scales and between the Two Flexibility Tests.

a)	Gough-Sanford Scoring Groups									
Mean Scores on:-	1-4	5-6	7	8	9	10-11	12-14	15-19		
Rokeach-Authoritarianism	2.1	3.2	3.5	3.25	3.2	3.3	4.7	5.7		
Rokeach - Paranoia	3.8	3.2	3.0	4.0	4.9	5.0	4.7	5.8		
Subjects in Groups N =	13	13	15	12	15	17	15	12		
	Authoritarianism Scoring Groups									
Mean Scores on:-	0	1	2	3	4	5	6	7-9		
Rokeach - Paranoia	2.6	3.6	3.8	4.0	4.2	4.8	5.5	5.6		
Subjects in Groups N =	10	16	18	29	23	13	11	14		
b)	Hidden Faces Scoring Groups									
Mean Score on:-	0-4	5	6	7	8	9	10	11	12-15	
Unusual Uses	6.8	5.1	6.0	6.6	9.6	9.9	7.1	9.4	8.8	
Subjects in Groups N =	16	10	15	21	14	11	20	14	14	



Appendix V

Item Analysis of the Rigidity and Flexibility measures

Analyses of the trends of the rigidity and flexibility measures over age were made using lamda coefficients, (Table 13, Chapter 14). The age groups of the analyses were 20 to 29, 30 to 39, and the third age group varying in range from 40 to 49 years to 40 to 58 years of age, (Table XXIII, Appendix III). Using these groups there was significant variance in the hypothesised directions between age groups on the Matrices test, Hidden Faces and the Gough-Sanford Scale, but not on Unusual Uses or the Dogmatism scale (Authoritarianism and Paranoia).

Among the abstract reasoning tests there was no significant variance between high and low Unusual Uses scorers on Matrices score. Therefore the convergent and divergent thinking measures seemed to be relatively independent of each other. In support of the findings of Hudson (1966 and 1968), the 20 to 29 year olds with low Unusual Uses scores did have a higher mean Matrices score than those with high Unusual Uses scores.

Because of this, unrelated t tests were computed on the Unusual Uses scores of this young group divided into subjects scoring 49 to 60, and those scoring 37 to 48 Matrices points. Another analysis was computed on the Matrices scores of this same age group with subjects divided into those scoring 6 to 14 and those scoring 2 to 5 Unusual Uses. In both cases the resulting t value was less than one, and therefore not significant. Thus there was no evidence that extreme

convergent ability inhibited divergent thinking, nor vice versa.

Both high and low scorers on the Unusual Uses test showed consistently above-average Matrices scores, the only exception being the 30 to 39 year olds who scored 7 or fewer Unusual Uses. This group had Matrices scores low enough to cause a significant quadratic age trend among the low Uses scorers. Since the 30's decade had an overall Matrices mean lower than either the 20's or 40's decades of this study it would seem that divergent and convergent thinking are independent measures in people of above-average intelligence, but are more closely related in the average population.

The variance on Hidden Faces scores between high and low scorers on the Unusual Uses test was significant, the high Unusual Uses scorers having higher Hidden Faces scores. The high Unusual Uses scorers, however, showed no change in their high Hidden Faces scores between 20 and 58 years of age, whereas the low Unusual Uses scorers showed a significant linear decline in Hidden Faces mean score over this age range. Since the 20 year olds with low Unusual Uses scores had Hidden Faces scores as good as the high Unusual Uses scorers, it was only in the 30's that this decline started, being more marked in the oldest group.

This suggests that perceptual flexibility is fairly universal in young adults, and that it only becomes related to other types of flexibility such as divergent thinking in more mature people.

The analyses of the Gough-Sanford Scale related to the two Flexibility tests showed no significant variance in Gough-Sanford scores between high and low scorers on either the Hidden Faces, nor Unusual Uses tests. Therefore the type of behavioural rigidity measured by the Gough-Sanford scale is more a reflection of the routines older people use to make life easier, than a correlate of rigid perception or thinking.

There was one significant trend, though, that being a linear increase over age on the Gough-Sanford score in subjects scoring low on Unusual Uses. Again the difference in rigidity between high and low Unusual Uses scorers did not begin until the 30's decade, so that the correlation of low divergent thinking ability with greater behavioural rigidity becomes greater as people get older.

The Dogmatism Scales; Authoritarianism and Paranoia showed no change between subjects of 20 to 49 years of age, and the Unusual Uses score showed no significant variance in either high or low Authoritarian subjects over the 20 to 56 age range. The Hidden Faces score though had a significant linear decline among high Authoritarian subjects over this same age range; and a significant quadratic trend among low Authoritarian subjects over age.

The nature of these trends was such that in both the 20's and 30's decades the Hidden Faces score was relatively independent of Authoritarianism, but in the 40 to 56 year olds the low Authoritarian subjects had as high Hidden Faces scores as the 20's decade.

The Paranoia mean scores of low Unusual Uses scorers went up with age, but not significantly, while the Paranoia scores of high Unusual Uses scorers showed a significant linear decline with age. The main drop in this trend occurred between the 20's and 30's decades. If the Unusual Uses test is a reflection of general ability in older people then its relationships with Paranoia reflect the insecurity or assurance with which older people perceive life, according to the ability they have.

Subjects scoring low on Paranoia showed no change on Hidden Faces score over age, but the high Paranoia scorers showed a significant quadratic trend of Hidden Faces score with age. This trend differed from that of the low Paranoia scorers primarily by the 20's decade who scored many more Hidden Faces than their less-Paranoid peers, and the 30's decade who scored far fewer Hidden Faces than their peers. Perhaps the high Paranoia scorers in the 20's felt more anxiety from personal relationships and their own subjective inadequacies, so that they were more motivated to seek out human faces; whereas the 30's who scored high on Paranoia may have felt more anxiety from their lower intellectual ability and thus from their chances of success in education and careers. Such an idea would of course need further testing before it could be taken too seriously.

The results of these trend tests and analyses seem to show that in adults of young and middle-age (20 to 58 years) the most general increase in rigidity with age is of the behavioural type involving the use of routine and convention, and not of the authoritarian or dogmatic-thinking type.

The interaction of the other trends suggests that the hypothesised correlations between high rigidity scores and low abstract reasoning scores (and vice versa) are greatest in subjects of either comparatively low intellectual ability or greater chronological age. For example the Unusual Uses scores were lower in the low Matrices group of 30 to 39 year olds, and the Unusual Uses scores were more related to both Hidden Faces and the Gough-Sanford Scale in the older decades. Conversely, in young adults or intellectually superior people the different abilities measured here are relatively independent of each other.

The Product Moment Correlation Matrix and Principal Component Analysis of the Rigidity-Flexibility dimension included all the questionnaire items, plus the raw scores of Unusual Uses and Hidden Faces, and subjects' age and sex. The age range of the subjects included was from 18 to 77 years, and the correlations between age and both Hidden Faces and Unusual Uses were very small. Therefore these measures of flexibility show no decline with age, (Table 22, Chapter 16).

Age was significantly correlated with agreement with the following items, (Table 20, Chapter 16):-  
from the Gough-Sanford Scale:-

2. I usually check more than once to be sure I have locked a door, put out the light or something of the sort.
5. I find it easy to stick to a certain schedule once I have started on it.
6. I try to follow a programme of life based on duty.



9. I am a methodical person in whatever I do.
10. I am often the last person to give up trying to do a thing.
12. I do not enjoy having to adapt myself to new and unusual situations.
14. I dislike to change my plans in the midst of an undertaking.
16. I always finish tasks I start even if they are not very important.
18. I have a work or study schedule which I follow carefully.
20. I believe that promptness is a very important personality characteristic.
21. I always put on and take off my clothes in the same order.

from the Authoritarianism Scale:-

4. There are two kinds of people in this world, those who are for the truth and those who are against the truth.
6. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
7. Most of the ideas which get printed today are not worth the paper they're written on.

In the Principal Component Analysis (Table 23, Chapter 16) Age loaded most highly on Factor 2. In this factor the loadings showed that older people agreed more with six of the Gough-Sanford items; five of these being items 18, 5, 16, 6 and 9 shown above, and the sixth being item:-

15. I think it is usually wise to do things in a conventional way.

There was also one Paranoia item with a sufficient loading to be included in Factor 2, again older people agreed more with this item:-

20. The main thing in life is for a person to want to do something important.

To summarise these Age-related items it seems that the type of rigidity that increases with age is of primarily the behavioural type. Older people prefer to live each day according to well-tried methods and habits; keeping life tidy by task completion and doing 'what ought to be done'.

The three Authoritarian items that are Age-related imply a more rigid black-white perception of beliefs and a rejection of modern ideas. These traits are probably a reflection of the greater difficulty older people have in the logical appraisal of complex information rather than an implication that older people become more militantly authoritarian.

The items which correlated significantly with the Hidden Faces test, such that a low Hidden Faces score went with agreement with these items, were:-

from the Gough-Sanford Scale:-

2. I usually check more than once to be sure I have locked a door, put out the light, or something of the sort.
4. I often find myself thinking of the same tune or phrases for days at a time.
13. I prefer work that requires a great deal of attention to detail.
18. I have a work or study schedule which I follow carefully.

from the Authoritarianism Scale:-

5. Of all the different philosophies which exist in the world there is probably only one which is correct.

6. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.

from the Paranoia Scale:-

18. I wish I could find someone who would tell me how to solve my personal problems.
19. It is only natural for a person to be rather fearful of the future.

In the Principal Component Analysis the Hidden Faces test loaded most highly on Factor I (Table 23, Chapter 16) High Hidden Faces scores loaded in the opposite direction to agreement with the two Gough-Sanford items 2 and 4, and the Paranoia item 18, shown above. Factor I also included 3 other Paranoia items:-

16. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.
17. Most people just don't give a damn for others.
14. I have often felt that strangers were looking at me critically.

Therefore the Hidden Faces score seems to be related mainly to a tendency to repeat behaviour and to a paranoid distrust and fear of other people. The fact that human faces were the elusive stimuli in this test may have had a lot to do with the consequent correlations with Paranoia. Since this cluster of items was the most important factor in the whole rigidity analysis, a basic lack of warmth in human relationships seem to be a very important correlate in the non-Age-related type of rigidity.

The items which correlated significantly with the Unusual Uses test, such that agreement with the items correlated with low Unusual Uses scores, were:-

from the Gough-Sanford Scale:-

17. I have never done anything dangerous for the thrill of it.

from the Authoritarianism Scale:-

1. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.
4. There are two kinds of people in this world, those who are for the truth, and those who are against the truth.
5. Of all the different philosophies which exist in the world there is probably only one which is correct.
8. My blood boils whenever a person stubbornly refuses to admit that he's wrong.

In the Principal Component Analysis the Unusual Uses test did not form a clear rigidity factor. It loaded most highly on Factor 5, and the only other items which had moderate loadings on this factor were the Authoritarian item 1, shown above, the Paranoia item:-

16. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.

and the Gough-Sanford item:-

15. I think it is usually wise to do things in a conventional way.

Sex also had a moderate loading on Factor 5, such that men had higher scores than women. Overall it seems that the most important rigidity correlate of divergent thinking is the authoritarian belief that there is only one right way to think and act. This seems reasonable from the nature of

the Unusual Uses test: believing in one right use prevents the deduction of further possible 'right ways'.

Sex did not load appreciably on any other factor, but it did correlate significantly with three items from the Dogmatism Scale. Women agreed more with the Authoritarian item:-

4. There are two kinds of people in this world, those who are for the truth and those who are against the truth.

Men agreed more with the Paranoia items:-

16. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.

17. Most people just don't give a damn for others.

Factors 3 and 4 of the Principal Component Analysis loaded highly on questionnaire items only (Table 23, Chapter 16). Factor 3 loaded most highly on the Paranoia item 'Its all too true that people just won't practise what they preach'. The other substantial loadings were for 7 Authoritarian items, numbers 9, 3, 2, 10, 4, 7 and 8 of the Rokeach Dogmatism scale as used in this study. All these items related to an intolerance of contrary beliefs and an adherence to the one true set of values, making the most suitable title for this factor 'Narrow-mindedness'.

Factor 4 loaded most highly on the Paranoia item 'It is only natural for a person to be rather fearful of the future'. Its other large loadings were on the Gough-Sanford items 11, 12 and 17, which all implied an anxiety about any future actions particularly in unfamiliar situations.

This seemed to be a 'Fear of the Unknown' factor.

The Product Moment Correlation coefficients of the rigidity analysis showed that neither the Gough-Sanford Scale nor the Dogmatism Scales (Authoritarianism and Paranoia) were measuring single traits because the intercorrelations within the items of each scale were not consistently large nor even consistently positive (Tables 16 and 17, Chapter 16).

In the Gough-Sanford Scale the items which correlated significantly and positively with at least 5 other items in that scale were:-

15. I think it is usually wise to do things in a conventional way.
18. I have a work or study schedule which I follow carefully.
5. I find it easy to stick to a certain schedule once I have started on it.
6. I try to follow a programme of life based on duty.
9. I am a methodical person in whatever I do.
12. I do not enjoy having to adapt myself to new and unusual situations.
14. I dislike to change my plans in the midst of an undertaking.
21. I always put on and take off my clothes in the same order.
16. I always finish tasks I start even if they are not very important.
11. I prefer to stop and think before I act, even on trifling matters.
13. I prefer work that requires a great deal of attention to detail.

The first two items of this list correlate significantly with 10 other items, which is half the total Gough-Sanford Scale. They sum up the essence of behavioural rigidity, namely 'doing the done thing' and having a detailed routine to face life with.

For the Dogmatism Scale there follows a list of the items which correlate significantly with other items in that scale, beginning with the items which correlate most extensively.

17. Most people just don't give a damn for others.
4. There are two kinds of people in this world, those who are for the truth and those who are against the truth.
8. My blood boils whenever a person stubbornly refuses to admit that he's wrong.
9. In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.
10. A person who gets enthusiastic about too many causes is likely to be a pretty 'wishy-washy' sort of person.
21. Its all too true that people just won't practise what they preach.
1. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.
6. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
18. I wish I could find someone who would tell me how to solve my personal problems.
20. The main thing in life is for a person to want to do something important.

This list includes 6 Authoritarianism items and 4 Paranoia items. In brief they relate to the Dogmatic thinker's lack of trust in other people, and his adherence to one belief system.

Between the Gough-Sanford Scale and the Dogmatism Scale there were significant correlations, (Tables 18 and 19, Chapter 16). The Gough-Sanford item:-

19. I usually find that my own way of attacking a problem is best, even if it doesn't always seem to work in the beginning.

correlated significantly and positively with the Authoritarian items 3, 4, 8 and 10, all of which refer to there being only one true opinion in the world, and from item 19 it would seem that this true opinion is the subjects' own one. This supports the view of Rokeach (1960) that the ultimate in-group of a closed-minded person is himself.

Some other Gough-Sanford items correlated significantly with 2 of the Authoritarian items. These were:-

1. I am always careful about my manner of dress.
3. I often become so wrapped up in something I am doing that I find it difficult to turn my attention to other matters.
11. I prefer to stop and think before I act, even on trifling matters.
15. I think it is usually wise to do things in a conventional way.
21. I always put on and take off my clothes in the same order.



The correlations between these items and the Authoritarian items were all positive (i.e. agreement on one went with agreement on the other) except for the correlation between Gough-Sanford item 3 and Authoritarianism item 6.

The Gough-Sanford item:-

15. I think it is usually wise to do things in a conventional way.

correlates significantly with items 16, 17 and 21 of the Paranoia Scale. Other Gough-Sanford items which correlated with two Paranoia items were:-

2. I normally check more than once to be sure I have locked a door, put out the light, or something of the sort.

6. I try to follow a programme of life based on duty.

10. I am often the last person to give up trying to do a thing.

14. I dislike to change my plans in the midst of an undertaking.

17. I have never done anything dangerous for the thrill of it.

20. I believe that promptness is a very important personality characteristic.

21. I always put on and take off my clothes in the same order.

Except for items 15 and 21, the Gough-Sanford items which correlate most with Authoritarianism are different from the ones which correlate most with Paranoia; therefore the two factors of dogmatic thinking seem to have separate behavioural correlates.

The Dogmatism item:-

20. The main thing in life is for a person to want to do something important.

correlates significantly and positively with 8 Gough-Sanford items. Perhaps people who are rigid in their performance of everyday tasks and who place emphasis on the detailed completion of tasks are more likely to feel that an important task is most likely to give meaning to life.

The other Dogmatism items which correlated significantly with 3 or 4 Gough-Sanford items were:-

4. There are two kinds of people in this world, those who are for the truth and those who are against the truth.
6. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
3. A group which tolerates too many differences of opinion among its own members cannot exist for long.
5. Of all the different philosophies which exist in the world there is probably only one which is correct.
10. A person who gets enthusiastic about too many causes is likely to be a pretty 'wishy-washy' sort of person.
12. It is better to be a dead hero than a live coward.
17. Most people just don't give a damn for others.
19. It is only natural for a person to be rather fearful of the future.

These suggest that a factor of closed mindedness and anxiety is present in behavioural rigidity, though the two complete scales may be measuring two largely separate personality syndromes.

A Comparison with the results of Rubenowitz (1963)

Rubenowitz used the same Gough-Sanford scale as in this study except for items 6 and 17.

The Gough-Sanford items which had significant correlations with at least three of the same other items in both studies are listed below:- (Table 21, Chapter 16)

13. I prefer work that requires a great deal of attention to detail.
14. I dislike to change my plans in the midst of an undertaking.
1. I am always careful about my manner of dress.
9. I am a methodical person in whatever I do.
15. I think it is usually wise to do things in a conventional way.
18. I have a work or study schedule which I follow carefully.
4. I often find myself thinking of the same tune or phrase for days at a time.
7. I usually maintain my own opinion even though many other people may have a different point of view.
11. I prefer to stop and think before I act, even on trifling matters.
20. I believe that promptness is a very important personality characteristic.

From this list items 9, 11, 13, 14, 15 and 18 are also present in the list given earlier of items which correlated significantly with at least 5 other Gough-Sanford items in this study. Also in this latest list in all but 4 instances the significant intercorrelations of these items were with other items in this same list.

Therefore it seems that the Gough-Sanford Scale items numbers 1, 4, 7, 9, 11, 13, 14, 15, 18 and 20 measure a fairly unitary type of behavioural rigidity in subject groups from different cultural and linguistic backgrounds.

For the Dogmatism Scale Rubenowitz used 7 items from both the Authoritarianism and Paranoia Scales of this study if item 21, in included (item 21 was originally meant to be a buffer item). The 3 intercorrelations common to both studies were all between item:-

21. Its all too true that people won't practise what they preach.

and items:-

8. My blood boils whenever a person stubbornly refuses to admit that he's wrong.

11. It is only natural for a person to have a guilty conscience.

20. The main thing in life is for a person to want to do something important.

(Table 21, Chapter 16)

This lack of extensive cross cultural agreement suggests that the only thing being measured in both studies was average human scepticism, guilt and ambition. So there is no evidence that dogmatic thinking as measured by these Rokeach items means the same thing in other than British or American subject samples.

Appendix VI

Letters written in the recruitment of subjects.	pp
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Bedford College,  
Regent's Park,  
London.  
N.W.1.

24th March, 1970.

Dear ,

I am a postgraduate research student at Bedford College, London University, and I am carrying out a survey of how well people will be able to adjust to the Decimal Currency system.

I am hoping to get together a group of people who have attended Adult Education courses on Decimal Currency, and compare this group with the general public who have only had access to mass produced information in newspapers, television and radio.

The research procedure consists of seven short tests which can easily be completed within an hour. These tests are not difficult to do, but they should give a profile of each person's problem solving tactics and habits.

I then hope to relate this data to the amount people benefit from small-group teaching in Institute courses, and from less personal mass media. The amount of benefit will be measured by the ease with which they begin to think in terms of the new currency next February.

I have written to ----- who has been teaching on some of your Institute courses, and she has very kindly discussed with me the methods she used to put across the Decimal Currency system to her group.

Would it be possible for you to give me the names and addresses of people who have attended such courses at ----- and -----, so that I could ask them if they would be willing to take part in this research? I have enclosed a copy of the letter I would send to them.

Since the changeover to Decimal Currency is something that everyone will have to cope with, this is a good opportunity to find out how well the public education media are working. I hope very much that you will be able to help me.

Yours sincerely,

Susan Crouch, B.Sc.  
(Miss)

Bedford College,  
Regent's Park,  
London.  
N.W.1.

Dear Sir or Madam,

A research project is being carried out at Bedford College, London University, to find out how well people are going to be able to adjust to the decimal currency system; and to what degree they have been helped by government publications, courses at Institutes of Adult Education, and information given in newspapers and television etc.

We hope very much that you will volunteer to take part in this research, since you have attended an Institute course on Decimal Currency, so that we can have a group of people who have attended such courses. We can then compare this group with the general public when decimal currency has come into operation.

The research will require no great mental or physical effort on your part. It consists of 3 short questionnaires and several rather more practical tasks, all of which are designed to find out in the easiest way possible how you go about solving new problems, and with which kinds of problems you are best equipped to deal. The tests can be completed in two half-hour sessions, that can be conducted at any time or place of your choosing, so we hope to put you to as little inconvenience as possible. If you would prefer to come to the college for these sessions we will refund your return fare.

After the changeover on February 15th 1971, we will come back and see you again to find out how you are managing with the new currency.

It is just as important to this research to have people taking part who do not look forward to the new system, as it is to have those who rather welcome it. After all, it is the whole general public who will be affected by the changeover.

If you are willing to take part could you please send your name and address and/or telephone number to Miss S. Crouch, Bedford College, Regent's Park, London. N.W.1.

Susan Crouch.

Dear Student,

We would like to invite you to take part in a research project which is being carried out at Bedford College.

The aim of this project is to find out if any particular attitudes or abilities are especially helpful in adapting to the decimal currency system.

When decimalisation occurs next February, the whole of the general public will have to get used to the new money, so this will be a very good opportunity to compare people of all ages and different backgrounds.

Mr. - has kindly agreed to let us ask for your help. The research consists of several short pencil and paper tasks. Your names will not be given to us, as the answers are entirely confidential, but we would need to meet you in a group, for an hour spread over two occasions. The first occasion will be before decimalisation day, and the second occasion about a fortnight after decimalisation day. We will be able to meet in a room at the Stanhope Institute. If you are willing to take part - and we do hope that you will be - please would you give your name to your Tutor-In-Charge at the Institute? This will let the office there get some idea of how many people are willing to help, and then they can arrange a time and place for the first meeting, and let you know about it.

We shall be very grateful to all those willing to help us with this project, and hope that, whatever your views about the changes in the currency, you will be willing to take part.

Yours sincerely,

Sheila Chown.  
Susan Crouch.



PLEASE FILL IN THE FOLLOWING INFORMATION:-

INITIALS FOR CODING \_\_\_\_\_

DATE OF BIRTH \_\_\_\_\_

SEX \_\_\_\_\_

OCCUPATION \_\_\_\_\_

ANY PREVIOUS EXPERIENCE WITH DECIMAL CURRENCY

\_\_\_\_\_



PLEASE DON'T TURN OVER UNTIL YOU ARE TOLD.

DON'T TURN OVER UNTIL

YOU ARE TOLD.

19. A group which tolerates too many differences of opinion among its own members cannot last for long.
20. There are two kinds of people in this world, those who are for the truth, and those who are against the truth.
21. Of all the different philosophies which exist in the world there is probably only one which is correct.
22. Man on his own is a helpless and miserable creature.
23. I have often felt that strangers were looking at me critically.
24. If given the chance I would do something of great benefit to the world.
25. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
26. The principles I have come to believe in are quite different from those believed in by most people.
27. I dislike to change my plans in the midst of an undertaking.
28. Most of the ideas which get printed today are not worth the paper they're written on.
29. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.
30. Most people just don't give a damn for others.
31. I think it is usually wise to do things in a conventional way.
32. I wish I could find someone who would tell me how to solve my personal problems.
33. I always finish tasks I start, even if they are not very important.
34. It is only natural for a person to be rather fearful of the future.
35. I have never done anything dangerous for the thrill of it.
36. My blood boils whenever a person stubbornly refuses to admit that he's wrong.
37. I have a work or study schedule which I follow carefully.
38. In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.
39. The main thing in life is for a person to want to do something important.

FALSE	TRUE

- 40. It's all too true that people just won't practise what they preach.
- 41. I usually find that my own way of attacking a problem is best, even though it doesn't always seem to work in the beginning.
- 42. A person who gets enthusiastic about too many causes is likely to be a pretty 'wishy-washy' sort of person.
- 43. I believe that promptness is a very important personality characteristic.
- 44. I always put on and take off my clothes in the same order.

FALSE	TRUE

DON'T TURN OVER UNTIL YOU ARE TOLD.

On the following pages there are several short tests on the use of decimal currency.

In each test please do as many items as you can in the time allowed.

Don't turn over between the tests until you are told.

The first example in each test has already been done for you, so that you will see what kind of answer is required.

Which new currency coins could you give for the following articles and what change (if any) would you get?

Answers

A stamp costing 4½p	One 5p coin. One ½p coin change
A newspaper costing 5p	
A light bulb costing £0.14	
A bag of carrots costing 9p	
A bar of soap costing 12p	
A fountain pen costing £1.43	
A lb of sausages costing 28p	
A toothbrush at 18p	
4 gallons of petrol costing £1.37.	
A leg of lamb costing £0.98	
A bus ticket costing 8p	
A pot plant costing £0.54	
A wristwatch costing £7.66½	
20 cigarettes costing 26p	
3 bananas costing 7½p	
A bag of oranges costing £0.23½	
A book costing £0.73	
A lb of tomatoes costing 11½p	
A bottle of squash costing 13p	
A teddy bear costing £1.44	

Please give the approximate price of the following articles in new currency, correct to the nearest new halfpenny.

	<u>Answers</u>
An 8/6d paperback book	42 $\frac{1}{2}$ p
A 23/- theatre ticket	
A 3/7d bottle of shampoo	
A 9/9d tin of talcum powder	
A lb of apples at 1/7d	
A pair of tights at 13/6d	
A meccano set at £2/17/4d	
A pair of shoes at £4/5/6d	
A box of soap powder at 2/5d	
A 1/9d packet of tea	
A tin of biscuits costing 17/3d	
Chocolates costing 7/6d	
A 10d packet of seeds	
Shoe repairs for 8/11d	
A pair of gloves at 19/9d	
A packet of buttons at 2/9d	
A writing pad at 5/2d	
A box of tissues at 2/2d	
A 4d box of matches	
A saucepan at £1/15/11d	
A $\frac{1}{2}$ cwt of potatoes at 11/4d	
A 1/9d loaf of bread	
A train ticket for 14/9d	
A 10/6d bunch of flowers	
A bottle of spirits at 37/10d	
A 4/6d magazine	
A 6/11 pair of socks	
A 1/10 cauliflower	
A 7d bus fare	
A 6d stamp	

DON'T TURN OVER UNTIL YOU ARE TOLD

Which old currency coins would you use to pay for the following articles and what change (if any) would you be given? (The change will be in new currency)

Answers

A 25p magazine	Two florins and one shilling. No change
A cup of coffee at 4p	
A packet of cigarettes at 33p	
A bag of apples at 11½p	
A pair of gloves at £1.68	
A train ticket at 17p	
A calendar at 39p	
A tin of plasters at 14½p	
A box of chocolates costing £1.37	
A loaf of bread at 6p	
A gallon of petrol at 34p	
A brush and comb set at £2.67	
A tin of baked beans costing 7p	
A lamp shade at 89p	
A packet of biscuits costing 8½p	
A torch costing £0.74	
A ball point pen at 5p	
A tea towel at 28p	
A 2p box of matches	
A packet of detergent at 12p	

DON'T TURN OVER UNTIL YOU ARE TOLD.



This next test is to find out how easily you can judge the values of the new coins.

For each pair of coins presented on the next 2 pages, please write down how many of the first coin makes up the value of the second coin.

For example:-

answer

How many



make up



?

25

How many



make up



?



ANSWERS

Do as many of the following sums as you can.  
Please work as quickly as you can.

ADD in these examples:-

£	s	d
20	17	4
<u>22</u>	<u>15</u>	<u>7</u>

£	s	d
45	4	7
<u>61</u>	<u>0</u>	<u>9</u>

£	s	d
89	3	9
<u>49</u>	<u>5</u>	<u>7</u>

£	s	d
40	10	6
<u>64</u>	<u>0</u>	<u>2</u>

£	s	d
64	17	4
<u>90</u>	<u>8</u>	<u>1</u>

£	s	d
98	17	2
<u>49</u>	<u>4</u>	<u>4</u>

£	s	d
29	12	1
<u>70</u>	<u>17</u>	<u>7</u>

£	s	d
49	0	9
<u>94</u>	<u>13</u>	<u>2</u>

£	s	d
58	12	1
<u>65</u>	<u>13</u>	<u>4</u>

SUBTRACT in these examples:-

£	s	d
23	0	1
<u>8</u>	<u>14</u>	<u>2</u>

£	s	d
91	12	4
<u>78</u>	<u>15</u>	<u>6</u>

£	s	d
12	18	2
	<u>15</u>	<u>5</u>

£	s	d
91	2	1
<u>65</u>	<u>4</u>	<u>6</u>

£	s	d
59	7	4
<u>26</u>	<u>4</u>	<u>5</u>

£	s	d
60	9	0
<u>12</u>	<u>18</u>	<u>0</u>

£	s	d
40	16	7
<u>31</u>	<u>0</u>	<u>9</u>

£	s	d
62	2	2
<u>26</u>	<u>15</u>	<u>0</u>

£	s	d
49	3	0
<u>2</u>	<u>19</u>	<u>9</u>

DON'T TURN OVER UNTIL YOU ARE TOLD.



ANSWERS

**STANDARD  
PROGRESSIVE MATRICES  
SETS A, B, C, D, & E**

Name \_\_\_\_\_

Ref. No. \_\_\_\_\_

Place \_\_\_\_\_

Date \_\_\_\_\_

Age \_\_\_\_\_

Birthday \_\_\_\_\_

Test begun \_\_\_\_\_

Test ended \_\_\_\_\_

A			B			C			D			E		
1			1			1			1			1		
2			2			2			2			2		
3			3			3			3			3		
4			4			4			4			4		
5			5			5			5			5		
6			6			6			6			6		
7			7			7			7			7		
8			8			8			8			8		
9			9			9			9			9		
10			10			10			10			10		
11			11			11			11			11		
12			12			12			12			12		

Notes

Time	Total	Grade

Tested by \_\_\_\_\_

DON'T TURN OVER UNTIL

YOU ARE TOLD.



Do as many of the following sums as you can.  
Please work as quickly as you can.

ADD in these examples:-

$$\begin{array}{r} \text{£} \\ 20 . 87 \\ \underline{22 . 78} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 45 . 23 \\ \underline{61 . 04} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 89 . 18\frac{1}{2} \\ \underline{49 . 28} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 40 . 52\frac{1}{2} \\ \underline{64 . 01} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 64 . 87 \\ \underline{90 . 40\frac{1}{2}} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 98 . 86 \\ \underline{49 . 21\frac{1}{2}} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 29 . 60\frac{1}{2} \\ \underline{70 . 88} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 49 . 04 \\ \underline{94 . 66} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 58 . 60\frac{1}{2} \\ \underline{65 . 67} \\ \hline \end{array}$$

SUBTRACT in these examples:-

$$\begin{array}{r} \text{£} \\ 23 . 00\frac{1}{2} \\ \underline{8 . 71} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 91 . 61\frac{1}{2} \\ \underline{78 . 77\frac{1}{2}} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 12 . 91 \\ \underline{0 . 77} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 91 . 10\frac{1}{2} \\ \underline{65 . 22\frac{1}{2}} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 59 . 37 \\ \underline{26 . 22} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 60 . 45 \\ \underline{12 . 90} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 48 . 83 \\ \underline{31 . 04} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 62 . 11 \\ \underline{26 . 75} \\ \hline \end{array}$$

$$\begin{array}{r} \text{£} \\ 49 . 15 \\ \underline{2 . 98\frac{1}{2}} \\ \hline \end{array}$$

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Please write down as many UNUSUAL USES as you can think of for a PAIR OF SCISSORS, that means ANYTHING except cutting with two blades.

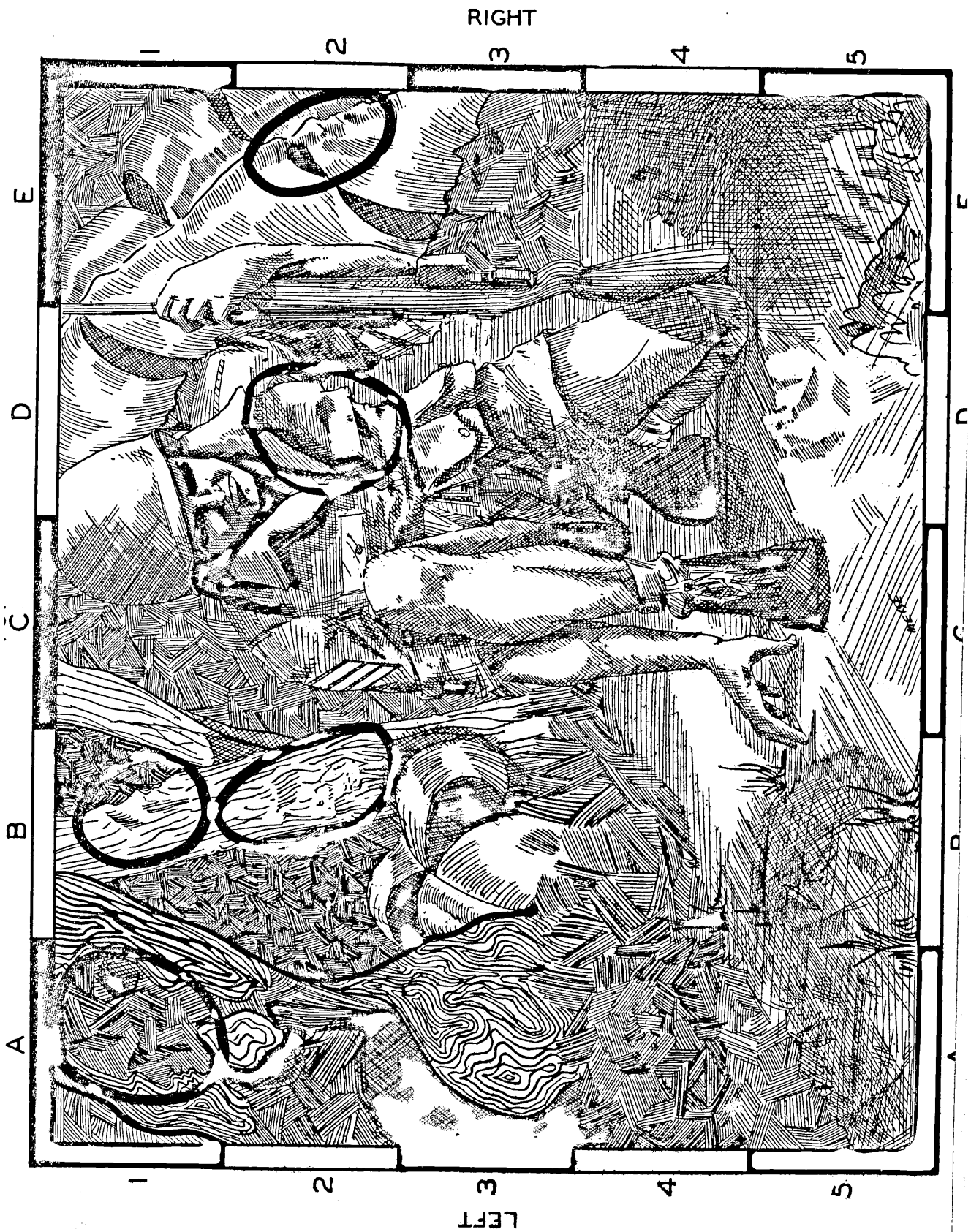
Here are some examples to show you what we mean:-

- 1) as a weapon, to throw or stab with.
- 2) as a conductor of electricity.
- 3) use the finger-holes to draw round shapes in a pattern.

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On the next page you will find a picture that has several camouflaged faces in it. Five of these faces have circles drawn round them: they are examples to show you the kind of faces we mean. Put circles round as many other faces as you can find in the picture. Go on to the second picture as soon as you can.

DON'T TURN OVER UNTIL YOU ARE TOLD.



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