# Responses to infrequent signals during repetitive work

# RESPONSES TO INFREQUENT SIGNALS DURING REPETITIVE WORK

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Thesis submitted for the Degree of Doctor of Philosophy of

Loughborough University of Technology

1969

## ACKNOWLEDGEMENTS

The work described in this thesis was supported financially by the Medical Research Council to whom the author is extremely grateful.

The author would also like to acknowledge her debt to Professor W.F. Floyd of the Department of Ergonomics and Cybernetics for his encouragement and support; to Mr. Hugh David for his advice and help on statistical matters and for the use of his generalized Analysis of Variance computer program; to Mr. R. Harding for his design of the electrical circuitry needed for the equipment.

Finally, the author would like to express her thanks to her Supervisor, Dr. Elwyn Edwards, for the generous help and advice which he gave throughout all phases of the work.

# SUMMARY

Eight women were employed on repetitive work. Records were made of their rate of production and its variability under different conditions, e.g. times of day, days of week, with and without rest breaks. The length of hand reaction times, in response to rare signals involving an interruption of the work cycle, were measured. Observations were made to see, whether the signal external to the work cycle or whether the next step required within that cycle, evoked the first response depending upon the point of injection of the signal.

The results suggest that the capacity, to interrupt the work cycle in response to the rare signal, depends upon its point of injection into the work cycle. A formula has been evolved which expresses a significant relationship between percentage of cycles broken or interrupted and "residual movement times", i.e. the time between the point of injection of the rare signal and the normal completion of the cycle movement.

The results also suggest that reaction times and production do vary under the different conditions.

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# PART 1. BACKGROUND TO THE RESEARCH

# 1. INTRODUCTORY PREAMBLE

This thesis examines the responses of subjects to a rare signal given during repetitive work. Response to the signal required that the subject should interrupt her work cycle. This research is an extension of that reported in Appendix 5. (Hartnett 1967).

Two experiments were carried out. These experiments varied both in terms of time and number of dependent variables measured. The number of measurements taken amounted to approximately one and a quarter million. The handling of this amount of data was made possible by the use of automatic or semi automatic techniques for collecting and analysing much of the data. This would not have been possible technically some ten years ago. It should be remarked that these new methods bring problems as well as blessings. The main problem is to integrate and present a coherent pattern from such an enormous amount of data while at the same time ensuring that the steps taken to reach one's conclusions are not lost in the welter of facts. It is possible that in another few years multivariate type analyses will be taken for granted, much as $X^2$ is now. Until that time it seems proper to present much information in verbal as well as tabular form.

The main purpose of the work was to simulate some aspects of an accident situation. Certain accidents seem to result more from the failure to interrupt a practiced response than from failure to initiate one. Instances of the need to interrupt practiced responses can be found in fairly common factory situations. The material in a machine may tear, may become jammed, may be displaced or misaligned. When this type of thing happens it often involves the employee in not completing his usual response.

for example:- not pressing the button he usually does at that part of the work cycle; not feeding the next piece of work into the machine; not operating the controls with a foot or hand when one hand may be inadvertently delayed with adjusting the misaligned or damaged work pièce in a danger area.

This research is an attempt to find some variables which may affect a person's capacity to interrupt such responses during a run of repetitive work.

The variables investigated include the following:-

1. I.Q., Manual Dexterity, Personality
2. Age
3. Speed of work cycles
4. Speed of different elements within the work cycle e.g. Response Initiation Time, Movement Time (Fig. 3, Page 44)
5. Presence or absence of Rest Breaks
6. Period of time after the start of the working session
7. Day of the week
8. Learning
9. Reaction Time
10. The point in the working cycle at which the rare signal was given.

The rare signal was given only once in every half hour period during the preliminary experiment and once in every twenty five minute period during the main experiment. It was considered that it would cease to be rare if it was given more frequently. During each period the proportion of ordinary work cycles to work cycles with the rare stimulus was approximately 599 to 1. Records were made of all work cycles as it was too good an opportunity to miss collecting such data. This enabled a study to be made of repetitive work quite independently of the main purpose of the experiment. The data and results from this secondary study are reported and discussed in this thesis.

## 2. LITERATURE SURVEY

### Accidents

An accident, near accident or critical event occurs when there is an inconsistency in any system, leading to a conflict within that system, such that its efficiency is more or less seriously impaired. In a man-machine system the inconsistency may be due to a lack in the human or some fault on the part of the machine or both. The results will be damage to the human, the machine or the product or any combination of them. An accident has been defined as "a failure on the part of an individual to deal adequately with a situation" as "it can be assumed, except in extraordinary circumstances, people do not wish to suffer injury" (Whitfield 1950). If the designer of the system was the same as the person operating within it, this definition could be accepted but usually this is not the case. It is suggested that this definition is inadequate as the emphasis is placed rather too heavily on the failure of the human element within the system rather than on the possible malfunction and poor design of any part of the entire system. This is not to deny that, even in the most well thought out systems, the "extraordinary circumstance" can occur. The human involved may choose to collect, for example, insurance money and if he does the best design wont stop him. It would be a contr-diction in terms to expect a design for a dynamic man-machine system such that the human had to be immobilised. Keeping that proviso in mind a system should be designed with due consideration for the capacities and limitations of any element forming part of it, including the human one. This involves a knowledge of what these capacities and limitationsare. It is the task of the Ergonomist, the Human Factors Engineer and the Systems Designer generally to further such knowledge and apply it. The advantages of the systems approach may be summed up as follows:- "The systems concept implies the identification and unbiased consideration of all pertinent variables of whatever class" (Haddon, Suchman, Klein, 1964).

Accidents and Individual Differences

There are various tests which can be used to measure human capacities and limitations. Attempts have been made to correlate the scores obtained on some of these tests with a person's accident history. The aim was to try and find tests to help with the selection of employees who would be less likely to incur accidents.

The pioneer work in this field was done under the auspices of the Industrial Fatigue and Industrial Health Research Boards. (Reports Nos.8, 55, 68, 74, 84). Some thirty tests were used in these studies to measure the following:- Sensori-motor abilities, Intelligence, Mechanical Aptitudes, Nervous Stability, Physiological Capacities, and General Analytic Tests - e.g. spatial perception, judgement of weight. Very few of these tests showed any relationship with accident rates and of those that did only two were statistically significant and then only with respect to Skilled Industrial Workers and not to R.A.F. and Dockyard Apprentices or Transport Workers. In the case of the last two groups there was a correlation between scores on the same or similar tests and accidents but the correlations were not significant. The tests showing some correlation were in the Sensori-motor group. They included Pursuit Tasks, Interrupted Pursuit Tasks, Dotting, Co-ordination and Choice Reaction Time. There was also a very slight indication, in the case of Sweet Coverers and packers, that nervous instability might be linked with accident causation. Subjects with many and large changes in skin conductivity had a higher mean accident rate than those with few and small changes. Sixteen other subjects who had a marked tremor of the hand, eye or tongue had a higher mean accident rate. To quote Report No.68, "There is nothing in this investigation to suggest that aesthetokinetic co-ordination is associated with accident proneness in all occupations, though it seems reasonable to suppose that it would be associated with it in groups doing similar work. The 'degree of association ......... is sufficiently small to make it clear that deficiency in this function accounts for only a part of the accidents sustained". Further research(Suhr 1953) has shown that "accident proneness" in both private and professional drivers is associated (circa 10 percent level of Statistical Significance) with certain scores on "The 16 P.F. Test" (Cattell, Eber, 1957) namely high Autia, low Super Ego, and low Self Sentiment Development. Other work (Dunbar 1943) has correlated certain personality profiles with accident proneness. Dunbar concludes that the focal conflict of a patient with the accident habit is in the realm of authority. When such a conflict threatens he may have an accident. A similar conclusion is reached by Tillmann and Hobbs (Tillmann and Hobbs, 1949) .... "accidents are not always chance happenings and they sometimes reflect the basic personality of the individual". Other work (Russell Davis, 1948, 1949) has suggested a link between accident proneness and the "acutely anxious" or "hysterical". Certainly his work shows that where "anticipatory tension" was increased, responses made in a test of skill became more extensive and less accurate. "Anticipatory tension" in this context means the subject's increased fear of giving a wrong response when facing complicated or ambiguous stimuli.

The concept of the accident prone individual first came into prominence in the 1920s with the work of Greenwood, Woods and Newbold (Greenwood, Woods 1919; Newbold 1926). Greenwood and Woods found that most of the accidents studied seemed to occur to a relatively small proportion of workers. They tried out three different hypotheses - that of a Simple Chance Distribution, that of a Biased Distribution and that of a Distribution of Unequal Liabilities. The first hypothesis corresponds to the idea that at any point of time all persons are equally liable to an accident. They second hypothesis suggests that "in a population initially all equally liable and exposed to risk, those who experience first accidents are by virtue of that experience rendered more or less liable to have another accident". The third hypothesis proposes "ab initio differentiation". The third theoretical distribution was considerably the best fit. The authors conclude that "so far as our present knowledge goes, it seems that the genesis of multiple accidents under uniform external conditions is an affair of personality." This conclusion assumes absolutely equal exposure and identical reporting. The authors are well aware of these assumptions they write "we have sheltering under the term individual susceptibility a motley host of motives or factors which will be very difficult indeed to separate and to measure." Newbold followed up this work and also found that a small number of workers had a high proportion of accidents. She concludes that "It is not possible in a mass examination of this kind to find how much of this may be due to individual differences in the conditions of work or how much to the personal tendency, but there are some indications that some part is due to personal tendency". She also concludes that age is one of the personal factors involved but that output is not and that these tendencies are common to men and women alike.

These concepts of Greenwood, Woods and Newbold have been re-examined. (Mintz, and Blum 1949). It is concluded that most of the variation in accident records can be attributed "to the operation of factors which are not predictable in terms of either the constant characteristics of people or of their previous accident record". They attribute only a small portion of the variance to individual susceptibility. The term Accident Proneness has been used ambiguously, - "we have not yet devised techniques of analysis which will enable us to disentangle the skeins of a confused and intricate pattern of events" (Arbous, Kerrich, 1953).

One might well conclude that in certain situations some persons might be more liable to accidents than others in the same situations but that as the situations changed the persons at risk changed also. One certainly cannot conclude with any certainty that the same persons are more liable to accidents in all situations at all times. More work needs to be done in order to partition out the various factors with any certainty.

## Ageing

Ageing is a specific human factor which must be considered, in relation to accidents and to skilled performance in general, "Experience and age are naturally closely bound together, and it is likewise generally found that older workers have as a rule fewer accidents than young ones when the conditions are more or less alike" (Newbold 1926). Newbold found that age and accidents had a coefficient with its commonest value somewhere near -0.2 for both men and women. In groups where the liability to accident was greater she found the coefficient rose to -0.4 and -0.5. She also pointed out that the connection between length of service is slight - the most common value of the total coefficient being -0.1. She found that when age was kept constant the association between length of service and accidents practically vanished, "being as often positive as negative".

Other work (King 1955) produced conflicting results, in that while certain injuries increased with age, others decreased. In an analysis of agricultural accidents King shows that, while cuts, lacerations and crushings decrease with age, the reverse is true for bruises and contusions and unspecified injuries. He concludes that the causes and nature of accidents differ with age. He criticises previous studies as being liable to misinterpretation because no proper account was taken of different exposures to risk of older and younger persons. This point is taken up in a more recent study (Griew 1958) in which accident rate is related to age and occupation. Ten different types of job were studied. (including a "miscellaneous" category). In three of these, namely 'Electrician', 'Miller' and 'Grinder', accident rate increased significantly (5% level) with age. In the 'miscellaneous' category, it decreased very highly significantly with age. The other categories showed no significance. The very interesting point emerged that there was a preponderence of younger workers in the jobs in which accident rate increased with age and that the biggest difference between observed and expected frequencies occured in the 45-52 years age group rather than in the 53 plus. Griew suggests that this last group may be atypical of its age group because many contemporaries may have moved to other jobs. He concludes that fluctuations in accident rates with age are a function of the type of work studied and are a reflection, in certain cases, of the difficulties of older workers in meeting the demands of certain types of work.

This conclusion leads into the whole question of ageing and skill because if Griew's conclusions are correct, it becomes necessary to isolate the specific demands which older workers are unable to meet so that jobs may be designed accordingly. Sensori-motor performance slows with age. This does not seem to be due to longer time required to execute the movements per se, "but to longer time needed to initiate, guide and monitor them, owing to a limitation in the capacity of central processes"........... "Where there is a choice open to them, older subjects appear rather consistently to shift the balance between speed and accuracy towards the latter" (Welford 1958). An experiment (Griew 1959) relating complexity of response with response initiation time shows there is a significant relationship for older persons (50-57 years). Response Initiation Time increases with complexity of response. It is suggested that older subjects prepare the manipulative part of their response during the period of initiation whereas younger persons prepare this during movement towards the target, older subjects being unable to prepare for this manipulation while monitoring the outward movement. A further study (Simon 1960) found that age had a greater effect on the manipulative component rather than the travel component of a task and it was suggested that this could have resulted from "increased carefullness and greater concern with accuracy on the part of older subjects." A very recent study of ageing and driving accidents (Quenault, Golby, Pryer 1968) concludes that young drivers "felt more frustration while driving ........ and took more chances than the older group".

In general however, there seems to be some doubt about whether older people in industry do have fewer accidents in proportion to their numbers despite the fact that this was taken as axiomatic until about fifteen years ago. It has been shown that older people in the 45-52 year age group have more accidents than younger persons in particular jobs and it has been suggested that the reduction thereafter was due to "first retirement". The consensus of opinion is that sensori-motor performance declines with age, in particular that part of it associated with decision and monitoring. These two aspects of ageing (i.e. Accident Rate and sensori-motor decrement) have been nicely linked in a suggestion that older people may decide upon a course of action and then carry it through despite changed conditions and that this characteristic is the possible explanation of a number of road accidents sustained by old people. (Welford 1958). It seems that there is an interesting field open for continued investigation, namely 1) precisely which characteristics of older people can be correlated with accident rate. 2) which specific occupations need to be modified so that the aforementioned characteristics are not stressed. 3) which specific occupations, may be better done by taking advantage of such characteristics.

Repetitive Work, Fatigue and Vigilance

Most studies of repetitive work make the assumption that there is a general understanding about the meaning of these words and that one type of repetitive work is much like another. It is assumed that such work involves an identical work cycle repeated every few minutes or seconds, throughout the working day or for long periods of time. It is also assumed that the work cycle is well within the physical and mental capacities of the person doing it so that after learning a minimum of conscious attention is required and measurable energy expenditure is nil.

The main concern of the various studies has been the improvement of efficiency and this has been linked with the elimination of boredom and monotony and of fatigue consequent upon these states. The provision of incentives, rest pauses and changes of occupation have played a large part in all studies. It is suggested that differences between types of repetitive work may be more important than is generally accepted from the point of view of fatigue and monotony and that, unless the jobs being done are very similar both in physical movements and end product, generalisations should not be made about the onset of fatigue.

Two types of repetitive work have been clearly distinguished i.e. paced and unpaced work. In paced work, if the speed of the machine is not carefully linked to the capabilities of individual operatives, one employee may be under speed stress while another may be underloaded and bored. The type of work dealt with in this present study is of the unpaced variety.

The first major study of industrial fatigue and repetitive work was undertaken by the Industrial Health/Fatigue Board between 1919 and 1938. The Board reported on hours of work in various industries:- munition work, tin plate millmen, women engaged in shell making. Other emergency reports were made, on hours of work, between 1940 and 1941. The conclusions reached were that very long hours of work affect the rate of working adversely and that, finally the hourly output falls so low, there is no increase in total production when more hours are worked. In the experiments, reported below, the subjects worked for three and a half hours per day so that excessive hours of work formed no part of this investigation. The main interest of the Board's work, for this paper, is in their studies relating to rest pauses.

Results of investigations into Rest Breaks (I.F.R.B. Report No.42) show that when suitable rest breaks are introduced, "the result is generally an improvement in the quality and quantity of output." and "the effect of a rest is particularly beneficial in repetitive work of a monotonous character." Also there was evidence that the beneficial effects of a rest break not only followed the rest but also occurred previous to it, presumably because of anticipation of the rest on the part of the employees. It was also found (I.F.R.B. Report No.32) that a rest break reduced variability in the time taken to repeat the same cycle of movements as the end of the working spell approached. There was a 14% reduction in the amount of time lost within the spell and there was increased contentment and satisfaction on the part of the operatives. Interestingly, authorized and expected rests were more favourable than enforced but unexpected stoppages of the same duration. The influence of the group was noted as being capable of counteracting "the particular desires or inclinations of an individual member of the group" and there was some evidence that "when two operatives were working in close association" the quicker of the two controlled the pace. In another study (I.F.R.B. Report No.47) a break of ten minutes in a five hour spell caused an increase of 6.2% in production and reduced labour turn over.

Investigations were also made into the effects of varying the forms of work in order to try and eliminate any fatigue that might result solely from monotony or boredom and into incentives (I.F.R.B. Reports Nos. 26, 52, 56, 69, 77). The conclusions reached were that varied forms of work increased production and reduced irregularity but that too many changes were detrimental to the swing of the work. Highest output was obtained when the form of activity was changed after one and a half to two hours of unvaried work. The experience of boredom was found to be prevalent and caused a reduced rate of working which was particularly noticeable about the middle of the working spell. Piece work payments rather than a time rate, a compact social group, suitable changes of activity and rest breaks all tended to reduce boredom. So also did the arrangement of the work as a series of self contained tasks. (I.F.R.B. Report No.56).

There was less boredom when the work was under the control of the operative rather than paced by the machine. (I.F.R.B. Report no.77). Four typical output curves were suggested as being indicative of a range from no boredom, through slight and moderate boredom to severe boredom. The "no boredom" type curve indicated successive decrement in output where the employee was interested but there was progressive fatigue. The "severe boredom" curve was the reverse of this and the slight and moderate curves were "U" shaped. Some 49% of employees complained of fatigue in the study but only 3% referred the fatigue to the parts of the body actually used in the work. Later work (Smith 1950, 1953) throws doubt on the idea of a consistent or characteristic work curve and suggests that the "rate of work and changes in rate throughout the day were determined by the workers concept of a proper days work and were not observably relatable to feelings of boredom". Behavioural criteria could not be related to reported boredom. Talking, rest pauses and variability of behaviour were considered to be determined primarily by the social situation.

Repetitive work and fatigue have been made the subject of a more recent study (Murrell 1962), which has the object of specifying the onset of fatigue more precisely. The term "actile period" is used to describe "the time during which a worker can maintain concentration upon the task in hand". The term is defined as "A period during which there is a state of preparedness to respond optimumly to stimulation either discretely or continuously". It is considered that if activity is continued beyond the actile period there will be deterioration of performance and output will begin to fall. Murrell re-examines the data in the I.F.R.B. Report No.32 and suggests that the end of the actile period is signalled by the appearance of long cycle times, namely those more than two standard deviations above the mean times for the self paced work. He further suggests that a rest pause will reduce the number of long cycle times and will result in a fresh period of actility. A laboratory study was carried out to test these proposals. (Murrell, Forsaith 1963). Long times were based on the mean work cycle time at the end of a warm up period. This led to the danger that long cycle times might be solely a function of output. It was found that a correlation did exist in the case of both subjects but that these correlations were not statistically significant. It was concluded that long times were a measure of a factor which was independent of gross fluctuations in output. It was found that the number of long times increased markedly after $1\frac{1}{4}$ hours and $2\frac{1}{2}$ hours of work. The thesis was that these long times indicated the end of the actile period, namely the point at which deterioration of performance commenced. Various conditions of Rest Breaks and No Rest Breaks did not affect total output significantly, but hourly rate of work was highest under a condition of two breaks of five minutes one hour and two and a quarter hours after work commenced. Variability for one subject was significantly different between the No Rest Breaks condition and all the breaks conditions combined. None of the other subject's variability results were significant. However, when the results for the two subjects were combined, for summed differences, the condition with two breaks, $1\frac{1}{4}$ hours and $2\frac{1}{2}$ hours after the commencement of work, was significantly different from all the other conditions. The conclusion suggested was that "long times" did indeed indicate the point at which deterioration of performance commenced and that this proposal warranted further investigation. The concept of the "actile period" is associated with vigilance tasks. (Murrell 1962). An interesting point seems to be implied here namely that the effect of twenty minutes to a half hour of a vigilance task has a similar fatigueing effect to one and a half or two hours of repetitive work and vice versa. The question arises as to whether or not the effects would be cumulative if a vigilance task was combined, as a rare event, with a repetitive work task. If this is the case there would be a deterioration in both tasks after half an hour and a further big deterioration in both tasks about forty five minutes later. Should there be no cumulative effect, i.e. should the Actile Period be solely task associated rather than associated with a general fatigue factor for a particular subject, then one would not expect the ending of the Actile Period for one task to effect the efficiency of the other. This point is relevant to the present study in which response to a rare event is combined with a repetitive work task.

"Vigilance is the name given to human performance where a faint and infrequent signal has to be detected at an uncertain time" (Broadbent 1964). Another definition might be "sustained efficiency" in monitoring "some display in search of critical but infrequent signals".... "it is clear that many signals well above absolute threshold are not detected either early or late in the session" (Holland 1958). It would seem that there is some disagreement about whether or not the signals need to be of low intensity in addition to being infrequent. It is suggested that either the faintness of a signal or its infrequency alone would be a sufficient criterion to justify calling a task a vigilance one providing that the strength of the signal was not such as to command attention rather than be available for it.

"As research on vigilance increases, it becomes evident that no one theory will account for all the phenomena" (Broadbent 1964). This lack of a unified theory need not involve the rejection of existent theories as partial explanations of the phenomena. In short vigilance decrement may be a function of intersignal intervals, probability of wanted to unwanted signals, signal strength, sensory modality, stimulus rate, signal location and/or time on watch. (Baker 1962, Buckner, McGrath 1963, Colquhoun, Baddeley 1964, Broadbent 1964).

McGrath (op.cit.) found that the percentage of signals detected by all subjects on all watches declined as a function of time on watch. Broadbent (op.cit.) quotes results from an experiment by Colquhoun which show that the probability of a stimulus being a signal is an important variable in detection. When there was a low probability of wanted to unwanted stimuli the percentage of detected signals dropped by 16% and 18%. McGrath (op.cit.) states that "the major criterion of performance on vigilance tasks is the detection of signals and the probability of detection within some specified limit following the occurance of the signal is the appropriate measurement of vigilance performance."

The relevant points for this study are the suggestion for an appropriate measurement, the probability of wanted to unwanted signals and the length of time on watch. The other factors mentioned above were held constant or were randomized, i.e. sensory modality, strength of signal and signal location were held constant and intersignal intervals were randomized. Signals were rare and a pretest expectancy was not given.

Response Times

The Reaction Time experiment was introduced into psychology as a result of research by Helmholtz into the speed of the nerve impulse. In 1850 he estimated that the speed of transmission along the motor nerve was about ninety feet per second. He also studied the sensory nerve and found transmission to be between fifty and one hundred feet per second. This demonstrated that sensation, thought and movement followed each other in temporal order and that actions were not instantaneous expressions of will. This posed some questions about the times needed for the functioning of different parts of the system i.e. receptors, conduction along the sensory nerves, central processes,conduction along the motor nerves and muscle contraction.

The term Reaction Time was originated by Exner in 1873 and following the establishment of Wundt's laboratory in Leipzig in 1879, the Reaction Time experiment in its various forms became established as an important part of the new "physiological psychology". "The history makes an instructive study in psychological method" (Woodworth, 1938).

Largely due to early difficulties of instrumentation, the Reaction Times recorded inevitably contained an element of Movement Time as well as the time occupied by sensing, transmission along the nerves and central processing. In order to make the distinction clear between internal lags and movement times, the term Response Initiation Time was introduced to emphasise the precise meaning of what had previously been called Reaction Time. Still more recently the term "Response Latency" has been used synonamously with Response Initiation Time. The term Response Time is generally used to include the total period between the appearance of the stimulus and the completion of the response.

The use of these various terms in relation to the present study is set out below:-

| CONTEXT | TERM | BEGIN | END |
|---|---|---|---|
| Work Cycle | Response Initiation Time | Appearance of Green Light | Release Button "C" |
| | Movement Time | Release Button "C" | Press Button "D" |
| Rare Signal | Reaction Time | Appearnce of Red Light | Press Button "E" - Preliminary Experiment |
| | | | Press Strip Switch Main Experiment |

The three main forms of the Reaction Time experiment relate to:- a) Simple Reaction b) Choice Raction c) Serial Reaction.

Simple Reaction "is simple in presenting a uniform stimulus and requiring a uniform response"........ The subject "knows in advance what stimulus will come and what response he will make. He places his finger on the response key or button in advance of the stimulus. Simple Reaction Time is a function of a number of different variables including the foreperiod, the strength of the stimulus and the sensory modality involved. Reaction Time to a visual stimulus is in the region of 200m.sec. to 250 m.sec. after a few trials. When the stimulus is a sound or touch, Reaction Time is in the region of 150 m.sec. and may sometimes be as low as 100-120 m.sec. (Woodworth and Schlosberg 1954). Reaction Time is a negative function of the strength of the stimulus, i.e. if the light is increased by a relative intensity of seven to one Reaction Time falls from 280 m.sec. to 205 m.sec. The area and duration of the stimulus are also important, Reaction Time being a negative function of both down to a limit of about 180 m.sec. (op.cit.). The foreperiod variable will be dealt with when Serial Reactions are discussed later in this Chapter.

Choice Reaction tasks are those "where different responses have to be made to each of several possible signals" (Welford 1968). Choice Reactions take longer than simple ones. Welford discusses work by Hick who found that if the number of possible signals is taken as n then Mean Choice Reaction Time = K log(n+1). Using logs to the base 2, log(n+1) = 1 when n = 1 so that K = Simple Reaction Time. Choice Reaction Time for two alternatives is approximately 316 m.sec. (Merkel 1885 - quoted by Woodworth and Schlosberg 1954). Choice or disjunctive reaction time is lengthened if the stimuli are alike and therefore more difficult to distinguish - i.e. when stimuli lights are coloured Red and Green the average choice reaction time is 203 m.sec. as compared with 246 m.sec. for Red and Orange lights (op.cit.). Signal response compatibility, practice, and different signal probablities also effect choice Reaction time as does the number of signal-response connections (Welford 1968).

The third major form of the Reaction Time experiment relates to Serial Reaction. This is closely linked with the tracking experiment and requires a rapid series of responses to a series of stimuli. When the interstimulus interval (i.e. the foreperiod for the second stimulus) is about 0.5 secs. or less, the reaction time for the second stimulus is usually longer than for the first. Telford (1931) found that when the interstimulus interval was 0.5 secs., reaction time for the second stimulus was about 335 m.secs. as compared with about 250 m.sec. for a single stimulus. Vince (1948) found that intersignal intervals from 0.5 secs. down to 0.05 secs. caused longer reaction times for the second signal. Some of these times were found to be in the region of 510 m.sec. Similar delays have been reported when the responses required did not interfere physically with one another. (Hick and Bates 1950; Davis 1956, Broadbent and Gregory 1967). Davis did not find increases in the second reaction time unless the intersignal interval was less than 0.25 secs. Broadbent and Gregory found increases with intersignal intervals of up to 0.55 secs. The tasks in the two experiments were different and Davis' subjects were highly practiced, which may account for the different results. It would appear to be indisputable that there is a longer reaction time for a signal given during the reaction time to a previous signal. Welford (1952) proposed the following formula for the second reaction time:-

$$TR_2 = TR_1 + TD_2 - I \quad (I < TR_1)$$

I = Intersignal Interval. $TD_2$ = time to process data from the second signal. He later (1968) amended this to take account of feed back from the responding organ thus:-

$$TR_2 = TP_1 + TC_1 + TE_1 + TK_1 + TP_2 + TC_2 + TE_2 - (I + TP_2)$$

TR = time to react

TP = time taken in sense organs and afferent pathways

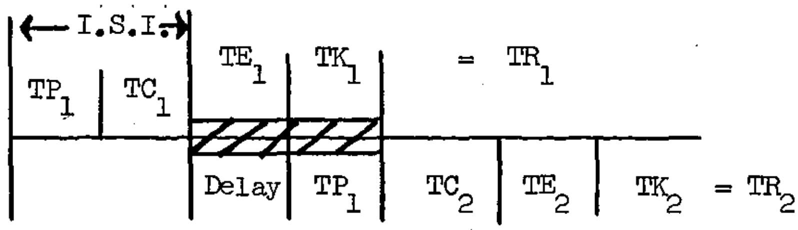
TC = Time taken in central mechanisms

TE = " " " efferent pathways

TK = " " " for Kinaesthetic or other feed back to each the brain from the responding limb.

Since $TP_1 + TC_1 + TE_1 = TR_1$ and $TP_2 + TC_2 + TE_2 = TD_2$, the second equation reduces to the first if $TK_1 = TP_2$.

1st Signal 2nd Signal




Some work has shown that reaction time to a second signal may also be longer, when this signal is given after the end of the first reaction but during the movement time associated with the first signal. Welford (op.cit.) suggests that such a signal could only be dealt with after Feedback from the first reaction had ended. The following formula was proposed as an expression of the time relationships involved:

$$TR_2 = TR_1 + TD_2 + TFb_1 - 1 \quad (TR_1 < I < (TR_1 + TFb_1))$$

A time of 150 m.sec is suggested for $TFb_1$. The symbols used are the same as in the previous formula with the addition that $TFb_1$ = Time for feedback. $TD_2$ cannot start until $TFb_1$ is complete i.e. within about 150 m.sec of the finish of the first reaction. Welford suggests that $TFb_1$ would be eliminated in the case of repetitive workers and others who "exercise a skill over a number of years".

Work has also been done on the influence of a second signal on the Choice Reaction Time to a first signal. Gottsdanker et al (1963) found that the first reaction time for a double-choice condition was longer than reaction time for a single choice condition. He concluded that reaction time for a choice is lengthened when a subject expects to make a second choice which is to be signalled 0.5 secs. after the first signal. It should be emphasised that he does not conclude that it is the second signal, per se, which affects the reaction time to the first but rather the subject's expectancy of a second signal. He was at pains to separate the two signals by 0.5 secs. in order to avoid the influence of the second signal per se.

Gottsdanker (1966, 1967) followed this up with experiments to test the effect of superseding signals on graded responses made by a single anatomical unit - one hand. In these experiments he found that the initial reaction time (i.e. time between signal and start of response) was not affected by the second signal. He did find that the second signal had an effect on the response as opposed to the reaction time to the first signal. For inter-signal intervals "of 50 m.secs. through 120 m.secs." he found that there was greater reduction in the amplitude and duration of the initial response as the inter-signal interval was briefer. He found no effect for an inter-signal interval of 240 m.sec. by which time the response had almost always started, (94% of the trials). He concludes that for intervals through 90 m.secs. there was only a small proportion of the distributions of which half or more than half could possibly be attributed to the first signal alone and that this finding made untenable the existence of an invariable condition of imperviousness during the reaction time period.

Bertelson (1967) experimented with the effect of interstimulus intervals on reaction times to both first and second signals. The signals required choice reactions with different hands, i.e. it was not necessary to curtail or restrict the first reaction when the second was also required. He found $R.T._1$ to be slightly longer when a second signal followed. The second signal was expected by the subjects though on certain trials the precise time of its arrival was not known. Berelson suggests that the lengthening of $R.T._1$ on double trials may have been due to the adoption of a more cautious strategy. This finding is in line with that of Gottsdanker (1963).

In the same experiment Bertelson also observed the effect of the inter-stimulus interval on $R.T_2$ and his results in part agree with the single channel model but not entirely. He found that $R.T._2$ still decreased for positive values of "W" (I.S.I. - $R.T._1$) which implied that occupation of the channel lasted on average longer than $R.T._1$. Very interestingly, he found that the slope of the curve, when $R.T._2$ was plotted against negative values of "W", was inferior to $45^o$ which implied that the channel was not fully occupied by the first reaction so that something could possibly be done about the second reaction during the "refractory period". This finding tends to support Gottsdanker's (1966) thesis. Bertelson found delays in $R.T._2$ with both Regular and Irregular I.S.I., but with irregular intervals the delays were longer. This finding is very difficult to explain if the idea of a fully occupied channel is accepted. Bertelson explains it by saying that knowledge of when a second signal will come makes it possible to programme a faster passage from one occupation time to the next.

Movements as distinct from their initiation have been defined "as reactions in which the contractions of the muscles affect the position of the moving member" (Stetson and McDill 1923). They classified movements as (1) Fixation i.e. holding still, (11) slow movement or controlled movement, muscles contracted with uneven tension, which can be changed at any point on its course (iii) rapid movement which is a matter of preliminary set and which cannot be changed at every point on its course. The extent to which movements are subject to voluntary control has been the subject of research. Woodworth (1899) quoted by Stevens (1951) distinguished two phases of voluntary movement, the first was an initial impulse lasting about 0.2 secs. and the second he called "current control". A value of about 0.5 secs. was reported for the interval between successive adjustments in the current control phase Welford (1958b) proposes, on the basis of work by Vince and others, two servo loops. The first, he suggests, is a short term loop occupying a time of 0.1 secs., concerned with the immediate phasing of movement, and not occupying the central decision mechanism. The proposed second loop occupies a time of 0.5 secs., relies on visual feedback and involves the central mechanisms. Very little work has been done on stopping movement. Bates (reported by Hick and Bates 1950) showed that once a decision to respond had been taken it could not be revoked in under 0.2 to 0.25 secs. In this case the signal involving cancellation was given prior to any perceived movement. Poulton (1950) reports an experiment which indicates that an ongoing movement cannot be stopped immediately. He found subjects needed "roughly about 0.25 secs. longer" than ordinary reaction time in order to stop moving. He goes on to say that if a bell was rung "0.6 secs. before the point was reached at which the movement had to be stopped, reaction time, when that point was reached, could apparently be eliminated" and that when a bell was rung 0.3 secs. before hand the results were intermediate between a no warning and a 0.6 sec. warning period. This seems to imply that subjects never take more than

0.6 secs. to stop movement though sometimes they can stop in a shorter time. There is a relationship between Reaction Times and subsequent movements. If the following movement is circular, Reaction Time increases (Pacaud 1942). When the following movement required precise aim it was found that auditory reaction time was 250 m.sec. instead of the more usual 150 m.sec. (Brown and Slater-Hammel 1949). Singleton (1954) in an experiment concerned with the change of Movement Time with age, found that Reaction Time preceeding a double movement was consistently a little longer than that preceeding a single one. In view of the brevity of certain movement times in relation to Response Initiation Times, it follows that such movements cannot be controlled en route and must therefore be preprogrammed. Hence it is reasonable that more elaborate prior programming should be associated with augmented response latency.

<u>Practice Effects</u>

This note is not concerned with explanatory theories of learning. Its purpose is to mention some changes noticed in performance with continued practice. The typical learning curve shows an initial period of positive acceleration, followed by a period of steady gain and then ends with negative acceleration as the limit is approached. Many curves have plateaus before the final level is reached. These may be due to a more difficult element in the task which blocks further improvement until it is mastered or may be due to practice limits for inferior ways of performing the task. (Woodworth and Schlosberg 1954).

There is evidence that simple industrial tasks continue to improve for years. Crossman (1959) shows that, in cigar making, work cycle times continued to improve over millions of work cycles.

Welford (1968) mentions the following effects of long continued practice:-

a) Improved data selection and judgement

b) Action becomes more precisely adapted to the requirements of the task and reliance on detailed knowledge of results becomes less.

c) Long practice may result in reduction of the time required to make a choice of response once the signal has been identified.

d) Routines of action are established. In consequence incoming data and outgoing action are dealt with in larger units.

Such tendencies lead to increased uniformity and performance becomes less variable but they can also lead "to 'rigidity' in the sense that action is carried through in the face of clear evidence that it is inappropriate". (op.cit.).

## 3. THE ARGUEMENT A PRIORI

The work discussed in the previous chapter leads to the postulation of expected relationships between the independent and dependent variables in the experiments described later.

The dependent variables are Work Cycle Time, Response Initiation Time, Movement Time, Reaction Time and the percentage of Work Cycles "Broken" (i.e. the capacity to cut short an on going response). The independent variables are Subjects, Period of time after the start of the working session, Rest Breaks/No Rest Breaks, Practice and the point in the Work Cycle at which the rare or stop signal was given.

Differences between subjects may be expected to affect the dependent variables, with older subjects and those with lower scores on the Manual Dexterity Test having slower times. Higher I.Q. scores may result in subjects becoming bored more easily and this may lead them to work more slowly in the middle of the working spell.

It is difficult to predict the relationship between intra-subject differences and the percentage of cycles broken. It might be argued that older people should break fewer cycles as their decision time is longer than that of younger people. It could equally well be argued that older people may compensate for their slowness in decision processes by moving more slowly, thus allow themselves greater tolerances. Assuming that there is a minimum time needed to process a signal to interrupt an ongoing response, it might be that younger subjects move too quickly to allow a sufficient lapse of time, for this processing, between the rare signal and the normal completion of a movement or response.

The assumption, that the rare signal and its required response is a simulation of accident conditions, leads to the expectancy that lower scores on the manual dexterity test and higher scores on certain of "The

16 P.F. Test" factors will result in fewer Broken Work Cycles. The age effect is uncertain.

Allowing for a short warm up-period, for possible boredom effects and for end of session attempts to reach a target, the Work Cycle Times etc. should be negative functions of time elapsing after the start of the working session. In short a fatigue effect should be apparent whether it is on Work Cycle Times or the capacity to perceive and respond to the rare signal. Greater variability would also be expected as the time elapsing after the start of the working session increased. When Rest Breaks are given these fatigue effects should not show themselves in so marked a fashion.

Cycle, Response Initiation and Movement Times should improve with increased practice and variability should decrease. The effects of increased practice on the Reaction Times and percentage of Cycles Broken cannot be so readily predicted. The normal improvement, due to practice, might occur but it could equally well be that improving skill at the repetitive work cycle might lead to "rigidity" and therefore increased difficulty in responding to a signal to interrupt that cycle. This increased difficulty might be in the central mechanisms or it could be that a faster movement time might result in such a decrease in time between the rare signal and the normal completion of movement that the usual time necessary to process a response simply would not be be available.

In the experiments which follow, "Reaction Time" is not the time required to break or interrupt a work cycle. It includes this time plus time for an element of action necessary to turn out the red light (or rare signal). It does not differentiate between these, it measures the entire time between the rare signal and the turning out of the red light. The points of injection of the rare signal during response intiation will therefore effect "Reaction Time" differently from any effect they may have on "Cycle Broken" - because a subject cannot start to break the cycle until Response Initiation Time is complete whereas "Reaction Time" starts with the point of injection. One would therefore expect that earlier points of injection would result in longer "Reaction Times" when the Interstimulus Intervals were smaller than Response Initiation Time.

Different points of injection should make no difference to "Reaction Times" when the Interstimulus Interval is longer than Response Initiation Time providing one makes the assumption that there is no interference from fixed periods of feedback. A fixed period of feedback at the end of Response Initiation Time/Beginning of Movement Time should result in longer "Reaction Times" in response to earlier points of injection whereas the reverse should occur if the interference is coming mainly from positioning efforts at the completion of movement.

The point of injection of the rare signal into the repetitive work cycle might affect the percentage of cycles broken in a number of ways. Unless the second signal is perceived as one with the first, the points of injection during Response Initiation Time should make no difference to the percentage of cycles broken because in both cases the start of the second response should have to wait until the completion of Response Initiation Time. When the rare signal is injected during Movement Time, the points of injection should make no difference if they are inside feedback time for the Response Initiation, or the beginning of movement. However if such feedback was eliminated, due to practice, then a difference in favour of earlier points of injection might be expected. The lapse in time between $P_1$ (first point of injection) and the normal ending of the movement would be greater than the lapse of time between $P_2$ and the normal ending and thus the first condition would allow more time to process responses to the rare signal.

When the lapse of time between the rare signal and the normal ending of Movement was less than 500 m.sec - 600 m.sec., one would not expect the subject to have sufficient time, on average, to process the response to a signal to interrupt the movement. A time lapse of 600 m.sec - 700 m.sec. (i.e. the normal movement time less the rare signal delay) should allow for successful processing in almost every case in accordance with Poultons (1950) results.

# PART II EXPERIMENTAL INVESTIGATIONS

# CHAPTER 4 THE PRELIMINARY EXPERIMENT

## INTRODUCTION

This experiment was very much a preliminary one with two main objects viz:-

1. To see whether or not there was a noticeable difference in responses to rare stimuli given during Response Initiation Time and Movement Time. (Hartnett. 1967. Appendix 5). This information was necessary in order to decide whether or not to plan a complicated and large scale experiment.

2. To test equipment under continuous and lengthy use conditions. Such testing, which turned out to be very necessary, (eight to eleven weeks were needed to eliminate the weak links) could not be given except in the full use situation. One of the points about the intended experiments was that, if there was a break-down in the equipment, the subject could not be replaced by another the following afternoon. The data was either lost or the entire experiment was ruined. If the equipment was not reliable this could happen after weeks of experimental work and hundreds of subject hours. In the main experiment, an unbroken period of eight weeks, 560 subject hours, the fact that no "Stimulus Cycle" Data was lost and very little Cycle Time Data justified the time spent on this initial testing under working conditions.

## THE EQUIPMENT

1. Four Consoles (Please see Figs. 1 and 2)

Both the green and red lights on the consoles were within $30^\circ$ of the normal visual axis of the subjects.

The consoles were made of $\frac{3}{8}$" ply front and back and $\frac{1}{4}$" ply at ends. The buttons, painted white, were of turned sapele mahogany $\frac{7}{8}$" diameter. When the buttons were pressed they operated micro-switches.

2. Work Pieces - $\frac{1}{2}$" steel ball bearings.

3. Stimulus Lights

$\frac{3}{8}$" diameter filament bulbs coloured red and green. The green light was turned on by pressing buttons "B" and "C". simultaneously and holding them. There was a fixed delay of $\frac{1}{2}$ second between the initial pressing of the buttons and the illumination of the light.

The power to the red light was controlled by:

(1) the experimenter's switch,

and

(2) a delay device triggered either by

(a) the illumination of the green light,

or

(b) the release of button "C" by the subject.

Both conditions (1) and (2) had to obtain. Therefore, the experimenter was free to choose the work cycle during which the red light should come on and also the part of that cycle, but the actual illumination of the light was triggered by the subject's movements within her work cycle. The subject could turn the red light out by pressing button "E".

4. Timing Devices

(A) Venner Electronic Millisecond Stop Clocks automatically timed the intervals between (1) the illumination of the green light and the release of button "C". (Subject's Response Initiation Time) OR between the release of button "C" and the depression of button "D" (Subject's Movement Time). (2) the illumination of the red light and the depression of button "E" (Subject's Reaction Time).

(B) The subjects' cycle times were recorded on magnetic tape and later transferred to punch tape suitable for feeding into a computer (I.C.T. 1900 series).

(C) A light signal on the Experimenter's console indicated whether or not a subject had broken the work cycle.

5. General

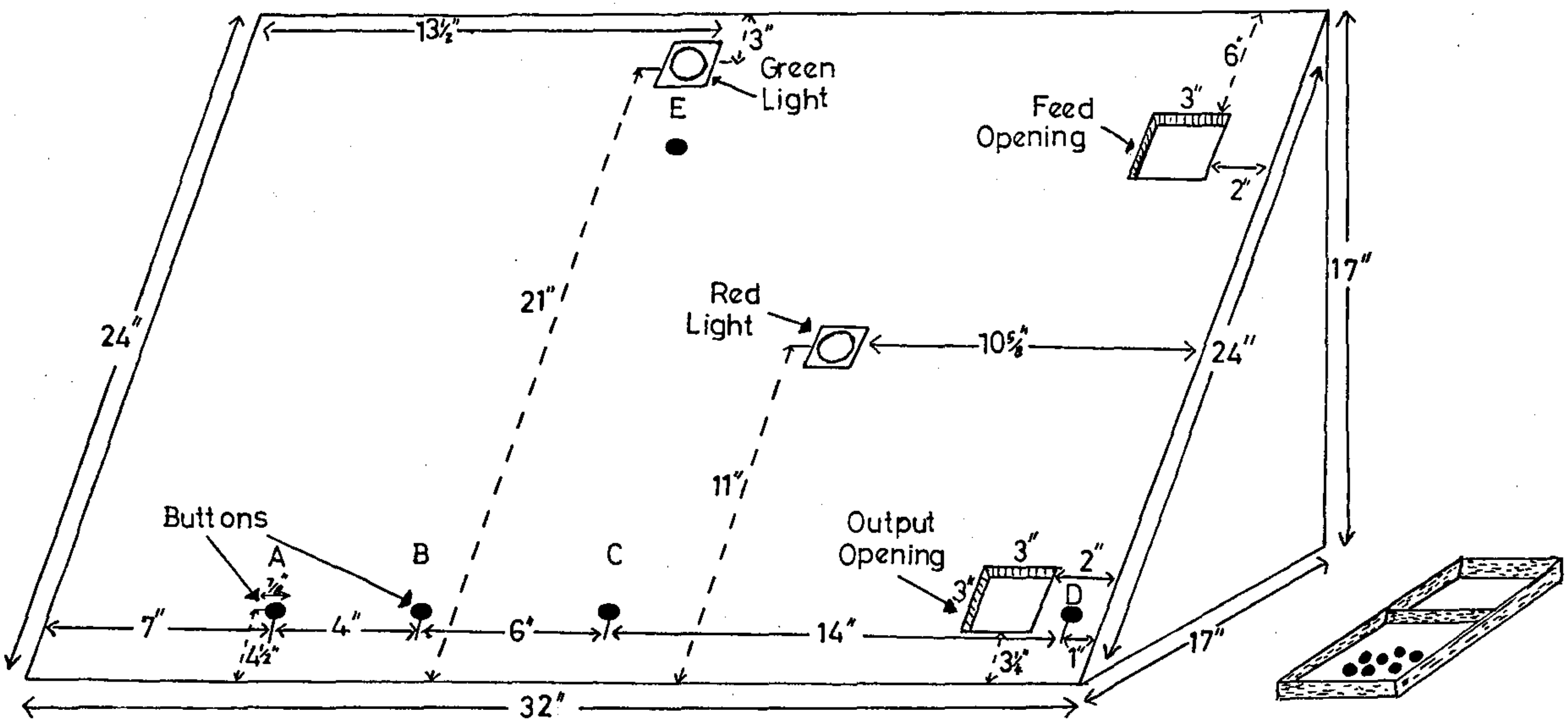
The consoles were mounted on tables 26" from floor level.

Four Tan-Sad Posture Chairs were used. The seats and back rests were adjustable. The chairs were not padded and subjects 1 and 3 brought cushions.

6. Knowledge of Results

Four counters which counted the number of cycles done by each subject were mounted together within the view of all four subjects in order to give them some extra motivation and involve them in some competition. This was not found to be satisfactory because subject 4 became so competitive that she disturbed the other subjects. After the first few days the counter was removed from view. The subjects were given their counts only in the middle and at the end of each daily session and the atmosphere became less tense. The data in this paper was recorded after an introductory period during which the above difficulty was dealt with.

<u>SKETCH OF CONSOLE (1966)</u>




BOTH THE RED AND GREEN LIGHTS WERE WITHIN 30 DEGREES OF THE NORMAL VISUAL AXIS OF THE SUBJECTS

Fig. 1

Fig. 2

## SUBJECTS

Four women were employed as subjects, one of whom (Subject 3) had previous industrial experience, She had not been engaged on repetitive machine work.

The subjects were well motivated in that all of them wished to work or save for some particular object and they were very pleased to get part time employment. Three of the women were married and the fourth was an unmarried student.

Two tests were given to each subject:- The Wechsler Adult Intelligence Test, and the Eysenck Personality Inventory (Form B).

Subject 1: Married, Age 54, Right handed.

| | | | | |
|---|---|---|---|---|
| Wechsler Scores - | I.Q.: Verbal = 115, | Performance = 101, | Full Scale = 108 |
| | Scaled: " = 73 | " = 40 | " " = 113 |

E.P.I. Scores - N=13 E=12 L=1

Subject 2: Married Age 52, Right handed

| | | | |
|---|---|---|---|
| Wechsler Scores - | I.Q.: Verbal = 95, | Performance = 99, | Full Scale = 96 |
| | Scaled: " = 53 | " = 40 | " " = 93 |

E.P.I. Scores - N=11 E=17 L=0

Subject 3: Married, Age 40, Right handed

| | | | |
|---|---|---|---|
| Wechsler Scores - | I.Q.: Verbal= 110, | Performance, = 96, | Full Scale = 104 |
| | Scaled: " = 70 | " = 43 | " " = 113 |

E.P.I. Scores - N=14 E=12 L=2

Subject 4: Unmarried, Age 22, Right handed

| | | | |
|---|---|---|---|
| Wechsler Scores - | I.Q.: Verbal= 125, | Performance, = 115, | Full Scale = 122 |
| | Scaled: " = 85, | " = 62 | " " =147 |

E.P.I. Scores - N=17 E=20 L=0

See Appendix 3 for copies of the Score Sheets and for Notes on the Tests

The competitiveness of Subject 4 was mentioned in Paragraph 6 of the chapter on Equipment. Her initial repeated references to Work Cycle counts and to who was doing better or worse than whom, alternately irritated and amused Subjects 1 and 2. Subject 3 was upset to the extent that she and Subject 4 started to bicker - with Subjects 1 and 2 acting as peacemakers or amused observers.

Subjects 1 and 2 spoke of the youth of Subject 4 a number of times. It became obvious that the greater age gap between these two Subjects and Subject 4 (as distinct from the lesser gap between Subjects 3 and 4) helped them to be more detached than Subject 3 in the matter of competition. Additionally Subjects 3 and 4 were seated beside one another and the speeds of their respective movements were clearly visible to each other.

Relationships greatly improved when the knowledge of results method was changed. Thereafter there was only the occasional bicker between Subjects 3 and 4.

The E P.I. Neuroticism ("N") Scores for Subjects, 1, 2 and 3 were within 1$\sigma$ of the Means for the General Population of Housewives and the Normal Population. The Neuroticism Score for Subject 4 was more than 1$\sigma$ above the Means for the General Population of Students and Normal Population. It was within 2$\sigma$ of these Means. It most nearly approached the Mean Score of 16.696 given in the Manual of the Eysenck Personality Inventory as typical for Obsessional Groups. It also approached that given for Female Prisoners:- 16.408 (Eysenck, Eysenck, 1964).

The Extroversion ("E") Scores for Subjects 1, 2 and 3 were within 1$\sigma$ of the Means for the General Population of Housewives and the Normal Population. Subjects 4's "E" score was more than 1$\sigma$ above the Mean for the General Population of Students and the Normal Population. It was within 2$\sigma$ of these Means. It was clearly very different from such scores given for the

Neurotic groups which tend to be lower than those for the Normal Population. Female Prisoners tend to have a higher Mean "E" score than the Normal Population and Subject 4's score was within 2$\sigma$ of this also.

The I.Q. Scores for Subjects 1, 2 and 3 come in the "Average" Classification. Subject 4's Score comes in the "Superior" Classification (Wechsler 1955).

All the scaled scores for Subjects 1, 2 and 3 were $< 1\sigma$ from the Mean Scores for their respective age groups. Subject 4's Verbal and Full Scale scores were $> 1\sigma < 2\sigma$ above the Mean for her group. Her Performance Score $\simeq 2\sigma$ above her age group mean.

# EXPERIMENTAL PROCEDURE AND DESIGN

1. General (Please see Figs. 3, 4 and 5)

During a run of repetitive work cycles the subjects were presanted unexpectedly with a task which involved a break in the rhythm and cycle of their repetitive work.

2. Subject's Repetitive Work Cycle

Each of the four subjects performed repetitively the following work cycle:-

(1) She picked up a ball bearing from the tray with her right hand and dropped it in the feed opening.

(2) She pressed buttons "B" and "C". Button "B" with her left hand and button "C" with her right.

(3) She held buttons "B" and "C" pressed until the green light came on(half second delay).

(4) She then released both of these buttons.

(5) Following this she moved her hands to buttons "A" and "D" - button "A" for the left hand and button "D" for the right one. She pressed buttons "A" and "D" simultaneously and the ball bearing fell into the output opening.

(6) She then lifted the ball bearing out of the output opening and placed it in the tray.

(7) She returned to (1) above.

Forefingers were used to press the buttons.

3. Procedure when Red Light came on

Subjects were instructed to stop immediately, no matter where they were in their work cycle, and press button "E" in order to turn the red light out. The button was to be depressed by using the right hand. Subjects were practiced in this procedure before the start of the experiment.

4. Duration of Experiment

The experiment continued for three and a half hours a day, from 9.00 a.m. to 12.30 p.m., through 20 days, five days a week for four weeks. A fifteen minute rest break was given from 10.30 a.m. - 10.45 a.m. e.g. between Periods 3 and 4. The subjects were highly practised for some eight weeks before the experiment began.

5. Dependent Variables

| | | |
|---|---|---|
| (1) | Cycle Time:- ($\bar{x}$., S.D., %>Mean+2 S.D.) | Duration of each work cycle recorded. |
| (2) | Reaction Time:- ($\bar{x}$) | Time between illumination of red light stimulus and subject switching it off by pressing button "E" |
| (3) | Response Initiation Time. R.I.T. (Stimulus Cycle):- | Time between illumination of green light and release of button "C". Measured only during those work cycles in which Red Light Stimulus was given wit delay in R.I.T. |
| (4) | Movement Time.M.T. (Stimulus Cycle):- | Time between release of button "C" and pressing of button "D". Measured only during those work cycles in which Red Light Stimulus was given with delay in M.T. |
| (5) | % Cycles Broken/Not Broken | |
| | Cycle Broken = | If Subjects turned out red light by pressing button "E" BEFORE pressing button "D". |
| | Cycle Not Broken = | If button "E" pressed AFTER button "D". |

6. Independent Variables (see Fig. 5)

(1) Days of Experiment (1-20)

(2) Days of Week (1-5)

(3) Fortnights of Experiment (1-2)

(4) Periods in day (1-7) 30 mins each; starting 9.00 a.m.

(5) Stimulus from Red Light

Once, per period, per subject. The Stimulus was given at one of the following times:-

(a) in each period:- 5, 10, 15, 20 or 25 minutes after the period began. These times were randomized - using random numbers tables.

(b) in each stimulus cycle:-

(i) R.I.T.:- with a delay of ($\alpha$) 10 m.sec. or ($\beta$) 100 m.sec after the illumination of the green light

(ii) M.T.:- with a delay of ($\alpha$) 10 m.sec. or ($\beta$) 20 m.sec. after the release of button "C".

7. <u>Notes on R.I.T./M.T. Delay Condition</u>

Whether or not the stimulus was given in R.I.T. or M.T. bears no relationship to the Cycle Time, Response Initiation Time or Movement Time Measurements. Response Initiation Time was measured only in those work cycles in which the delay was in R.I.T. and with a change in the relevant details . the same is true for Movement Time Measurements.

The condition does apply to Cycle Broken and Reaction Time measurements and is confounded with Days of Experiment for these dependent variables. There was a considerable work-load on the Experimenter - namely the setting of conditions and the manual recording of all the data apart from Cycle Times. In a trial run it was found that if the stimulus was continually changed in any one day from the R.I.T. to the M.T. condition (a procedure necessary for balancing over Days, Weeks, etc.)

then the Experimenter could not keep track. The continuous switching also affected the equipment adversley causing it to become "temperamental". For both of these measurements it was possible to get an indication of learning or otherwise from the "Fortnights" independent variable.

8. <u>Notes on Delays within R.I.T. and M.T.</u> (10, 20 and 100 m.sec. delay)

These delays are balanced over six of the Periods of the Day but not the seventh during which a zero delay was tried unsuccessfully. This lack of balance makes it necessary to look on the significances obtained or lack of them with caution - and very much only as indicators. The results of the $\chi^2$ test for Cycles Broken in relation to delays is not affected. It is the Analyses of Variance Results, for Periods of the Day in particular, which need cautious interpreting. Cycle Time measurements are not affected. These difficulties were eliminated in Experiment 2 - the main experiment.

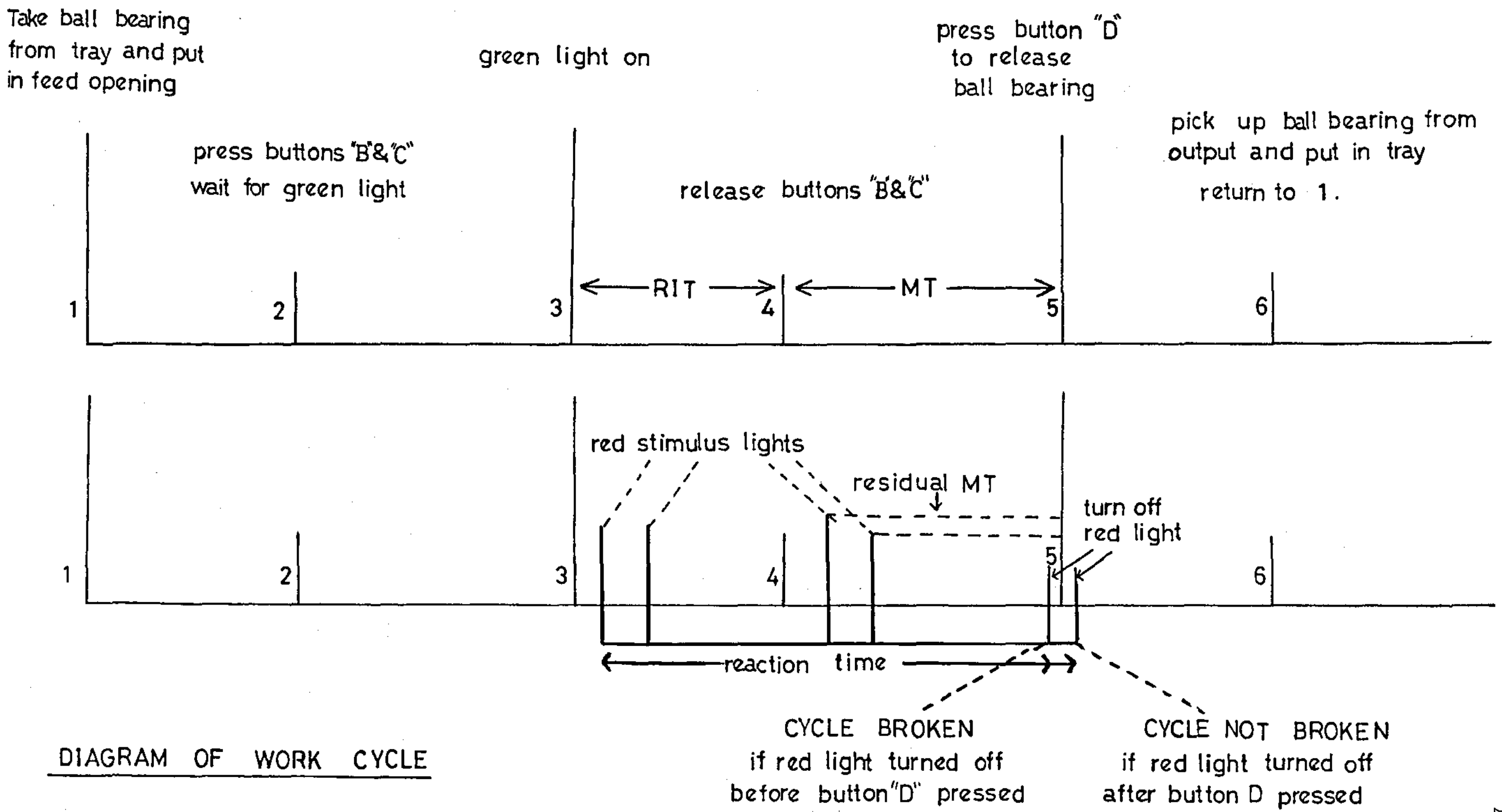
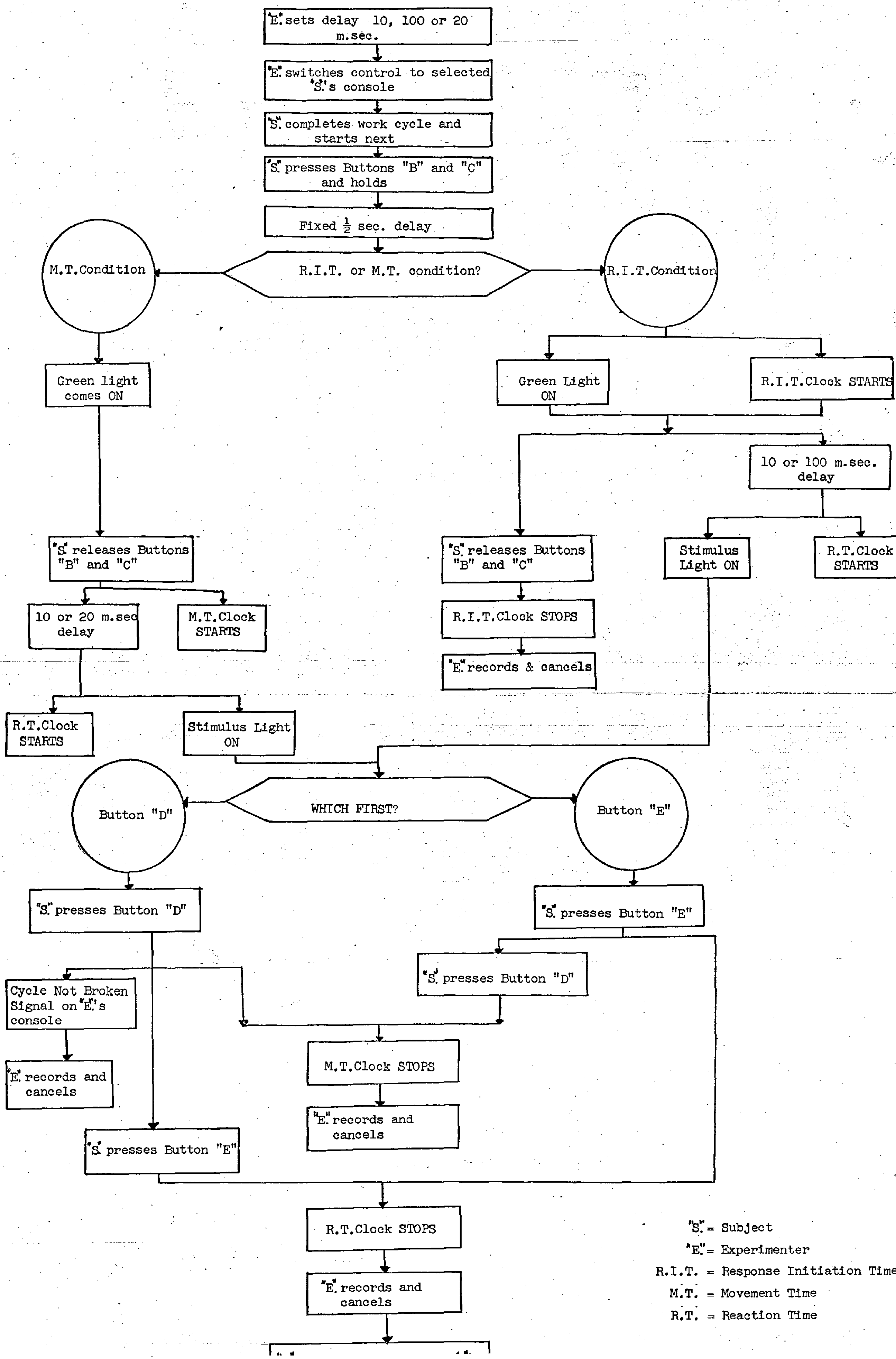

Take ball bearing
from tray and put
in feed opening
green light on
press button "D"
to release
ball bearing
press buttons "B"&"C"
wait for green light
release buttons "B"&"C"
pick up ball bearing from
output and put in tray
return to 1.
RIT
MT
1
2
3
4
5
6
red stimulus lights
residual MT
turn off
red light
reaction time
CYCLE BROKEN
if red light turned off
before button "D" pressed
CYCLE NOT BROKEN
if red light turned off
after button D pressed
DIAGRAM OF WORK CYCLE

Fig. 3

Flow Diagram for Basic Equipment and Procedure. Stimulus Cycle. Preliminary Experiment 1966



## DIAGRAM LAYOUT OF EXPERIMENT (1966)

| DAYS 1-20 | | | | | 5 | | | | | 10 | | | | | 15 | | | | | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKS | 1 | | | | | 2 | | | | | 3 | | | | | 4 | | | | |
| DAYS OF WEEK | M | T | W | T | F | M | T | W | T | F | M | T | W | T | F | M | T | W | T | F |
| RIT & MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT |

(7 PERIODS IN EACH DAY)

| WEEKS | 1 | | | | | 2 | | | | | 3 | | | | | 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORDER OF DELAYS BETWEEN PERIODS 1-6 | | | | | | | | | | | | | | | | | | | | |
| MT | | AB | | BA | | AB | | BA | | AB | | BA | | AB | | BA | | AB | | BA |
| RIT | AB | | BA | | AB | | BA | | AB | | BA | | AB | | BA | | AB | | BA | |
| DELAYS IN PERIOD 7 | 0 | 10 | 0 | 10 | 10 | 20 | 10 | 20 | 10 | 10 | 0 | 20 | 0 | 10 | 10 | 20 | 10 | 10 | 100 | 10 |

cycle times recorded in week 4 only

RIT — STIMULUS GIVEN IN RESPONSE INITIATION TIME $\begin{cases} A = 10 \text{ msecs} \\ B = 100 \text{m secs} \end{cases}$

MT — STIMULUS GIVEN IN MOVEMENT TIME $\begin{cases} A = 10 \text{ msecs} \\ B = 20 \text{ msecs} \end{cases}$

TIME OF RED LIGHT STIMULUS IS RANDOM WITHIN THE PERIOD

Fig. 5

## DESIGN OF ANALYSIS OF VARIANCE (for both Preliminary and Main Experiments)

### Basic Design

The basic design of these experiments is a simple factorial analysis of variance with three factors : Subjects, Days of experiment, and Periods.

The first order interactions may be evaluated, and the second order interaction (SDP) is used as an estimate of residual deviance.

| Source of Variance | Degrees of Freedom (Main experiment) |
|---|---|
| S = Subjects | 3 |
| D = Day of Experiment | 39 |
| P = Periods | 7 |
| SD = Subjects/Days Interaction | 117 |
| SP = Subjects/Periods IA | 21 |
| DP = Days/Periods IA | 273 |
| SDP = Residual | 819 |
| Total | 1279 |

Within this analysis, the term Days of Experiment is further hierarchically divided into the effects of the Week of Experiment and the Day of Week.

| Source of Variance | Degrees of Freedom (Main experiment) |
|---|---|
| E = Day of Week | 4 |
| W = Week of Experiment | 7 |
| Residual Between Days (EW) | 28 |
| Total Days of Experiment | 39 |

Within this analysis again, the Term Week of Experiment can be divided hierarchically into the Effects of Break/No Break and a residual term representing the variation between weeks when the effect of breaks has been allowed for.

| Source of Variance | Degrees of Freedom | (Main (Experiment) |
|---|---|---|
| B = Rest Break/No Rest Break | 1 | |
| Residual Between Weeks | 6 | |
| Total Week of Experiment | 7 | |

These subdivisions of the Day of Experiment apply not only to the main term 'Day of Experiment', but also to any interaction term containing the letter D - including the residual SDP.

These are variations on this basic design, as follows:-

1. In designs II, IIa, III, IIIa, VI and VIa the hierarchical division of the Term Days of Experiment includes Fortnights instead of Weeks.
2. In designs I and Ia the Term Days of Experiment = Days of Week and there is no hierarchical division. (This design results from the fact that Cycle Time was recorded for one week only in the Preliminary Experiment 1966).
3. The Factor "B", Rest Break/No Rest Break, - a division of the Term "W" Weeks of Experiment is not relevant to and is not included in Designs I - IIIa. The condition Rest Breaks/No Rest Breaks was not part of the Preliminary Experiment.
4. In designs VI and VIa the Term "B" - Rest Break/No Rest Break is a subdivision of the Main term "D" Days of Experiment instead of a subdivision of the term "W" Weeks of Experiment.
5. In designs III, IIIa, V, Va, VI and VIa the hierarchical division of the term Days of Experiment "D" includes another factor "G" = R.I.T/M.T. = Red Light Stimulus Delay initiated by start of Response Initiation Time or Movement Time.

6. In addition to the three factors "S" (Subjects), "D" (Days of Experiment), "P" (Periods), Design V, Va, VI and VIa include a fourth factor "H" = Red Light Stimulus Delay of either 10 m.sec. or 50 m.sec. (In the Preliminary Experiment a $\chi^2$ Test was used to evaluate the significance of the Delay Factor).

The layout of each type of Design is given in detail on the pages that follow.

PRELIMINARY EXPERIMENT (1966)

Designs for Analysis of Variance (including subdivision of "D" term)

Design I - Dependent Variable = Cycle Times. Subjects Combined

$\bar{X}$., Average S.D., %$\geq$ M + 2 S.D.

S = Subjects

D = Days of Week (Experiment)

P = Periods

SD = Subjects by Days Interaction

SP = Subjects by Periods Interaction

DP = Days of Week by Periods Interaction

SDP = Residual

Design Ia. - Dependent Variable = Cycle Times. Subjects Individually

$\bar{X}$., Average S.D., %$\geq$ M + 2 S.D.

D = Days of Week (Experiment)

P = Periods of Day

R = Residual = DP

Design II - Dependent Variables = (Response Initiation Time $\bar{X}$ ) Subjects
(Movement Time $\bar{X}$ ) Combined

S = Subjects

P = Periods

D = Days of Experiment

---

E = Days of Week

F = Fortnights

EF = Residual

---

SP = Subjects by Periods interaction

SD = Subjects by Days interaction

---

SE = Subjects by Day of Week interaction

SF = Subjects by Fortnights interaction

Residual of SD interaction

---

PD = Periods x Days

---

PE = Periods by Days of Week

PF = Period by Fortnight

Residual

---

SPE = Subjects by Periods by Days of Week

SPF = Subjects by Periods by Fortnights

Residual (overall) = (SPD = Subjects by Periods by Days)

Design IIA - Dependent Variables = Response Initiation Time $\bar{X}$ ) Subjects
Movement Time $\bar{X}$ ) Individually

P = Periods

D = Days of Experiment

-------------------------------------------------

E = Days of Week

F = Fortnight

Residual between Days

---------------------------------------------

PE = Period by Day of Week

PF = Period by Fortnight

Residual (overall)

<u>Design III</u> - Dependent Variables = (Reaction Times $\bar{X}$ ) Subjects
(% Cycles Broken ) Combined

S = Subjects

P = Periods

D = Days of Experiment

-----------------------------------------------

E = Day of Week

F = Fortnight

G = R.I.T./M.T. = Red Light Stimulus Delay initiated by the start of Response Initiation Time or Movement Time

Residual between Days of Experiment

-----------------------------------------------

SP = Subject by Period Interaction

SD = Subject by Day of Experiment Interaction

-----------------------------------------------

SE = Subject by Day of Week

SF = Subject by Fortnight

SG = Subject by R.I.T./M.T.

Residual between S.D.

-----------------------------------------------

PD = Period by Day of Experiment

-----------------------------------------------

PE = Period by Day of Week

PF = Period by Fortnight

PG = Period by R.I.T./M.T.

Residual between PD

-----------------------------------------------

SPE

SPF

SPG

Residual (overall)

<u>Design IIIA</u> - Dependent Variables = (Reaction Times $\bar{X}$ ) Subjects
(% of Cycles Broken ) Individually

P = Periods

D = Day of Experiment

---

E = Day of Week

F = Fortnight

G = R.I.T./M.T. = Red Light Stimulus Delay initiated by the start of Response Initiation Time or Movement Time

Residual between Days

---

PE = Period by Day of Week

PF = Period by Fortnight

PG = Period by R.I.T./M.T.

Residual (overall)

Design IV - Dependent Variables = (Cycle Time ) (Response Initiation Time ) (Movement Time ) Subjects Combined

$\bar{X}$., Average S.D., %> Mean + 2 S.D.

S = Subjects

D = Day of Experiment

---

E = Day of Week

W = Week of Experiment

---

B = Rest Break/No Rest Break

Residual between Weeks

---

EW = Residual between Days

---

P = Period of Day

SD = Subjects by Days Interaction

---

SE = Subjects/day of Week

SW = Subjects/Week of Experiment

---

SB = Subjects/Break/No Break

Residual Subjects/Week IA

---

SEW = Residual SD term

---

SP = Subjects by Periods Interaction

DP = Day of Experiment by Periods Interaction

---

EP = Day of Week by Period Interaction

WP = Week by Period

---

BP = Rest Break/No Rest Break

Residual of WP

---

Residual DP

Design IV continued

SPE

SPW

-------------------------------------------------

SPB

Residual of SPW

-------------------------------------------

Residual Overall

<u>Design IVA</u> - Dependent Variables = (Cycle Time ) Subjects<br>(Response Initiation Time ) Individually<br>(Movement Time )<br>$\bar{X}$., Average S.D., % > Mean + 2 S.D.

D = Day of Experiment

---

E = Day of Week

W = Week of Experiment

---

B = Rest Break/No Rest Break

Residual (Weeks)

---

Residual (Days)

---

P = Period of Day

PE = Period of Day by Day of Week Interaction

PW = Period of Day by Week of Experiment Interaction

---

PB = Period by Rest Break Interaction

Residual (PW)

---

Residual (overall)

<u>Design V</u> - Dependent Variables = (Reaction Time $\bar{X}$ ) Subjects
(% Cycles Broken ) Combined
(Response Initiation Time (Stimulus Cycle) $\bar{X}$ )
(Movement Time (Stimulus Cycle) $\bar{X}$ )

S = Subjects

D = Day of Experiment

---

E = Day of Week

W = Weeks of Experiment

---

B = Rest Break/No Rest Break

R = Residual (Weeks)

---

G = R.I.T./M.T. = Red Light Stimulus Delay initiated by start of Response Initiation Time or Movement Time

Residual (Days)

---

P = Period of Day

H = Red Light Stimulus Delay of either 10 m.sec. or 50 m.sec.

SD = Subject by Day of Experiment Interaction

---

SE = Subject by Day of Week Interaction

SW = Subject by Week Interaction

---

SB

Residual (SW)

---

SG = Subject by R.I.T./M.T. Interaction

Residual SD

---

<u>Design V continued</u>

SP = Subjects by Periods Interaction

SH = Subjects by Delay Interaction

DP = Day by Period Interaction

---

EP = Day of Week by Period

WP = Week by Period

---

BP = Rest Break by Period

Residual (WP)

---

GP = R.I.T./M.T. by Period

Residual (DP)

---

DH = Day of Experiment by Delay (10 m.sec./50 m.sec.)

---

EH = Day of Week by Delay

WH = Week by Delay

---

BH = Rest Break/No Rest Break by Delay

Residual (WH))

---

GH = R.I.T./M.T. by Delay

Residual (DH)

---

PH = Period by Delay

SEP

SWP

---

SBP

Residual SWP

---

Design V continued

SGP

SPH

Residual (Overall)

Design $\bar{V}$A - Dependent Variables = Reaction Time $\bar{X}$ ) Subjects Individually
% Cycles Broken )
Response Initiation Time )
(Stimulus Cycle) )
Movement Time )
(Stimulus Cycle) )

D = Day of Experiment

---

E = Day of Week

W = Week of Experiment

---

B = Rest Break/No Rest Break

Residual Weeks

---

G = R.I.T./M.T. = Red Light Stimulus Delay initiated by start of Response Initiation Time or Movement Time

Residual (Day of Experiment)

---

P = Period of Day

H = Red Light Stimulus Delay of 10 m.sec. or 50 m.sec.

DH = Day of Experiment by Delay (10 m.sec., 50 m.sec.) Interaction

---

EH = Day of Week by Delay

WH = Week by Delay

---

BH = Rest Break/No Rest Break by Delay

Residual (WH)

---

GH = R.I.T./M.T. by Delay

Residual DH

---

EP = Day of Week by Period

WP = Week by Period

---

Design $\bar{V}$A continued.........

BP = Rest Break/No Rest Break by Period

Residual (WP)

---

GP = R.I.T./M.T. by Period

Residual (Overall)

Design VI - Dependent Variables - % Cycles Broken ) Subjects
Reaction Time ) Combined

S = Subjects

D = Day of Experiment

---

E = Day of Week

* F = Fortnights

B = Rest Break/No Rest Break

G = R.I.T./M.T. = Red Light Stimulus Delay initiated by start of Response Initiation Time or Movement Time

* Residual (Days)

---

H = Delay for Red Light Stimulus (10 m.sec. or 50 m.sec.)

SD = Subject by Days Interaction

---

SE = Subject by Day of Week

*SF = Subject by Fortnight

SB = Subject by Rest Break/No Rest Break

SG = Subject by R.I.T./M.T.

*Residual SD

---

DH = Day of Experiment by Delay (10 m.sec. or 50m.sec.) Interaction

---

EH = Day of Week by Delay

*FH = Fortnight by Delay

BH = Rest Break/No Rest Break

GH = R.I.T./M.T. by Delay

*Residual (DH)

---

Design VI continued....

*    These elements in the analysis differ from Design V and VA in that Fortnights replaces Weeks and in consequence the Residuals also differ in that they are larger in this Design. Therefore with the exception of 'B' which is now tested against Residual (Days) instead of Residual (Weeks), the likelihood of factors being statistically significant is less in this design. This being so it was unecessary to retest any hierarchy in Designs V and VA which was already insignificant.

Design VIA - Dependent Variables - % Cycles Broken ) Subjects
Reaction Time $\bar{X}$ ) Individually

D = Day of Experiment

---

E = Day of Week

*F = Fortnights

B = Rest Break/No Rest Break

G = R.I.T./M.T.=Red Light Stimulus Delay initiated by start of either Response Initiation Time or Movement Time

*Residual (Days)

---

H = Red Light Stimulus Delay (10m.sec. or 50 m.sec.)

DH = Day by Delay Interaction

---

EH = Day of Week by Delay

*FH = Fortnight by Delay

BH = Rest Break/No Rest Break by Delay

GH = R.I.T./M.T. by Delay

*Residual DH

---

* Please see note at foot of Design VI

## NOTE ON APPENDICES

The Appendices contain Tables of Data and Probability Values. The Graphs are also to be found in the Appendices and are in "fold out" form so that they may be consulted while the text is being read.

Appendix I contains the Tables and Graphs relevant to the next chapter on Results.

Within the Appendix, all Tables containing Data values are given first, followed by the Probability Value Tables, followed by the Graphs e.g. Tables 1-15 are tables of Data Values and Tables 16-26 are tables of Probability Values.

The number of Tables and Figures is large. An effort has been made to reduce this number to a minimum. In consequence some of the interactions which are significant but from which no pattern can be abstracted have not been presented graphically or in tables other than the Probability Value Tables. In the next chapter reasons are suggested for their significance but where there were no systematic trends further space has not been devoted to them.

# RESULTS

## 1. General

Cycle Times average out at just over 2 sec., Response Initiation Times (Stimulus Cycle) at 186 m.secs., Movement Times (Stimulus Cycle) at 390 m.secs., Reaction Times at just over 1 sec. and the percentage of Cycles Broken at approximately 27% (Table 1)

The remainder of this chapter will be divided into sections, each one dealing with the effects of all the Independent Variables on one Dependent Variable. Each section is headed with the name of the Relevant Dependent Variable.

In contrast the Probability Value Tables in particular have been arranged so that the data may be looked at from the point of view of the effects of one Independent Variable on all the Dependent Variables.

It is hoped that this effort to present the results from "two sides" will facilitate their clarification and will take account of any personal preference the reader may have when envisaging results.

## 2. Percentage of Cycles Broken

The Subjects differed very highly significantly from one another (Tables 2 and 16. Fig.9). Subject 1 broke the work cycle most often, 50% of the time, followed by Subjects 2, 4 and 3 in that order.

The percentage of cycles broken was affected highly significantly for Subjects Combined and Subjects 1 and 2 individually, by varying the point in the work cycle at which the rare stimulus (Red light) was given. Subjects 3 and 4 followed the same trend as the other Subjects but these two broke so few cycles that a significant result was not to be expected (Tables 3, 20 and 21. Figs. 12-15). All Subjects broke more cycles when the rare stimulus was given in Response

Initiation Time rather than Movement Time. Similarly, the shorter the delay in giving the rare stimulus after the start of Response Initiation Time or Movement Time, the greater was the number of cycles broken.

The Days of Experiment had a very highly significant effect on the percentage of cycles broken for Subjects Combined and Subjects 1, 2, and 4 individually. (Tables 12 and 17). This was to be expected as the R.I.T. and M.T. conditions were not balanced over days and as already stated, these conditions had a major effect on the percentage of cycles broken.

Days of the Week, Periods of the Day and Fortnights were not significant for either Subjects Combined or Subjects individually. (Tables 11, 13, 14, 15, 18, 19, 22).

Out of 105 possible interactions (Table 26) only five were significant so it is very possible that at least one or two of these five resulted from pure chance. Perhaps the most interesting of these interactions is Subject by R.I.T./M.T. conditions. In all cases where any cycles were broken (Table 12), the percentage broken was less in the M.T. condition for all subjects. However Subject 3 for eighteen out of twenty days did not break any cycles at all and the resulting very small difference between R.I.T. and M.T. conditions in her case would be very different from the relationship between these conditions in the case of the other Subjects. This is quite apart from the fact that the M.T. condition resulted in a much greater proportional reduction in the percentage of Cycles Broken for Subjects 2 and 4 (approx. 20 to 1) than for Subject 1 (approx. 4 to 1).

The interaction, Subjects by Days of Experiment, was highly significant but it could not fail to be if Subject by R.I.T/M.T. conditions was. The reasons for this have been explained above.

Another highly significant interaction was Day of Experiment by Period. This can probably be attributed to the fact that Periods for Days with the R.I.T. condition show completely different and fluctuating trends for Periods for Days with the M.T. condition, which quite often are undeviating and at or close to zero cycles broken.

3. <u>Reaction Time</u>

The Subjects differed very highly significantly from one another (Tables 2, 16. Fig.10). Subject 4 was the fastest at 872 m.secs. followed by Subjects 2, 1 and 3 in that order. Subject 3's time was 1189 m.secs.

The Days of Experiment had no significant effect for Subjects Combined but for Subject 2 individually their effect was highly significant and for Subjects 1 and 4 it was significant. (Tables 10, 17. Figs. 31 and 32).

Days of Week and R.I.T./M.T. conditions were significant at 5% level only for Subject 1. There were no significances for Subjects Combined or for the other Subjects individually. (Tables 7a, 18, 20). Periods of the Day had no significant effect either for Subjects Combined or Individually. (Tables 7, 19. Figs. 24,27).

Fortnights were not significant for Subjects Combined and only for Subject 2 individually (Tables 14, 15, 22).

No interactions were significant for Subjects individually (Table 24). Subjects by Day of Week and Subjects by R.I.T./M.T. conditions were both highly significant. For instance Subjects 1 and 2 had slower Reaction Times during the M.T. condition whereas Subject 4 had a quicker reaction in that condition. The conditions R.I.T./M.T. made no difference to Subject 3's times. It is difficult to interpret these results and those of Day of Week in any light other than that of intra Subject variability.

The interaction, Period by Fortnight, is also significant at the 5% level. For some reason Reaction Times in Periods 3 and 4 are longer than those in Periods 5, 6 and 7 in the first fortnight whereas the reverse is true in the second fortnight.

4. Response Initiation Time (Stimulus Cycle)

The Subjects differed very highly significantly from one another (Tables 2, 16. Fig.8). Subject 1 had the fastest time at 150 m.sec. followed by Subjects 3, 4 and 2. Subject 2's Response Initiation Time was 220 m.sec.

The Days of Experiment had a very highly significant effect on Response Initiation Time for Subjects Combined and a significant effect (5% level) for Subjects 2 and 4 (Tables 8.17. Figs.28,29). Both Subjects 2 and 4 had very long times on Day 3. Both times were over 440 m.sec. compared with their average times of 220 m.sec. and 216 m.sec. respectively. These times are reflected in the times for Subjects Combined. It is suggested that the statistical significance for Subjects Combined may be due to the effect of the times of Subjects 2 and 4 on Day 3 rather than to any systematic trend - e.g. learning - of which there seems to be no sign.

Days of the Week showed no significant difference for Response Initiation Times for either Subjects Combined or Individually (Table 18).

Periods of the Day was highly significant for Subjects Combined and significant for Subject 2. (Tables 6, 19. Figs.24, 26). No systematic trend is visible.

There was no significant effect either for Subjects Combined or Individually for Fortnights. (Tables 14, 15, 22).

The interactions, Subjects by Periods and Subjects by Day of Experiment, were very highly significant. (Table 25. Figs. 26, 29). The first seems to be due mainly to fluctuations in the times of Subjects 2 and 4 and the second to unsystematic differences between all Subjects. The same applies to the interaction Subjects by Day of Week which is significant at the 5% level only. (Table 25).

Periods by Day of Experiment is also very highly significant (Table 25), but no pattern emerges.

5. Movement Time (Stimulus Cycle)

Once again the Subjects differed very highly significantly from one another (Tables 2, 16. Fig.11). Subject 4 was the fastest followed by Subjects 3, 2 and 1. This difference was to be expected because when a Subject broke a work cycle her movement included Reaction Time. Subjects 1 and 2 broke the highest percentage of work cycles.

For Subjects 3 and 4, Days of Experiment were highly significantly different. There was no significant difference for Subjects Combined. (Tables 9, 17. Figs. 28, 30). There were no significant results for Day of Week or Period of Day (Tables 6, 18, 19. Figs. 24, 25).

Fortnights were significant for Subjects 3 and 4. Subject 3 became slower and Subject 4 faster. There were no significant results for the other Subjects individually or for Subjects Combined (Tables 14, 15, 22). No interactions were significant. (Table 25).

6. Cycle Time: ($\bar{X}$, Average S.D., % $>$ M + 2 S.D.)

Subjects again differed very highly significantly from one another. They differed in $\bar{X}$, average S.D., and percentage of cycle times greater than the mean plus two Standard Deviations. (Table 2,16. Figs. 6,7.)

Days of the Week were significant (5% level) for Subjects Combined for the $\bar{X}$ only (Tables 4, 5, 18. Figs. 16, 20). This seems to be due mainly to a faster rate on Day 2 Tuesday.

Periods of the Day were not significant for $\bar{X}$. They were very highly significant for average S.D. for Subjects Combined, highly significant for Subject 2 and significant for Subject 1. They were also significant for percentage greater than the mean plus two Standard Deviations for Subjects Combined and highly significant for Subject 1. (Tables 4, 5, 19. Figs. 17,18,19,21,22,23).

There were no significant interactions for Subjects Individually (Table 23) or in the case of average S.D. for Subjects Combined. Days by Periods interaction was highly significant for $\bar{X}$ for Subjects Combined. Subjects by Periods and Days by Periods were significant for Subjects Combined for percentage of cycle times greater than the Mean plus two Standard Deviations. This means that out of a possible 45 values only three were statistically significant. The possibility of pure chance must be kept in mind.

The significance of the Subjects by Periods interaction for percentage of cycles times $>$ M + 2 S.D. seems likely to be due to differences between the Subjects during periods 2, 3 and 7 particularly (Fig.23).

The Days by Periods interaction for Cycle Time ($\bar{X}$) may be due mainly to unsystematic trends at the beginnings and ends of the daily work sessions. The Days by Periods interaction for the percentage of cycle times $>$ M + 2 S.D. shows similar unsystematic trends.

7. Concluding Remarks

The results of both experiments will be discussed in the chapter titled "Conclusions". At this stage however, it is necessary to remark on the particular result which justified the decision to further the study.

The results of this preliminary experiment show without doubt that there were noticeable differences in response to the rare signal depending on the point in the work cycle at which it was given. Also the responses from all of the subjects followed the same trend even when they differed quantitively. This result made it worthwhile continuing with the study. Responses from different subjects could be studied for a longer period of time. It became possible to envisage the collection of sufficient data with trends sufficiently similar to make some attempt at curve fitting and mathematical prediction worthwhile. To these ends a second and more complicated experiment was designed and carried out. This experiment is described in the next chapter.

# CHAPTER 5 THE MAIN EXPERIMENT

## INTRODUCTION

This experiment though very similar to the preliminary one differs from it in some important respects. These differences are fully described in the section titled "Experimental Procedure and Design".

One difference ought to be mentioned at this point. In the preliminary experiment no records were made of Response Initiation and Movement Times independently of the Stimulus Cycle. Indeed owing to limitations of equipment no records could be made of these two times in one and the same work cycle. There being no independent measurement of these times, they could not be related to the percentage of cycles broken (e.g. if the cycle was broken, Movement Time included Reaction Time).

In this main experiment this was one of the defects remedied. Independent measurements of these times were made, thus enabling correlation and curve fitting procedures to be attempted.

## THE EQUIPMENT

1. Four Consoles (Please see Figs. 33 and 35.)

These were very similar to the ones used in the preliminary experiment. The buttons were different in that they were made of black plastic and measured 7/10" diam.

Button 'E' on the preliminary experiment console was replaced by a Strip Switch. The subject pressed this to turn out the Red light. The buttons operated Burgess Miniature Micro Switches.

2. Work Pieces - ½" steel ball bearings.

3. Stimulus Lights

Fluorescent lamps with a rise time of 1 m.sec. 6" in length. Type T.L. 4W/33 K4. Manufactured by Philips Electrical.

Each lamp was viewed through a slot measuring 4½" x 9/10". These slots were covered by pieces of transparent Red and Green 'CINEMOID'. Reduction in light transmission was negligible in the context of the experiment.

The Green light was operated by pressing Buttons 'B' and 'C' simultaneously as in the preliminary experiment.

The power to the Red light was controlled as for the preliminary experiment. The subject turned the Red light out by pressing anywhere on the strip switch. The strip switch, unknown to the subject, was composed of ten segments each activating a different micro-switch. A signal on the experimenter's console recorded which of these switches had been pressed.

4. Timing Devices

A. Venner stop clocks as in the preliminary experiment but in this experiment an extra clock was fitted so that both Response Initiation Time AND Movement Time could be recorded for the same cycle.

Reaction Times were recorded as before except that Reaction Time became the interval between the illumination of the red light and the pressing of the strip switch.

B. Cycle Times were recorded as for the preliminary experiment.

C. Again a light signal on the experimenter's console indicated whether or not a subject had broken the work cycle.

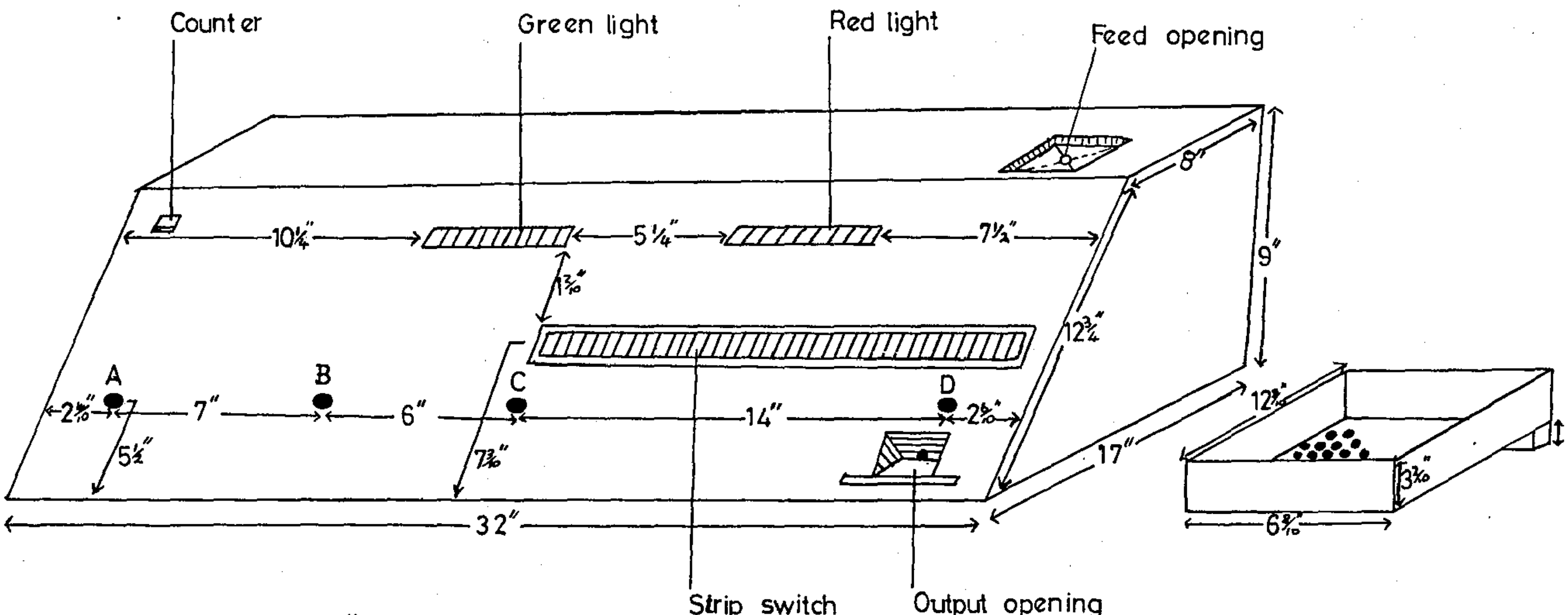
5. General

The mounting of the subject's consoles and the chairs used were the same as for the preliminary experiment. This time all subjects used cushions.

6. Knowledge of Results

Four counters recorded the number of work cycles done by each subject. In contrast with the preliminary experiment these counters were mounted on the subject's consoles and were not in general view. Thus it was left to each subject to mention to the others how she was doing or not, as she felt. Each subject had continuous knowledge of results as far as her own work was concerned.

SKETCH OF CONSOLE (1967)




BUTTONS A, B, C, D, 7/10" dia.

LIGHTS 4½" X 9/10"

STRIP SWITCH 15 1/10" X 1 2/10"

FEED & OUTPUT OPENING 3" X 3"

COUNTER 1 4/10 X 1 2/10

Fig. 33

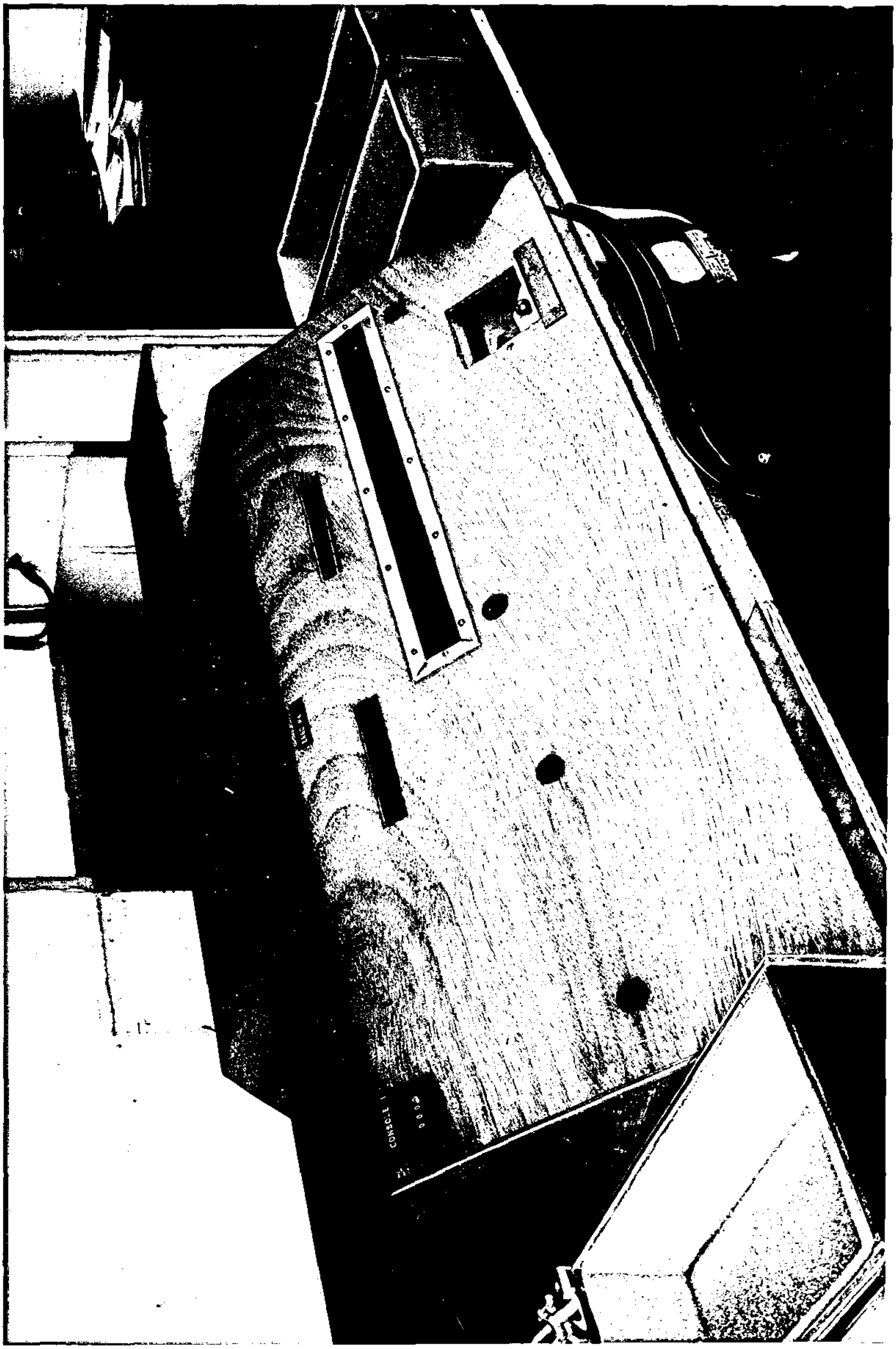
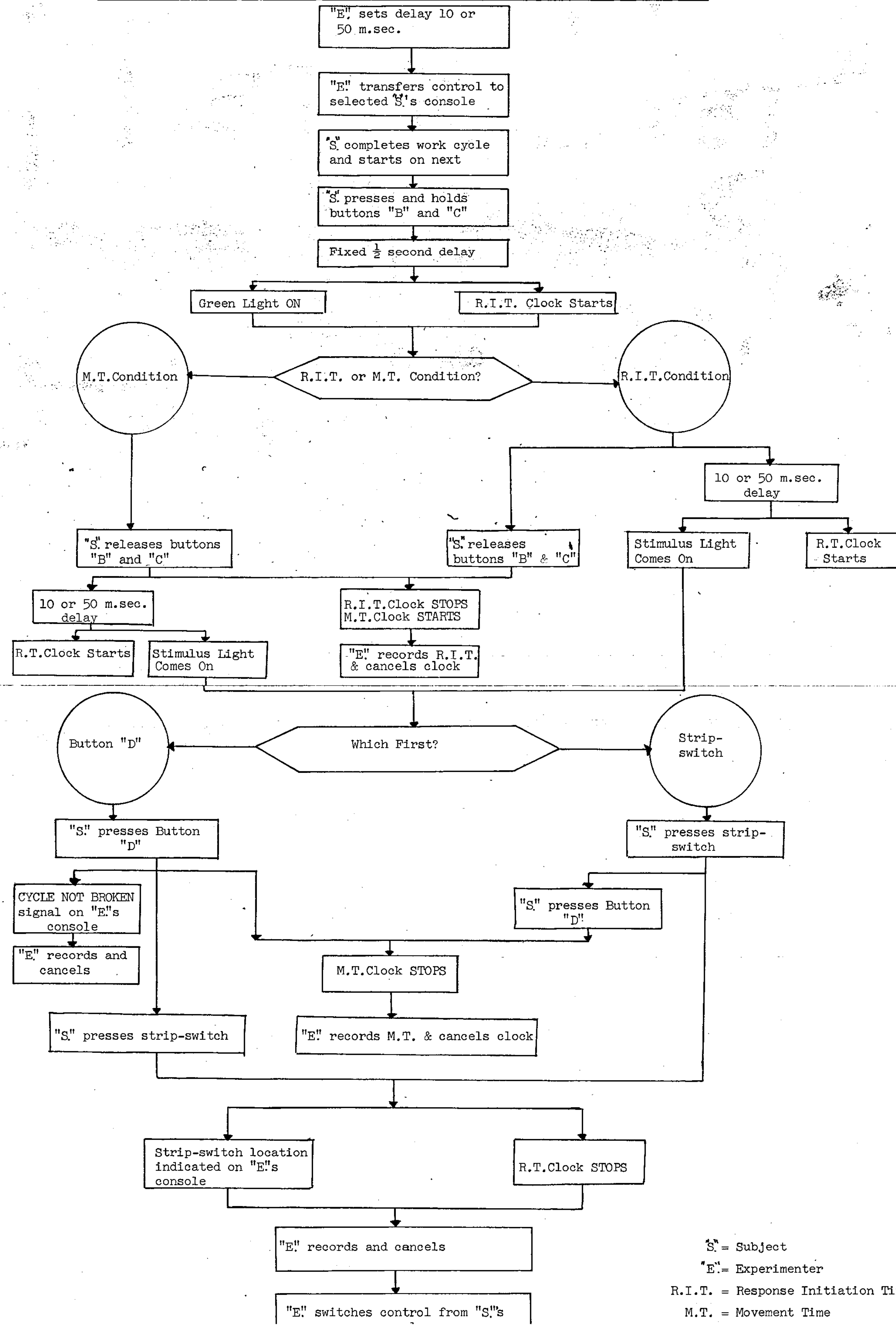


Fig. 34


MILLISECOND STOPCLOCK TYPE TSA 3314
VENNER ELECTRONICS LIMITED SURREY ENGLAND
MILLISECOND STOPCLOCK TYPE TSA 3314
1 2 3 4 5 6 7 8 9 10
1-10 CANCEL

Fig. 35

Flow Diagram for Basic Equipment and Procedure. Stimulus Cycle. Main Experiment 1967




"S." = Subject
"E." = Experimenter
R.I.T. = Response Initiation Time
M.T. = Movement Time

## DIAGRAM LAYOUT OF EXPERIMENT (1967)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAYS 1-40 | | 10 | | 20 | | 30 | | 40 |
| WEEKS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | rest break | no rest break | no rest break | rest break | rest break | no rest break | no rest break | rest break |
| DAYS OF WEEK | M T W T F | M T W T F | M T W T F | M T W T F | M T W T F | M T W T F | M T W T F | M T W T F |
| RIT & MT | RIT.MT.RIT.MT.RIT | MT.RIT.MT.RIT.MT | RIT.MT.RIT.MT.RIT | MT.RIT.MT.RIT.MT | RIT.MT.RIT.MT.RIT | MT.RIT.MT.RIT.MT | RIT.MT.RIT.MT.RIT | MT.RIT.MT.RIT.MT |
| (8 PERIODS IN EACH DAY) | | | | | | | | |
| WEEKS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| ORDER OF DELAYS BETWEEN PERIODS | | | | | | | | |
| MT | AB BA | AB BA AB | BA AB | BA AB BA | AB BA | AB BA AB | BA AB | BA AB BA |
| RIT | AB BA AB | BA AB | BA AB BA | AB BA | AB BA AB | BA AB | BA AB BA | AB BA |

RIT – STIMULUS GIVEN IN RESPONSE INITIATION TIME

MT – STIMULUS GIVEN IN MOVEMENT TIME

A = 10 m secs
B = 50 m secs

TIME OF RED LIGHT STIMULUS IS RANDOM WITHIN THE PERIOD

Fig. 37

## SUBJECTS

Four women were employed as subjects, none of whom had previous industrial experience. All four were married and were pleased to get part time employment in order to earn money for Christmas presents. Two have since gone back to full time employment.

Four tests were given to each subject:- The Wechsler Adult Intelligence Test, The Eysenck Personality Inventory (Form B), "The 16 P.F. Test" (Form A), and the Stromberg Dexterity Test.

Subject 1: Married, Age 59, Right handed.

Wechsler Scores - I.Q.: Verbal = 114, Peformance = 112, Full Scale = 112
Scaled: " 70 " 43 " " 113

E.P.I. Scores - N=11 E=23 L=4

Stromberg Score - 197

Subject 2: Married, Age 57, Right handed

Wechsler Scores - I.Q.: Verbal = 113, Performance = 112, Full Scale = 113
Scaled: " 69 " 46 " " 115

E.P.I. Scores - N=12 E=11 L=5

Stromberg Score - 198

Subject 3: Married, Age 29, Right handed

Wechsler Scores - I.Q.: Verbal = 113, Performance = 107, Full Scale = 111
Scaled: " 74 " 55 " " 129

E.P.I. Scores - N=9 E=11 L=2

Stromberg Score - 169

Subject 4: Married, Age 25, Right handed

Wechsler Scores - I.Q.: Verbal = 120, Performance = 110, Full Scale=116
Scaled: " 81 " 57 " " 138

E.P.I. Scores - N=15 E=6 L=3

Stromberg Score - 175

See Appendix 4 for copies of Score Sheets and Notes on Tests.

It was hoped that the change in positioning of the four counters, which provided the subjects with knowledge of results, would avoid the excessive competition between subjects encountered in the first experiment. There was still trouble. Unfortunately, it failed to show itself until the end of the first week of data recording when any possible advantage from a further change would have been outweighed by the disadvantage.

Subject 4 decided that the other three were competing too much and that she was going to have nothing to do with it. She was going to set her own pace at what she considered a reasonable standard. She told the other subjects this in no uncertain terms adding that she was going to be tired that day as there was no rest break due. She was seated beside Subject 3 who was visibly faster than she was. Subject 4 repeated these types of remarks throughout the experiment particularly during the "no rest breaks" condition. The other subjects were not affected to the extent of any visible ill feeling showing itself.

Subject 3 was absent for the last week of the experiment. She had been waiting for some time to go into hospital for treatment for impacted wisdom teeth and a bed suddenly and unexpectedly became vacant.

She was not disabled from doing repetitive work. Her teeth were not troubling her during the experiment. She tried to arrange another time with the hospital but it was not known when next a bed would be available.

At times the group would chat very much less than usual. The experimenter does not know why this occurred. It seemed quite spontaneous and was not particularly associated with Monday mornings. When these silences happened Subject 1 invariably became visibly restless. She would attempt to start a conversation going. On one memorable occassion her failure to do so resulted in tears which immediately had the desired effect. Things were soothed over within minutes

The E.P.I. neuroticism ('N') scores for Subjects 1, 2, and 3 were $< 1\sigma$ from the Means for the Housewife and Normal Populations. The score for Subject 4 was $> 1\sigma, < 2\sigma$ above these Means. Her score most nearly approached the Mean - 14.869 given for Mixed Neurotic groups.

The Extraversion ('E') scores for Subjects 2 and 3 were $< 1\sigma$ from the Mean scores for the Housewife and Normal Populations.

Subjects 1's 'E' score was very high $> 2\sigma$ above the Means for the Housewife and Normal Populations. Subject 4's 'E' score was low. It was $> 1\sigma$ and just inside $2\sigma$ lower than the Mean score of the Housewife Population. It was $> 2\sigma$ lower than the mean score for the Normal Population. It was $> 1\sigma$ but well within $2\sigma$ of the Mean score for the Obsessional Group.

The figures used as standard are taken from the Manual of the Eysenck Personality Inventory (Eysenck, Eysenck, 1964).

The three factors of particular interest in "The 16 P.F. Test" are 'M' (Autia), 'G' (Super Ego), and '$Q_3$' (self sentiment development). High M, Low G and Low $Q_3$ are considered to be associated with accident proness in both private and professional drivers.

All four Subjects had average score for 'M'. Subjects 2 and 4 had average scores for '$Q_3$'. Subjects 1 and 3 had scores $< 1\sigma$ from the Mean score for that factor. The scores of Subjects 1 and 4 were average for 'G'. Subject 3's score was $> 1\sigma < 2\sigma$ below the Mean. Subject 2's score $\simeq 2\sigma$ above the Mean score for Factor 'G'.

Factor 'C' perhaps should be mentioned as it has been linked with Eysenck's concept of "general neuroticism". (Cattell, Eber, 1957). Subjects 3 and 4 had average scores and the scores of the other two Subjects were both $< 1\sigma$ below the Mean score. Subject 4's greater deviation above the 'N' score Mean of the E.P.I. is not reflected in her Sten score for Factor 'C' of the 16. P.F. Test.

A lower score in the Stromberg Dexterity Test (S.D.T.) indicates a better performance. The younger Subjects 3 and 4 scored considerably better than Subjects 1 and 2. The score is the time required to complete the test. The more rapidly a subject completes the test the better the performance. Norms for several Industrial and Educational Groups have been established. The Mean score for Female Assembler and Welder Applicants was found to be 159.7 with a Standard Deviation of 16.4. Subjects 3 and 4 were within this range. Subjects 1 and 2 were comparatively slow. The 5th Percentile score is given as 194. It has been found that older workers as a group tend to get poorer S.D.T. scores (Stromberg, 1951).

The I.Q. scores for all subjects come in the "Bright Normal" Classification (Wechsler, 1955). The Scaled scores for Subjects 1, 2 and 3 are $< 1\sigma$ from the Mean scores for Verbal, Performance and Total Scaled scores for their age groups. Subject 4's Performance score is $< 1\sigma$ from the Mean for her age group. Her Verbal and Full Scale scores are $> 1\sigma$ and $< 2\sigma$ above the respective means for her group. (Wechsler (1955).

# EXPERIMENTAL PROCEDURE AND DESIGN

1. General (Please see Figs. 3, 36, 37)

The first two paragraphs in the chapter on Experimental Procedure for the preliminary experiment apply also to this experiment.

2. Procedure when Red Light came on

Subjects were instructed to stop immediately, no matter where in the work cycle, and Press the Strip Switch to turn out the Red light. They were told they could press the Strip Switch anywhere along its length. It had to be depressed by using the right hand. Subjects were practiced in this procedure before the start of the experiment.

3. Duration of Experiment

The experiment continued for $3\frac{1}{2}$ hours per day from 9 a.m. to 12.30 p.m. through 40 days, 5 days a week for 8 weeks. The subjects were practiced for a week before the experiment began.

4. Dependent Variables

| | |
|---|---|
| (1) Cycle Time:- (CT) ($\bar{X}$., S.D., % $>$ Mean+2 S.D.) | Duration of each work cycle recorded |
| (2) Reaction Time:- (RT) ($\bar{X}$) | Time between illumination of Red Light and Subject turning it off by pressing Strip Switch. |
| (3) Response Initiation Time:-(RIT) ($\bar{X}$., S.D., % $>$ Mean+2 S.D.) | Time between illumination of Green light and release of Button 'C'. A sample of ten recorded for each Subject for each period - from the same work cycle as Variable (4) below. |

| | | |
|---|---|---|
| (4) | Movement Time:- (MT) ($\bar{X}$, S.D., % > Mean+2 S.D.) | Time between release of Button 'C' and pressing of Button 'D'. A sample of ten recorded as for Variable (3) |
| (5) | Response Initiation Time:- (Stimulus Cycle) ($\bar{X}$) | As Variable (3) except measured only during the work cycle in which the Red light Stimulus was given (Both when delay in RIT and MT) |
| (6) | Movement Time (Stimulus Cycle):- ($\bar{X}$) | As Variable (4) except measured only during work cycle in which Red light Stimulus was given (both when delay in RIT and MT) |
| (7) | % Cycles Broken/Not Broken:- | |
| | Cycles Broken = | If Subjects turned out Red light by pressing Strip Switch BEFORE pressing Button 'D'. |
| | Cycles Not Broken = | If Strip Switch pressed AFTER Button 'D'. |
| (8) | Location on Strip Switch:- (Mode) | Locations 1 - 10 dependent on where the Subject pressed the Switch. |

5. Independent Variables (See Fig. 37)

(1) Days of Experiment 1 - 40

(2) Days of Week 1 - 5

(3) Weeks of Experiment 1 - 8

(4) Fortnights of Experiment 1 - 4

(5) Periods in Day 1 - 8. 25 minutes each; starting 9.5 a.m.

(6) With rest breaks and without 1 - 2. A ten minute rest break was given between 10.40 a.m. and 10.50 a.m. between Periods 4 and 5 during weeks 1, 4, 5 and 8.

(7) Stimulus from Red light. Once, per period, per Subject.

The Stimulus was given at one of the following times:-

a) in each period:- 5, 10, 15, 20 or 25 minutes after the period began. These times were randomized - using random numbers tables.

b) in each stimulus cycle:-

(i) R.I.T.:- with a delay of ($\alpha$) 10 m.sec. or ($\beta$) 50 m.sec. after the illumination of the green light.

(ii) M.T.:- with a delay of ($\alpha$) 10 m.sec. or ($\beta$) 50 m.sec. after the release of Button 'C'.

These different delays were balanced over Days of Week, Periods in the Day and Rest and No Rest Breaks conditions.

This Variable does not effect Cycle Time, Response Initiation Time and Movement Time which were not connected with the Work Cycle in which the Red Light Stimulus was given (Stimulus Cycle).

6. General

The design was optimised so as to obtain the most relevant information consistent with the Equipment's and Experimenter's reliability. Both imposed constraints. For instance - for the Stimulus Cycle Data, the R.I.T. and M.T. delay conditions are not balanced over Days of Experiment and Weeks. Even more than in the preliminary experiment there was a considerable load on the experimenter - namely the setting and recording manually of all the data apart from Cycle Time. Even more data was collected than in Experiment 1. Finally in this experiment also the continual switching affected the equipment adversely. The switch was set each day to either the R.I.T. or M.T. delay. The result was that one could be certain that the Stimulus Delay, Period, Day of Week and With and Without Rest Breaks factors were reliable for "Cycles Broken" and "Cycle Not Broken".

In the case of the Stimulus Cycle Data, Days and Weeks of Experiment would be confounded with R.I.T. and M.T. delays. This was considered to be a reasonable sacrifice for R.I.T. (Stimulus Cycle) and M.T. (Stimulus Cycle). Particularly so in view of the fact that duplicate and more comprehensive Data for Response Initiation Time and Movement Time was collected in cycles other than the Stimulus Cycle. Therefore there ~~was~~ no information lost for this data due to confounding.

The 10 m.sec. and 50 m.sec. delays within R.I.T. and M.T. were balanced over all factors.

The most serious affect of the lack of balance mentioned above was the loss of information concerning any possible learning or reverse effects for Cycles Broken and Reaction Time. For these reasons a second analysis of Variance was carried out for Cycles Broken and Reaction Times with Fortnights as an independent variable. (Both the R.I.T./M.T. conditions and the Rest Break/No Rest Break conditions were balanced over Fortnights). This analysis was capable of giving the information about learning or its reverse, for the two dependent variables affected.

# RESULTS

## 1. General

The average Cycle Time was 3 secs., Response Initiation (Stimulus Cycle) 118 m.sec., Movement Time (Stimulus Cycle) 933 m.sec., Response Initiation Time 111 m.sec., Movement Time 456 m.sec., Reaction Time just over 1 sec. and the percentage of cycles broken was 51% (Table 27).

The Days of Experiment were either Significant, Highly Significant or Very Highly Significant for every Dependent Variable for both Subjects Combined and Individually (Table 63). This was to be expected as Days included so many other sources of variation. It is not proposed to refer to Days under the separate headings for each Dependent Variable.

At this point it is as well to mention again that Subject 3 was absent for the last week of the Experiment. It is necessary to be aware of this when looking at the Tables and Figures for Weeks for Subjects Combined. In the Figures for Weeks the lines are discontinuous between Weeks 7 and 8 as a reminder of Subject 3's absence.

## 2. Percentage of Cycles Broken

The Subjects differed very highly significantly from one another. (Tables 28, 62, 78. Fig. 44). Subject 4 broke the work cycle most often, 81% of the time, followed by Subjects 1, 2 and 3 in that order. Subject 3 only broke the cycle 19% of the time. The condition Response Initiation Time/Movement Time affected the percentage of cycles broken very highly significantly for Subjects Combined and all four Subjects Individually. The 10 or 50 m.sec. delays also affected the percentage of cycles broken, very highly significantly for Subjects Combined and Subject 1, highly significantly for Subject 3 and Significantly for Subject 2. (Tables 30, 68, 69. Figs. 45-49). All subjects broke more cycles when the Rare Stimulus was given in Response Initiation Time rather than Movement Time. Similarly in the case of Subjects 1, 2 and 3 the shorter the delay in giving the Rare Signal after the start of Response Initiation Time the greater was the percentage of cycles broken. Subject 4 did not follow this pattern for the delays after the start of Response Initiation Time. In her case a 10 m.sec. delay resulted in 94% cycles broken while a 50 m.sec. delay resulted in 96% broken. All subjects broke more work cycles when the Rare Stimulus was given at the shorter delay after the start of Movement Time.

The mean Response Initiation Times and Movement Times of each Subject were calculated. The means of Response Initiation Time plus Movement Time gave an estimate of how long each Subject took from Steps 3 to 5, inclusive, of the work cycle. (Fig.3). The means of Movement Time alone gave an estimate of how long each Subject took from Steps 4 to 5, inclusive, of the cycle. By subtracting the Rare Stimulus delays from these times it became possible to estimate measurements called "Residual Times" - which could take one of two forms, viz:-

A. $\quad$ R.I.T. + M.T. - $\begin{cases}10\\50\end{cases}$ = Residual R.I.T. plus M.T.

B. $\quad$ M.T. - $\begin{cases}10\\50\end{cases}$ = Residual Movement Time.

These measurements were estimates, for each subject, of the duration in time between the giving of the Rare Signal and the point of time in an non stimulus cycle at which the subject usually pressed Button 'D'. (Once Button 'D' was pressed in a Stimulus Cycle it was not possible to break that cycle). These measurements may be thought of as the time remaining to a Subject during which it was possible for her to break or interrupt the work cycle instead of following the alternative of completing it without interruption.

The percentage of cycles broken by each Subject was plotted against the corresponding Residual Time. In the case of 'A' the plot simply followed the Subject order of percentage of cycles broken and the Residual Time order within Subjects (Table 36). In the case of 'B' however, the percentage of cycles broken followed the order of the Residual Movement Times, despite the fact that the times of Subjects 1 and 2 overlapped. (Table 35, Fig.54). In order to investigate the relationships further, it was decided to plot the percentage of cycles broken per subject per week against the corresponding Residual Movement Times. Thus there were two measurements per Subject per week yielding sixty two points in all (Table 35a. Figs.55). Subject 3 was absent for the last week which accounts for the loss of two points. The correlation coefficient between percentage of cycles broken and Residual Movement Time was calculated and found to be 0.82. This value was statistically very highly significant ($<.01 = 0.325$). This significance encouraged an attempt to fit a theoretical curve to the data. This was done (Table 35b. Fig.55). Two curves fitted the data very highly significancly ($<0.001$). The first was a straight line:- $Y = A.X + B$ with $A = 0.2055$ $B = 56.7014$. This accounted for just over two thirds of the variation. The second formula was $Y = A.e^{BX}+C$. This formula accounted for considerably over two thirds of the variation in the data.

The Days of the Week (Tables 33, 64, Figs. 52, 53) had a highly significant effect for Subjects Combined in the Design V analyses (Weeks was a hierarchical division of Days). In Design VI, when Fortnights was a hierarchical division of Days, there were no significances. (Table 75). There were no significances, in either analysis, for Subjects Individually. The pattern for each subject follows an identical trend with poorer performances on Tuesdays and Thursdays.

In the first analyses, Weeks of Experiment were very highly significant for Subjects Combined and Subject 2. They were highly significant for the other Subjects (Tables 33, 65. Figs. 50,51). In these analyses the effect of weeks included the effect of the Rare Signal being given in Movement Time for three days out of the five in alternate weeks. The same applies to the Rare Signal being given in Response Initiation Time. A second analyses by Fortnights avoided this. (The same arguement applies to the dependent variable "Reaction Time"). Fortnights had a very highly significant effect on the percentage of cycles broken for Subjects Combined and Subject 2. They had a highly significant effect for Subject 4 and a significant effect for Subject 3. (Tables 31, 76). There was no significance for Subject 1. On the whole the number of cycles broken showed a decrease as the fortnights progressed. Subject 1 was an exception. She remained practically steady for the first three fortnights and only dropped in the last. This difference on the part of Subject 1 would also account for the very high significance of the Subject by Fortnight Interaction (Table 79).

Periods of the Day had no significant effect on percentage of cycles broken for either Subjects Combined or Subjects Individually, (Tables 34,67). The Rest Breaks/No Rest Breaks condition was highly significant for Subject 1 and significant for Subject 3. The effects were in opposite directions. (Tables 32, 77). There were no statistical significances for the other Subjects or for Subjects Combined.

The Subject/Day interaction was very highly significant but in itself this is not very interesting because Days include so many other variables, for instance Subject by R.I.T./M.T. conditions. (S X G). This last interaction was very highly significant (Tables 30,73,79). This can be accounted for by the different relationships between the conditions for the various Subjects. Subjects 2 and 3 broke approximately five times more cycles for the R.I.T. condition than for the M.T. condition. The ratios for Subjects 1 and 4 were 2.5 to 1 and 1 to 0.66 respectively. A similar inter subject variation in ratios occurs for the delay conditions 10 m.sec. and 50 m.sec. This accounts for the high significance of the interaction S X H. (Tables 30, 73).

Subject/Week was very highly significant. This can be accounted for mainly by Subject 1's comparative steadiness until Week 5 followed by an increase in cycles broken in Week 6. All the other Subjects broke fewer cycles in Week 6. There are other intra subject variations (Fig.51) for instance Subject 1's very much steeper drop in percentage of cycles broken in Week 8 and Subject 4's sudden increase in Week 7. The most notable difference is Subject 1's different trend.

The Subject/Rest Breaks Interaction was very highly significant (Tables 32, 79). Three of the Subjects showed improvement in the Rest Breaks condition and the reverse was true for the other Subject.

There were no significant interactions for Subjects individually.

3. Reaction Time

The Subjects differed very highly significantly from one another (Tables 28,62. Fig.41). Subject 3 had the fastest mean time at 603 m.sec. and Subject 1 the slowest at 1339 m.sec. The times of the other two Subjects were approximately 1 sec. each. The range of Reaction Time for Subjects Combined extended from 0.4 secs to 2.6 secs. The majority of times were between 0.5 sec. and 1 sec. with a peak between 0.8 and 0.9 secs. (Table 38. Fig.62).

Days of the Week had no significant effect either for Subjects Combined or Subjects Individually. All Subjects had faster Reaction T mes on Fridays than on Thursdays. Apart from that no systematic trend is observable (Tables 43,64,75).

Fortnights had a very highly significant effect on Reaction Times for Subjects Combined and Subject 1 only. (Tables 40,76). No systematic trends are visible. Weeks had a similar statistical significance. (Tables 42,65, Fig.63, 64). The main reason for the effect seems to be the learning curve exhibited by Subject 1. Periods of the Day had no significant statistical effect for either Subjects Combined or Subjects Individually (Tables 43,67).

Rest Breaks/No Rest Breaks condition had a very highly significant effect for Subjects Combined and a highly significant effect for Subject 1. (Tables 41,77). All Subjects had faster Reaction Times in the No Rest Breaks condition

Reaction Time was effected by the point of Stimulus injection (i.e. in R.I.T. or M.T.). The effect was very highly significant for Subjects Combined and Subjects 1 and 2 individually. It was highly significant for Subject 3 and not significant for Subject 4. (Tables 43a, 78). The delays of 10m.secs and 50 m.secs had significant effects on the Reaction Times of Subjects 1 and 3 but there were no significant effects for the other two Subjects or Subjects Combined (Tables 43a, 69).

The Subjects/Days of Experiment interaction was very highly significant, which can be explained by Days including most other independent variables. The Subjects/Weeks interaction was also very highly significant (Table 73). Subject 1's steep learning curve, as compared with the other Subjects, has already been commented on. The Subject/Fortnights Interaction was very highly significant. (Tables 40, 79). This is likely to be due to the very large differences between the four average times of Subject 1 over successive fortnights in contrast with the fairly steady average times of the other Subjects.

The interaction Subjects/Rest Breaks/Periods was significant at the 5% level. This is very difficult to interpret and would seem to be due to differences one example of which would be:- Subject 1 increased the length of her Reaction Times in Period 3 under the Rest Break Condition and decreased under the No Break Condition while Subject 4's trends were the reverse of this. All this has then to be compared with another period, P6 for instance. The trends in this period are reversed for the Subjects and Rest Breaks/No Rest Breaks Condition. No systematic information emerges from a survey of the whole picture in those terms.

There were no significant interactions for the Subjects Individually.

4. Response Initiation Time ($\bar{X}$, Average S.D., % > M + 2 S.D.)

The Subject's times differed very highly significantly from one another in both their means and average Standard Deviations. There were no significant differences between Subjects for percentage of times greater than the mean plus two Standard Deviations (Tables 28, 62, Fig.40.).

Days of the Week had a highly significant effect on the mean times of the Subjects Combined and were significant for Subjects 1 and 2 but not for the other two Subjects. They were not significant for the average

Standard Deviation or for the percentages greater than the mean plus two Standard Deviations. (Tables 53, 64, Figs.89-92). No systematic trends were observable for either of the last two dependent variables. The mean times of all Subjects were slowest on Monday. Subjects 2 and 3 continued to improve their times fairly steadily each day. Their fastest times were on Fridays. Subject 1's rate of improvements on Tuesday, as compared with Monday, was not continued through the remaining Days of the Week. Her slowest times were on Monday. Subject 4's slowest times were also on Monday and her fastest on Tuesday.

Table 65 shows that Weeks of Experiment had significant effects on the three measurements ($\bar{X}$, Average S.D., %>M + 2 S.D ) but Residual (Weeks) is more relevant because it concerns the effect of Weeks without the Rest Break/No Rest Break effect. Residual (Weeks) had a very highly significant effect for the mean times of the Subjects Combined and of all the Subjects individually. It had a significant effect for the average Standard Deviation of Subjects Combined and Subject 2. This effect was very highly significant in the case of Subjects 1 and 4. There were no statistical significances for percentage of times greater than the mean plus two Standard Deviations. (Table 49, 50, 66. Figs. 77-82). The average times for Subjects 1, 2 and 3 show fairly steady learning over the weeks. Subject 4 was faster in the first week. The average Standard Deviations of the times of all Subjects increased in Week 2, apart from which there were no systematic trends. The percentage of times, greater than the mean plus two Standard Deviations, fluctuated unsystematically.

Periods of the Day were very highly significant for the average times of the Subjects Combined and Subject 1. They were significant for Subject 4. The only significance for the average Standard Deviation was for

Subject 4's times. There were no significances for the percentage of times, greater than the mean plus two Standard Deviations. (Tables 51, 52, 67. Figs. 83-88). The times for the Subjects Combined show an improvement until Period 4. Thereafter they fluctuate. The times for Subjects Combined result more from an averaging out of differences in the times of Individual Subjects rather than from a reflection of similar trends.

The average Standard Deviations of the times of Subjects 2, 3 and 4 were greater in the second period of the day than in the first. They were greater in the penultimate period than in the last one (Period 8), for all Subjects.

The Rest Breaks/No Rest Breaks condition was statistically insignificant for Response Initiation Time.

The Subject/Days and Subject/Weeks interactions were very highly significant for the mean and average Standard Deviation (Table 71). The high significance in the case of weeks seems mainly due to the difference in the trends of Subject 4's times as compared with those of the other Subjects (Figs. 78,82). The same applies to the Subject/Periods interaction.

The interactions in the analyses for the Subjects Individually were very few and except in the case of Weeks/Periods for the mean times are not reflected in the interactions for Subjects Combined. The Weeks/Periods interaction for Subjects Combined was significant at the 5% level only. The differences in trends were not systematic.

5. Movement Time ($\bar{X}$, Average S.D., $\% > M + 2$ S.D.)

The Subjects differed very highly significantly from one another in both their mean times and average Standard Deviations (Tables 28,62. Figs. 39).

Days of the Week had a very highly significant effect on the mean times of Subject 1 and a significant effect on Subject 2's times. They were significant for the average Standard Deviation for Subjects Combined and Subject 3 and highly significant for Subject 1. The only significance for the percentage greater than the mean plus two Standard Deviations was at the 5% level for Subject 1. (Tables 58, 64. Figs. 105-108). Subjects 1, 2 and 3 all have faster times on a Friday than on any other day of the Week. All Subjects have smaller average Standard Deviations on that Day.

There were quite a number of statistical significances for the effect of Weeks (Table 65) but Residual (Weeks) is more relevant (i.e. excludes Rest Breaks/No Rest Breaks effect). Mean Movement Times for Subjects Combined and Subjects 1 and 2 individually were affected very highly significantly. The mean Movement Times of Subjects 3 and 4 were affected significantly. The average Standard Deviations of Subjects 1 and 2 were affected very highly significantly and significantly respectively. The percentage of cycle times greater than the mean was affected significantly for Subjects 1 and 2. (Tables 54, 55, 66. Figs. 93-98). The mean movement times in general show learning over the weeks even if only by a small fraction for Subject 3. The Subjects follow individual patterns for the average Standard Deviations and the percentage of times greater than two Standard Deviations above the mean.

Periods of the Day were significant for the mean times of Subjects 1, 2 and 3 and highly significant for Subject 4. They were significant and highly significant for the average Standard Deviations of the times of Subjects 2 and 3 respectively (Tables 56, 57, 67. Figs. 99-104). Each Subject has a different trend in times over the periods. This applies to the means, average Standard Deviations and percentage of times greater than the mean plus two Standard Deviations.

The Rest Breaks/No Rest Breaks Condition had no effect on Movement Times.

Table 71 shows that quite a number of interactions were significant at various levels. Everyone of these includes Subjects as one element in the interaction. Subjects differed unsystematically. (Figs. 94, 96, 98, 100, 102, 106, 108).

6. Cycle Time (${\bar X}$, Average Standard Deviation, $\% > M + 2$ S.D.)

The Subjects differed very highly significantly from each other (Tables 28, 62. Fig. 38).

The Days of the Week were significant for the Average Standard Deviation of Subject 1's times. There were no other significances. (Tables 48, 64.).

Residual (Weeks) was highly significant for the mean times of the Subjects Combined and Subject 2 and very highly significant for those of Subject 1. This independent variable was also highly significant for the average Standard Deviation of Subject 2's times and significant for those of Subject 1. The percentage of times greater than the mean plus two Standard Deviations was effected highly significantly for Subjects Combined, Subjects 1 and 2 and significantly for Subject 3. (Tables 44, 45, 66. Figs. 65-70).

Subjects 1, 2 and 3 show some learning over the eight weeks. Subject 4 seems to show none for the mean cycle times. The average Standard Deviations of the Subjects mean times fluctuate considerably and to no fixed pattern. The same may be said for the percentage of times greater than the mean plus two Standard Deviations. The most that can be said is that there was a slight increase over the eight weeks.

Periods of the Day were very highly significant for the mean times of Subjects Combined and Subject 4. They were significant for the average Standard Deviations of Subject 1's and 4's times. There were no significances for the percentage of times greater than the mean plus two Standard Deviations (Tables 46, 47, 67. Figs. 71-76). The Subjects' mean cycle times were remarkably steady over the Periods, Subject 4's times excluded. Her times were approximately a third of a second slower at the end of the working session. Subjects followed individual patterns for the other two measurements (i.e. average S.D., %$>$M + 2 S.D.).

The Rest Breaks/No Rest Breaks Condition had a highly significant effect on the mean cycle times of Subject 4 only. Subjects 1 and 3 slightly improved their times in the No Rest Breaks Condition. The reverse occured for Subjects 2 and 4. Subject 4's cycle time slowed by about a fifth of a second (Table 61a, 70).

The most interesting interaction was Rest Breaks/No Rest Breaks by Periods. This was significant for the mean cycle times and highly significant for the average Standard Deviation of Cycle Times. (Table 59, 60, 61, 71. Figs. 109-123). The average cycle times over the Periods in the No Rest Condition for the Subjects Combined are higher than in the Break Condition. The same is true for Subjects 2 and 4 for all periods. In the case of Subject 1 the period after the restbreak has faster times than the same period when no break was given. Subject 3's times are considerably faster in the No Rest Breaks Condition but the tendency is for them to get longer as the session progresses. This tendency is reversed in the Breaks Condition. It is interesting that in every case, except the No Break Condition for Subject 4, there is an improvement in the last period of the working session as compared with the penultimate period.

Both Individually and Combined, the Subjects have higher average Standard Deviations for most periods in the No Breaks Condition. Except in the case of Subject 3 the same is true for percentage of cycle times greater than the mean plus two Standard Deviations.

7. Response Initiation Time (Stimulus Cycle)

There is not much to be gained from a lengthy analyses of this variable. The results, obtained from analysing Response Initiation Times other than those in the Stimulus Cycle, provide a more comprehensive survey based on a greater amount of data.

The most relevant point of interest is that there should be a reasonable resemblance between the two sets of data so that they may be considered as coming from the same population.

The average Response Initiation Time (Stimulus Cycle) for Subjects Combined is 118 m.sec. The Average Response Initiation Time, from the other cycles, is 111 m.sec. (Table 27). This is very close and confirms the idea that it is not necessary to go into detail about both sets of results. There is a similar closeness in times for each Subject Individually. (Table 28. Cf.Figs. 40 and 43). The range for Response Initiation Time (Stimulus Cycle) supports the idea of close similarity between the two sets of data (Table 38. Fig.60).

The average Response Initiation Times in the Non-Stimulus Cycle were tested against the average times in the Stimulus Cycle using the "t" test. No significant differences were found either for Subjects Individually or for Subjects Combined. The same holds true when Response Initiation Times in the Stimulus Cycle were broken down into times forcycles in which the Stimulus was given with a 10 m.sec. Delay and a 50 m.secs. Delay. (Please see Table No. 36a).

However, when Response Initiation Time (Stimulus Cycle) was broken down into average times for Cycle Broken and Cycle Not Broken, there were significant differences between these times and average Response Initiation Times for the Non-Stimulus Cycle. The Subjects Combined had shorter times (Highly Significant) when they failed to break their work cycles in response to the stimulus. They had longer times (Highly Significantly) when they were successful. Where there is any significant result for a Subject Individually the same holds true. Subject 4 did not show the same trend but these were no significant results for her times. Subject 1 had in effect the same times for the conditions 10 m.sec. Cycle Broken and 10 m.sec. Cycle Not Broken. It should be noted that Subject 4 broke a large majority of her work cycles when the stimulus was given during R.I.T.

It would seem that the Subjects were more likely to break their work cycles when their Response Initiation Time was longer.

8. Movement Time (Stimulus Cycle)

Movement Times recorded during the Stimulus Cycle did of course differ from Movement Times recorded for the other Cycles. This was implicit in the fact that, when a subject broke a work cycle in response to the Rare Stimulus, her movement time included Reaction Time. Table 27 shows that the mean Movement Time (Stmulus Cycle) was approximately twice as long as Movement Times recorded in other cycles. Table 28 shows that the same is true for the mean times of the Subjects individually and that Subject 3 who broke the fewest cycles had the smallest differences. between her mean Times (Cf. Figs. 39 and 42 note difference in scales).

Figure 61 shows the distribution of Movement Times (Stimulus Cycle) to be bimodal. The first peak was in the region of 300 to 600 m.se.c corresponding to when a Subject did not break the work cycle. This may be compared with a mean of 456 m.sec. and average S.D. of 44 m.sec. for Movement Times recorded in cycles other than the Stimulus Cycles. The second peak of the distribution corresponds to when a subject did break the work cycle (Table 38).

This dependency of Movement Times (Stimulus Cycle) on Cycles Broken/ Not Broken is reflected in the trends taken by this measurement. Table 39 of these times over Weeks confirms this dependency when it is compared with Table 33 and Figure 50 showing the percentage of cycles broken each week.

The dependency is also reflected in the Probability Tables - i.e. Tables 68 and 69. The R.I.T./M.T. and 10 m.sec/50 m.sec. delay conditions are very highly significant for both percentage of cycles broken and for Movement Times (Stimulus Cycle) for Subjects Combined.

The same arguement applies to this measurement as to Response Initiation Times (Stimulus Cycle). It would be duplication to analyse the results lengthily because they have already been dealt with under Movement Times from cycles other than the Stimulus Cycle.

9. Location on Strip Switch

These locations are shown in Tables 28 and 37 and Figs. 56-59. Subjects 1, 3 and 4 used the seventh, eighth and ninth locations most. Subject 2 used the sixth, seventh and eighth.

# PART III. CONCLUSIONS

## CONCLUSIONS

The object of this thesis was to try and answer some questions about the relationships between the following:-

| | | | | |
|---|---|---|---|---|
| A. | Frequency of interruption of the work cycle. (% of Cycles Broken) | and | (1) | Point of injection of rare signal |
| | | | (2) | Periods of the Day |
| | | | (3) | Presence or absence of Rest Breaks |
| B. | Reaction Times | | (4) | Day of Week |
| | | | (5) | Week of Experiment (learning) |
| | | | (6) | Individual Differences |

C. Work Cycle Times (including the elements Response Initiation Times and Movement Times) and (2)-(6) above.

In addition an attempt was made to note:-

D. Any associations or otherwise between Percentage of Cycles Broken, Reaction Times and Cycle Times.

E. Whether the experimental results suggested any design recommendations and/or changes in industrial legislation.

A. Percentage of Cycles Broken

(1) Point of injection of the rare signal; The answer to this question falls into two parts depending on whether the point of injection was during Response Initiation Time or during Movement Time.

When the point of injection was during Movement Time, the best predictor of the percentage of cycles broken seems to be the "backwards measurement" from the normal ending of movement to the point of injection, i.e. "Residual Movement Time". When an average "Residual Movement Time" of 638 m.sec. was available, there was one hundred percent successful interruption of the work cycle. The success rate decreased to fifty percent when the time available was 556 m.sec. and to zero when only 220 m.sec. was available. These Times resemble those reported, in another context, by Poulton (1950) and support the idea that Reaction Time is lengthened, when it involves a response to a signal given during another, previously initiated, response. A formula has been evolved which expresses a significant relationship between Percentage of Cycles Broken and Residual Movement Times viz:-

$$Y = A.e^{BX} + C$$

where

$A = 4.2393, \quad B = 0.4970, \quad C = -11.0864$

The different response success rates to rare signals given during Movement Time do not support the idea that a fixed period of feedback (150 m.sec - 190 m.sec) was operative at the end of Response Initiation Time / beginning of Movement Time. The points of injection of the rare signal were within this period and had feedback, with its resultant fixed delay, been operative then the success rates for both points of injection should have been the same. It is very clear that the success rates were not the same. The prior point of injection invariably resulted in greater success with interruption of the work cycle. The Subjects in these experiments were highly practiced and the results seem to support the suggestion that such feedback could be eliminated with practice. (Welford, 1968)

Successful responses to stimuli or signals given during Movement Time do not bear any clear relationship to the intervals between the points of injection and the green signal initiating movement i.e. to interstimulus intervals. This contrasts with the significant relationship which such responses bear to "Residual Movement Time". It would seem that the dominant factor, affecting the capacity to interrupt a movement, is not so much the relative temporal proximity of the first and second signals but rather how close the movement is to completion when the second signal is injected.

The percentage of cycles broken, in response to interrupting signals given during Response Initiation Time rather than Movement Time, does not bear the same neat relationship to Residual Time. More cycles were broken when Residual Time was longer, i.e. more cycles were broken when the point of injection of the rare signal was during Response Initiation Time rather than Movement Time, but it was not possible to evolve a formula relating Percentage of Cycles Broken and Residual Times when the point of injection was during Response Initiation Time.

Times to inhibit the movement still showed the lengthening that is generally associated with responses to a second stimulus given close in time to a first.

The differing response success rates to signals given during Response Initiation Time do not necessarily support the idea that second signals can be processed during Response Initiation Time. The different rates could be due to the earlier red light signals being so close to the first or green light signal that both signals were perceived as one composite signal.

When interstimulus intervals were shorter than Response Initiation Time, these results tend to support those of Gottsdanker (1966) in so far as they show that Response Initiation Time was not affected by the second signal. Comparison of R.I.T's from Stimulus and Non-Stimulus Cycles shows that both sets of times come from the same population so that R.I.T. was not affected by a second signal which was unexpected and which was concerned with the alteration of the first response rather than with the initiation of a separate and expected response. (Cf. Gottsdanker 1963, Bertelson 1967).

Whereas the average R.I.T. for all the Stimulus Cycles, and for the Stimulus Cycles with I.S. Intervals of 10 m.secs. or 50 m.secs. are not different from the average R.I.T. for the Non-Stimulus Cycle, this does not hold when the Stimulus Cycles are broken down into Cycles Broken and Not Broken. The average Response Initiation Times are longer when Cycles are broken and shorter when they are not. This tempts one to conclude that perhaps the breaking or not of the cycle did not affect R.I.T. but that the length of R.I.T. may have affected the breaking of the cycle, when the rare signal was given during R.I.T. Gottsdanker (1966) does not give any figures showing a relationship - if there was any - between the length of R.T. (R.I.T. in this experiment) and the duration of response and unfortunately in this experiment the amplitude and length of response were not measured in the say was as in Gottsdankers experiment, so no comparisons can be made. The responses in the two experiments were different in kind.

The Subjects in Gottsdanker's experiment were required to slide a pointer in a groove in one of two directions over one of two very short distances. In this experiment the Subjects made a free ballistic type movement over a much longer distance and always to the right. It was never necessary to vary this movement in the uncorrected condition. In any case the average R.T. was longer in Gottsdanker's experiment, which one would expect when a choice R.T. is compared with a rather more practiced simple one with a fixed fore period. Possibly, as in the case of Subject 4 whose R.I.T. was longest, no relationship would show itself if the length of the R.T's in Gottsdanker's experiment were compared with the length and amplitude of responses. The effect may only show itself with very short and highly practiced R.T's which are part of a repetitive cycle.

(2) Period of the Day; )
)
(3) Presence or absence of Rest Breaks; ) Any difficulty which the subjects experienced in interrupting the work cycle cannot be ascribed to fatigue since Periods of the Day had no significant effect in either experiment and since the Rest Break/No Rest Break condition did not have a consistent effect. The rare signal was well above threshold level. In fact, the subjects, when talking among themselves, said that they saw the signal but "could not stop - again."

(4) Day of Week; The Subjects' responses to the rare signal tended to be less successful on Tuesdays and Thursdays. The author cannot suggest any reason for this. The result was not significant statistically for the Subjects individually. Nevertheless they all followed the same pattern rather too closely to be able to dismiss the point, comfortably, without mention. It would be interesting if the Annual Report of H.M. Chief Inspector of Factories contained a Day of Week analysis of the numbers of accidents reported to H.M. Inspectorate. So far as the author is aware, such an analysis has not been published.

(5) Week of Experiment (learning); Subjects found increased difficulty in interrupting the work cycle as the duration of the main experiment increased. It seems reasonable to link this increased difficulty with the general speeding up of Response Initiation Times, Movement Times and Work Cycle Times over the same period of time. In other words, as the Subjects became more skilled at the Repetitive work cycle, their capacity to respond to the rare signal became poorer. This could result from "Residual Movement Times" becoming too short to allow sufficient time for a successful response to be made to interrupting signals. This decrease in "Residual Movement Time" may underlie or provide some explanation for the increased "Rigidity" suggested by Welford (1968). Welford (op.cit.) suggested that this "rigidity" resulted in persons finding it more difficult to respond to unexpected signals which required them to interrupt a highly practiced movement.

(6)Individual Differences; The four older Subjects, average age fifty five years, broke more work cycles than did the younger Subjects, average age twenty nine years; 44% compared with 28.6%. The contrast between the two groups is even more marked when the results from Subject 4 (1967 Experiment) are removed from the data for the younger group. The figures then become 44% compared with 11.1%. This Subject tended to be an exception to the older/younger grouping in all measurements.

These comparisons do not contradict Griew's (1958) findings about the 45-52 year age group being more susceptible to accidents in certain occupations and they support the findings made by both Griew and others that accidents decreased highly significantly with age in the "miscellaneous" job category.

The scores of the Subjects, in the various tests, did not serve as reliable predictors for their performance at interrupting their work cycles. The Subject with the second highest I.Q. broke most cycles and the Subject with the highest I.Q. broke the fewest. The Subject with the best score on the manual dexterity test broke the least number of cycles and the Subject with the second best score broke the most. The scores on the personality tests were no more informative though the Subject, who broke the fewest work cycles, did have a low "G" (Super-ego) score on "The 16 P.F. Test". Her other scores did not follow the pattern suggested for accident proneness by Suhr (1953).

The results from the manual dexterity test support the finding (Stromberg 1951) that older Subjects tend to score less well on the test than do younger ones.

B. Reaction Times

This time is not only the time required to break or interrupt a work cycle. It is the time taken to press the button or strip switch in order to cancel the rare signal, irrespective of whether the work cycle was broken or not.

It seems apposite to remark here that the strip switch locations most used were numbers five to ten and that the rest of the switch was practically superfluous. Each switch segment or location measured one and a quarter inches. The clearance between each segment was one sixth of an inch with a half inch clearance at the ends of the switch. To the Subjects the whole switch appeared to be continuous. The clearances were not sufficiently large to permit pressure on any part of the switch without activating one of the segments or locations. The Subjects were not given any advice about which strip switch locations to use - the emphasis was put on speed. It is of some interest that the Subjects chose in effect to use a switch approximately nine inches in length. One might conclude that emergency switches should be emphasized not only by marking and position but also by being of greater size than they are at present.

(1) Point of injection of rare signal; In the main experiment reaction times generally tended to be longer when the interstimulus interval was larger. The same seems to be true for the preliminary experiment in so far as the relevant data is available for comment. This relation suggests that Subjects were hindered more by interference due to the completion of the work movement rather than that due to its initiation. Such interference became more likely with longer interstimulus intervals because as these intervals increased the

normal completion of movement became closer to the second stimulus. This conclusion supports the findings from the data concerned with the percentage of cycles broken.

Average Reaction Times were in the region of one to two seconds which agrees with the findings of Hartnett (1967).

(2) Period of the Day; )
)
(3) Presence or absence of Rest Breaks; )
)
(4) Day of week; ) Reaction Time does not show a fatigue effect any more than does percentage of cycles broken. Ironically, Reaction Times were slightly (but not significantly: Sub.2 &4) faster for all Subjects in the No Rest Breaks Condition. Presumably the three and a half hour working session was not sufficiently long to demonstrate a fatigue effect.

(5) Week of Experiment (learning); Apart from Subject 1 in the main experiment, none of the Subjects shows any sign of learning where Reaction Times are concerned. One can only suggest that the rarity of the signal did not allow of any build up of skill in this respect. Possibly skill with the movement required to extinguish the red light did improve but its effect was negated by an increase in the intrinsic difficulty of responding to an interrupting signal as skill and speed at the repetitive work cycle improved.

(6) Individual Differences; The twenty two and twenty nine year old Subjects had considerably shorter Reaction Times than those of the older Subjects but the twenty five year old's time was close to that of the fifty two and fifty seven year old Subjects. This is in line with her (Subject 4, Main Experiment) slowness of Response

Initiation Time, Movement Time and Cycle Time. This slowness was not reflected in her score on the Manual Dexterity Test. There was nothing unusual about her I.Q. but, as has already been stated in the section entitled "Subjects", she was determined not to compete in anyway with the other Subjects and she made this very clear. Her scores on "The 16 P.F. Test" and E.P.I. showed her to be markedly more introverted than average and she scored the highest possible score for $Q_2$ (self sufficient, prefers own decisions) on "The 16 P.F. Test".

C. Work Cycle Times. (including the elements Response Initiation Time and Movement Time).

(2) Periods of the Day; )
(3) Presence or absence of Rest Breaks; ) The preliminary and main experiments do not show the same patterns for average cycle times over Periods of the Day, even taking into account the fact that there were seven periods in the first experiment and eight in the second. However, both experiments show some improvement in average cycle times, for Subjects Combined, in the period after the Rest Break when compared with the times in the period just previous to the break. This is only a slight indication as there was no statistical significance for Periods in the preliminary experiment and none for three out of four of the Subjects in the main experiment. Once more it can only be suggested that perhaps the working session was not sufficiently long to show a marked effect on average cycle times. There was an end of session improvement in the main experiment (Hartnett 1967).

Periods of the Day had very similar effects on average Response Initiation Time and Movement Time which in turn were very similar to their effect on Cycle Times with one interesting variation. Whereas average Cycle Times for Subjects Combined showed a tendency to improve in the period after the Rest Break, Response Initiation Times and Movement Times both showed the opposite tendency. The Cycle Time improvement in the period after the Rest Break must therefore have been due to fewer delays in feed and take off rather than in quicker manipulation of the controls on the consoles. Perhaps the rest break influenced Subjects to "show willing" rather more than anything else! / particularly Sub.4.

In both the preliminary and main experiments the average Standard Deviation of the Cycle Times went up in the period after the break.

In the preliminary experiment the percentage of cycle times greater than the mean plus two standard deviations showed a definite drop in the period after the Rest Break but this was not so in the case of two Subjects in the main experiment though for Subjects Combined there was a drop. However the percentage of cycle times greater than two standard deviations above the mean was smaller in more periods when a break was given than when there was no Rest Break. This is in line with the findings of Murrell and Forsaith (1963).

It also supports the notion that perhaps Subjects were influenced to "show willing" when a Rest Break was given and in consequence they were not having little unauthorized Rests by slowing down their rates of feeding the machines while actually operating them at the same speed or at faster speeds.

(4) Day of Week; There were no statistical significances for the Cycle Times apart from the average standard deviation on one Subject's times. Average Movement Times tended to be longer on Tuesdays and Thursdays. Response Initiation Times were longest on Mondays. It is possible that the weekend break may have had an adverse effect on the capacity to preprogram and in consequence on Response Initiation Times. R.I.T. and M.T. were fastest on Fridays.

(5) Week of Experiment (learning); The average Cycle Times, Response Initiation Times and Movement Times all show the expected improvement over the eight weeks of the main experiment for all Subjects. This trend is opposite to that shown by the percentage of cycles broken and the implications of this have been discussed earlier in this chapter.

(6) Individual Differences; The work cycles were not identical in both experiments - the feed and take off arrangements were different - therefore it is not possible to compare the absolute Cycle Times for the two experiments. When cycle times are considered separately for each experiment no conclusion can be drawn about any age effect. Movement Times correlated positively with age except in the case of Subject 4 (Main Experiment). Unexpectedly Response Initiation Times did not.

The I.Q. scores showed a positive correlation with the Cycle Times in each experiment i.e. Subjects with higher I.Q. had longer Cycle Times but the differences were too small to draw any firm conclusions.

In both experiments the Subject with the lowest "N" score in the E.P.I. had the fastest Cycle Times but again the numbers were too small to draw any firm conclusions.

D. Associations or otherwise between "A", "B" and "C" (% of Cycles Broken, Reaction Times, Cycle Times).

In the main experiment, longer cycle times, Movement Times and Reaction Times were associated with each other and with a higher percentage of cycles successfully interrupted. The same association does not hold for Response Initiation Times.

The Response Initiation Times in these experiments are not likely to be typical of Response Initiation Times in general. Practice effects probably led to such preprogramming that decision time, as commonly visualized, must have been practically eliminated. This is borne out by the fact that the Response Initiation Time of one Subject was only 85 m.sec. and of another was 95 m.sec. Such short times would not be reached in an ordinary Reaction Time experiment. This sort of preprogramming needs to be taken into account when practice effects are considered particularly if some emergency might arise which would involve cancellation of the preprogrammed Response.
It would not be satisfactory to estimate a residual time based upon the more usual 250 m.sec. Response Initiation Time.

The Subjects were not seen to release the control buttons before the green light was illuminated. The point was carefully watched and the Subjects were expressly warned about it before hand and were regularly reminded of it throughout both experiments.

E. Suggested Design Recommendations and Changes in Industrial Legislation

The relationship between the capacity to interrupt an ongoing movement and "Residual Movement Times" should be of interest to designers of man-machine systems.

It is suggested that automatic fail safe or correction devices should form an integral part of any system in which short time lags can occur between any possible malfunction and consequent breakdown or accident, the prevention of which would otherwise depend upon the operator changing his usual mode of action. The human operator, on the evidence, does not seem to be equipped to deal with such contingencies.

Further work needs to be done in order to evaluate, more precisely, the time lag required to ensure a success rate as close as possible to one hundred percent. At the moment the evidence indicates that a time lag of less than 640 m.sec. certainly cannot be relied upon and such an estimate makes no allowance for any positive action that may be required on the part of the operator. When even the simplest positive action is required a time of 2 sec. may be needed to ensure successful response. It may seem the height of stupidity to bring a tool or other part of a machine down on ones own hand or to get caught by inrunning rolls, but where a time factor of this sort is involved, the operator would seem to have little alternative given the limitations of the human organism.

The possible specification of some dangerous parts of machinery in such general terms as those associated with time factors and man-machine systems might make it possible to extend Section 17 of the Factories Act 1961. This Section deals with the guarding of new machinery by the sellers. Its application is very limited at present and its extension is made difficult by the need to specify particular dangerous parts of a machine before it even reaches the market and has had a chance to cause an accident and thus to be demonstrably dangerous. An amendment of this type would be particularly helpful to the "small man" who may employ as few as one or two persons and who is likely to have neither the "know how" nor the resources to guard or modify a machine satisfactorily.

The suggested type of extension to Section 17 could be done "without prejudice" to the other Sections of the Act which deal with guarding.

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# APPENDIX I

## Tables and Figures of Results

## Preliminary Experiment

## LIST OF TABLES

| | | | Table |
|---|---|---|---|
| % Cycles Broken | Day of Experiment | Subjects Combined )<br>Subjects 1 - 4 ) | 12 |
| % Cycles Broken | Day of Week | Subjects Combined )<br>Subjects 1 - 4 | 13 |
| Response Initiation Time - $\bar{X}$<br>(Stimulus Cycle) | Fortnights | Subjects Combined | 14 |
| Movement Time - $\bar{X}$<br>(Stimulus Cycle) | " | " " | " |
| Reaction Time $\bar{X}$ | " | " " | " |
| % Cycles Broken | " | " " | " |
| Response Initiation Time-$\bar{X}$<br>(Stimulus Cycle) | Fortnights | Subjects 1 - 4 | 15 |
| Movement Time - $\bar{X}$<br>(Stimulus Cycle) | " | " " | " |
| Reaction Time - $\bar{X}$ | " | " " | " |
| % Cycles Broken | " | " " | " |

Probability Values

| Dependent Variable | Independent Variable | | | Table |
|---|---|---|---|---|
| Cycle Broken | | Subjects | | 16 |
| Reaction Time - $\bar{X}$ | | " | | " |
| Response Initiation Time - $\bar{X}$ (Stimulus Cycle) | | " | | " |
| Movement Time - $\bar{X}$ - (Stimulus Cycle) | | " | | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | | " | | " |
| Cycle Broken | Day of Experiment | Subjects Combined ) Subjects 1 - 4 ) | | 17 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$ (Stimulus Cycle) | " | " | " | " |
| Cycle Broken | Day of Week | Subjects Combined ) Subjects 1 - 4 ) | | 18 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$. (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$ (Stimulus Cycle) | " | " | " | " |
| Cycle Time - $\bar{X}$ , Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Broken | Period | Subjects Combined) Subjects 1 - 4 ) | | 19 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$ (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Broken | RIT/MT | Subjects Combined ) Subjects 1 - 4 ) | | 20 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$ (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$ (Stimulus Cycle) | " | " | " | " |

| Dependent Variable | Independent Variable | | Table |
|---|---|---|---|
| Cycle Broken | Delays | Subjects Combined )<br>Subjects 1 - 4 ) | 21 |
| Cycle Broken | Fortnights | Subjects Combined )<br>Subjects 1 - 4 ) | 22 |
| Reaction Time - $\bar{X}$ | " | " " | " |
| Response Initiation Time - $\bar{X}$<br>(Stimulus Cycle) | " | " " | " |
| Movement Time - $\bar{X}$<br>(Stimulus Cycle) | " | " " | " |
| Cycle Time - $\bar{X}$, Average S.D.,<br>$\% > M+2$ S.D. | Interactions | Subjects Combined )<br>Subjects 1 - 4 ) | 23 |
| Reaction Time - $\bar{X}$<br>(Stimulus Cycle) | Interactions | Subjects Combined )<br>Subjects 1 -4 ) | 24 |
| Response Initiation Time - $\bar{X}$,<br>(Stimulus Cycle) | Interactions | Subjects Combined )<br>Subjects 1 - 4 ) | 25 |
| Movement Time - $\bar{X}$ | " | " " | " |
| Cycle Broken | Interactions | Subjects Combined )<br>Subjects 1 - 4 ) | 26 |

## LIST OF FIGURES

DATA TABLES

| PARAMETER | | | VALUE |
|---|---|---|---|
| | | | Subjects Combined |
| Cycle time | sec | $\bar{X}$ | 2.08 |
| | | Average S.D. | 0.87 |
| | | % > M+2S.D. | 2.89 |
| Movement Time (Stimulus cycles) | msec | $\bar{X}$ | 390 |
| Response Initiation Time (Stimulus cycles) | msec | $\bar{X}$ | 186 |
| Reaction Time | msec | $\bar{X}$ | 1041 |
| Cycles Broken | % | | 26.9 |

Table 1

| PARAMETER | | | VALUE | | | |
|---|---|---|---|---|---|---|
| | | | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
| Cycle Time | sec | $\bar{X}$ | 2.27 | 1.97 | 2.00 | - |
| | | Average S.D. | 0.90 | 0.75 | 0.95 | - |
| | | %> M+2S.D. | 2.72 | 2.37 | 3.59 | - |
| Movement Time (Stimulus Cycle) | msec | $\bar{X}$ | 629 | 408 | 278 | 234 |
| Response Initiation Time (Stimulus Cycle) | msec | $\bar{X}$ | 150 | 220 | 162 | 216 |
| Reaction Time | msec | $\bar{X}$ | 1160 | 939 | 1189 | 872 |
| Cycles Broken | % | | 50 | 43 | 1.5 | 13 |
| I.Q. | | | 109 | 96 | 104 | 122 |
| E.P.I. Score | | N | 13 | 11 | 14 | 17 |
| | | E | 12 | 17 | 12 | 20 |
| | | L | 1 | 0 | 2 | 0 |

Table 2

CYCLES BROKEN

| CONDITIONS | Subjects Combined | | Subject 1 | | Subject 2 | | Subject 3 | | Subject 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % |
| <u>Signals Given in R.I.T.</u> | | | | | | | | | | |
| Delay: 10 msec | 128 | 55.5 | 33 | 88.6 | 32 | 96.9 | 33 | 3 | 30 | 33.3 |
| 100 msec | 125 | 32.3 | 32 | 71.9 | 32 | 46.9 | 32 | 0 | 29 | 10.3 |
| Total | 274 | 43.4 | 70 | 80 | 69 | 72 | 70 | 1.4 | 65 | 20 |
| <u>Signals Given in M.T.</u> | | | | | | | | | | |
| Delay: 10 msec | 148 | 8.6 | 38 | 26.3 | 38 | 7.9 | 35 | 0 | 37 | 0 |
| 120 msec | 125 | 2.4 | 32 | 9.4 | 31 | 0 | 29 | 0 | 33 | 0 |
| Total | 273 | 5.8 | 70 | 19 | 69 | 4.3 | 64 | 0 | 70 | 0 |
| <u>Signals Given in R.I.T. and M.T.Combined</u> | 557 | 26.9 | 150 | 50 | 138 | 43 | 134 | 1.5 | 135 | 13 |

Table 3

CYCLE TIME (sec)

| CONDITIONS | | SUBJECTS COMBINED | | |
|---|---|---|---|---|
| | | $\bar{X}$ | S.D. | % over 2 S.D. above $\bar{X}$ |
| Day of Week | M | 2.14 | 0.88 | 3.02 |
| | T | 1.99 | 0.87 | 2.68 |
| | W | 2.08 | 0.86 | 2.88 |
| | Th. | 2.08 | 0.91 | 2.81 |
| | F | 2.09 | 0.86 | 3.08 |
| Period | 1 | 2.08 | 0.87 | 2.85 |
| | 2 | 2.09 | 0.84 | 3.14 |
| | 3 | 2.14 | 0.85 | 3.17 |
| | 4 | 2.02 | 0.97 | 2.42 |
| | 5 | 2.12 | 0.76 | 3.06 |
| | 6 | 2.03 | 0.87 | 2.80 |
| | 7 | 2.08 | 0.95 | 2.81 |

Table 4

CYCLE TIME (sec)

| CONDITIONS | | SUBJECT 1 | | | SUBJECT 2 | | | SUBJECT 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | S.D. | % over 2 S.D. above $\bar{X}$ | $\bar{X}$ | S.D. | % over 2 S.D. above $\bar{X}$ | $\bar{X}$ | S.D. | % over 2 S.D. above $\bar{X}$ |
| Day of Week | M | 2.30 | 0.93 | 3.08 | 2.07 | 0.80 | 2.49 | 2.06 | 0.90 | 3.49 |
| | T | 2.12 | 0.94 | 2.56 | 1.93 | 0.74 | 2.20 | 1.93 | 0.93 | 3.27 |
| | W | 2.34 | 0.86 | 2.81 | 1.92 | 0.76 | 2.15 | 2.00 | 0.97 | 3.69 |
| | T | 2.29 | 0.95 | 2.40 | 1.91 | 0.72 | 2.34 | 2.04 | 1.06 | 3.68 |
| | F | 2.30 | 0.84 | 2.77 | 2.01 | 0.77 | 2.67 | 1.97 | 0.97 | 3.80 |
| Period | 1 | 2.30 | 0.86 | 2.77 | 1.96 | 0.88 | 2.60 | 1.99 | 0.88 | 3.18 |
| | 2 | 2.29 | 0.91 | 3.37 | 1.96 | 0.68 | 2.26 | 2.01 | 0.93 | 3.78 |
| | 3 | 2.38 | 0.86 | 3.17 | 2.03 | 0.75 | 2.58 | 2.00 | 0.95 | 3.77 |
| | 4 | 2.22 | 1.00 | 2.04 | 1.91 | 0.87 | 2.01 | 1.92 | 1.06 | 3.21 |
| | 5 | 2.37 | 0.80 | 3.39 | 1.98 | 0.62 | 2.52 | 2.00 | 0.87 | 3.27 |
| | 6 | 2.20 | 0.94 | 2.38 | 1.97 | 0.75 | 2.42 | 1.91 | 0.93 | 3.60 |
| | 7 | 2.12 | 0.95 | 1.95 | 1.96 | 0.75 | 2.19 | 2.16 | 1.15 | 4.30 |

Table 5

X̄ RESPONSE INITIATION TIME (Stimulus Cycles)
(msec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| Period | 1 | 168 | 157 | 172 | 155 | 186 |
| | 2 | 219 | 139 | 389 | 156 | 194 |
| | 3 | 179 | 132 | 193 | 171 | 226 |
| | 4 | 161 | 137 | 173 | 156 | 186 |
| | 5 | 206 | 148 | 214 | 174 | 323 |
| | 6 | 194 | 189 | 194 | 172 | 231 |
| | 7 | 159 | 149 | 189 | 149 | 149 |

X̄ MOVEMENT TIME (Stimulus Cycles)
(msec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| Period | 1 | 311 | 408 | 330 | 265 | 238 |
| | 2 | 466 | 759 | 547 | 285 | 253 |
| | 3 | 389 | 693 | 346 | 281 | 224 |
| | 4 | 412 | 812 | 333 | 279 | 212 |
| | 5 | 345 | 524 | 350 | 281 | 221 |
| | 6 | 394 | 687 | 352 | 278 | 247 |
| | 7 | 412 | 517 | 598 | 277 | 243 |

Table 6

$\bar{X}$ REACTION TIME (msec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Period 1 | 1030 | 1181 | 916 | 1116 | 914 |
| 2 | 999 | 1060 | 940 | 1130 | 873 |
| 3 | 1036 | 1160 | 953 | 1187 | 841 |
| 4 | 1022 | 1044 | 928 | 1242 | 870 |
| 5 | 1051 | 1288 | 950 | 1116 | 832 |
| 6 | 1072 | 1180 | 931 | 1296 | 870 |
| 7 | 1082 | 1211 | 956 | 1234 | 903 |

Table 7

$\bar{X}$ REACTION TIME (msec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| R.I.T. | 1026 | 1076 | 932 | 1189 | 882 |
| M.T. | 1057 | 1243 | 945 | 1188 | 862 |

R.I.T. = Stimulus given in Response Initiation Time

M.T. = Stimulus given in Movement Time

Table 7a

$\bar{X}$ RESPONSE INITIATION TIME (Stimulus Cycle)
(msec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| Day | 1 | 204 | 166 | 242 | 179 | 229 |
| | 2 | 176 | 181 | 181 | 172 | 169 |
| | 3 | 282 | 143 | 413 | 156 | 416 |
| | 4 | 180 | 185 | 190 | 158 | 187 |
| | 5 | 157 | 122 | 141 | 160 | 207 |
| | 6 | 183 | 167 | 213 | 155 | 198 |
| | 7 | 162 | 113 | 191 | 143 | 213 |
| | 8 | 171 | 143 | 256 | 150 | 90 |
| | 9 | 182 | 165 | 201 | 187 | 165 |
| | 10 | 148 | 109 | 170 | 160 | 151 |

Table 8

$\bar{X}$ MOVEMENT TIME (Stimulus Cycles)
(msec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Day 1 | 329 | 420 | 371 | 265 | 261 |
| 2 | 502 | 752 | 711 | 260 | 287 |
| 3 | 378 | 612 | 384 | 264 | 252 |
| 4 | 359 | 575 | 354 | 268 | 239 |
| 5 | 451 | 967 | 334 | 284 | 217 |
| 6 | 460 | 985 | 328 | 290 | 238 |
| 7 | 335 | 487 | 346 | 284 | 224 |
| 8 | 323 | 399 | 369 | 304 | 218 |
| 9 | 433 | 674 | 565 | 282 | 208 |
| 10 | 309 | 415 | 317 | - | 196 |

Table 9

$\bar{X}$ REACTION TIME (msec)

| CONDITIONS | Subjects Combined | | Subject 1 | | Subject 2 | | Subject 3 | | Subject 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT |
| Day 1, 2 | 1121 | 1123 | 1047 | 1140 | 1030 | 1053 | 1373 | 1317 | 1034 | 983 |
| 3, 4 | 1030 | 1139 | 1128 | 1432 | 964 | 1013 | 1107 | 1208 | 923 | 902 |
| 5, 6 | 996 | 1013 | 1050 | 1133 | 996 | 960 | 1104 | 1067 | 832 | 891 |
| 7, 8 | 1019 | 1045 | 1055 | 1098 | 961 | 937 | 1224 | 1338 | 806 | 807 |
| 9, 10 | 994 | 1071 | 1067 | 1345 | 889 | 993 | 1111 | 1072 | 907 | 874 |
| 11, 12 | 951 | 984 | 996 | 1043 | 869 | 943 | 1102 | 1108 | 837 | 841 |
| 13, 14 | 1006 | 1187 | 1027 | 1749 | 953 | 917 | 1165 | 1245 | 876 | 836 |
| 15, 16 | 1034 | 981 | 1123 | 1088 | 888 | 888 | 1139 | 1123 | 790 | 827 |
| 17, 18 | 1031 | 1003 | 1058 | 1103 | 836 | 872 | 1280 | 1215 | 841 | 822 |
| 19, 20 | 1075 | 1011 | 1206 | 1299 | 932 | 882 | 1286 | - | 874 | 851 |

R.I.T. - Stimulus given in Response Initiation Time

M.T. - Stimulus given in Movement Time

Table 10

PERCENTAGE OF CYCLES BROKEN

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Period 1 | 20 | 45 | 25 | 0 | 10 |
| 2 | 28 | 50 | 50 | 0 | 10 |
| 3 | 24 | 50 | 31 | 0 | 15 |
| 4 | 25 | 65 | 35 | 0 | 2 |
| 5 | 24 | 40 | 40 | 5 | 12 |
| 6 | 26 | 50 | 35 | 0 | 17 |
| 7 | 33 | 45 | 52 | 5 | 28 |

Table 11

PERCENTAGE OF CYCLES BROKEN

| CONDITIONS | Subjects Combined | | Subject 1 | | Subject 2 | | Subject 3 | | Subject 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RIT | MT | RIT | MT | RIT | MT | RIT | MT | RIT | MT |
| Day 1, 2 | 54 | 0 | 86 | 0 | 100 | 0 | 14 | 0 | 14 | 0 |
| 3, 4 | 46 | 15 | 86 | 29 | 86 | 32 | 0 | 0 | 14 | 0 |
| 5, 6 | 61 | 4 | 71 | 14 | 86 | 0 | 0 | 0 | 86 | 0 |
| 7, 8 | 39 | 4 | 71 | 14 | 71 | 0 | 0 | 0 | 14 | 0 |
| 9, 10 | 36 | 11 | 86 | 43 | 57 | 0 | 0 | 0 | 0 | 0 |
| 11, 12 | 46 | 11 | 86 | 43 | 71 | 0 | 0 | 0 | 29 | 0 |
| 13, 14 | 43 | 4 | 57 | 14 | 57 | 0 | 0 | 0 | 57 | 0 |
| 15, 16 | 31 | 0 | 86 | 0 | 35 | 0 | 0 | 0 | 5 | 0 |
| 17, 18 | 59 | 11 | 86 | 29 | 100 | 14 | 14 | 0 | 37 | 0 |
| 19, 20 | 39 | 0 | 86 | 0 | 57 | 0 | 0 | 0 | 14 | 0 |

R.I.T. - Stimulus given in Response Initiation Time

M.T. - Stimulus given in Movement Time

Table 12

PERCENTAGE OF CYCLES BROKEN

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Day of Week | | | | | |
| M | 26 | 46 | 43 | 4 | 11 |
| T | 27 | 50 | 43 | 4 | 13 |
| W | 26 | 46 | 39 | 0 | 18 |
| T | 23 | 54 | 37 | 0 | 4 |
| F | 26 | 50 | 30 | 0 | 23 |

Table 13

| PARAMETER | | | VALUE |
|---|---|---|---|
| | | Fortnight | Subjects Combined |
| $\bar{X}$ Response Initiation Time (Stimulus Cycle) | msec | 1 | 201 |
| | | 2 | 169 |
| $\bar{X}$ Movement Time (Stimulus Cycle) | msec | 1 | 404 |
| | | 2 | 375 |
| $\bar{X}$ Reaction Time | msec | 1 | 1055 |
| | | 2 | 1027 |
| Cycles Broken | % | 1 | 27 |
| | | 2 | 24 |

Table 14

| PARAMETER | | | VALUE | | | |
|---|---|---|---|---|---|---|
| | | Fort-night | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
| $\bar{X}$ Response Initiation Time (Stimulus Cycle) | msec | 1 | 159 | 235 | 165 | 246 |
| | | 2 | 140 | 205 | 160 | 172 |
| $\bar{X}$ Movement Time (Stimulus Cycle) | msec | 1 | 665 | 431 | 268 | 251 |
| | | 2 | 592 | 385 | 290 | 217 |
| $\bar{X}$ Reaction Time | msec | 1 | 1076 | 932 | 1189 | 882 |
| | | 2 | 1243 | 946 | 1188 | 864 |
| Cycles Broken | % | 1 | 50 | 43 | 1.4 | 13 |
| | | 2 | 49 | 33 | 1.5 | 14 |

Table 15

PROBABILITY VALUES

MAIN FACTORS AND INTERACTIONS

1966

| Dependent Variable | Independent Variable | SUBJECTS |
|---|---|---|
| Cycle Broken | | $<0.001$ |
| Reaction Time | $\bar{X}$ | $<0.001$ |
| Response Initiation Time (Stimulus Cycle) | $\bar{X}$ | $<0.001$ |
| Movement Time (Stimulus Cycle) | $\bar{X}$ | $<0.001$ |
| Cycle Time | $\bar{X}$ | $<0.001$ |
| | Average S.D. | $<0.001$ |
| | %>M+2 S.D. | $<0.001$ |

Table 16

| Dependent Variable / Independent Variable | DAYS OF EXPERIMENT | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | $<0.001$ | $<0.001$ | $<0.001$ | | $<0.001$ |
| Reaction Time $\bar{X}$ | | $<0.05$ | $<0.01$ | | $<0.05$ |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | $<0.001$ | | $<0.05$ | | $<0.05$ |
| Movement Time (Stimulus Cycle) $\bar{X}$ | | | | $<0.01$ | $<0.01$ |

Table 17

| Dependent Variable \ Independent Variable | | DAYS OF WEEK | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | | | | | |
| Reaction Time | $\bar{X}$ | | <0.05 | | | |
| Response Initiation Time (Stimulus Cycle) | $\bar{X}$ | | | | | |
| Movement Time (Stimulus Cycle) | $\bar{X}$ | | | | | |
| Cycle Time | $\bar{X}$ | <0.05 | | | | |
| | Average S.D. | | | | | |
| | % > M+ 2 S.D. | | | | | |

Table 18

| Independent Variable / Dependent Variable | | PERIODS | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | | | | | |
| Reaction Time | $\bar{X}$ | | | | | |
| Response Initiation Time (Stimulus Cylce) | $\bar{X}$ | $<0.01$ | | $<0.05$ | | |
| Movement Time (Stimulus Cycle) | $\bar{X}$ | | | | | |
| Cycle Time | $\bar{X}$ | | | | | |
| | Agerage S.D. | $<0.001$ | $<0.05$ | $<0.01$ | | |
| | %> M+ 2 S.D. | $<0.05$ | $<0.01$ | | | |

Table 19

| Dependent Variable \ Independent Variable | | (Red Light stimulus given in) RIT/MT | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | $<0.001$ | $<0.01$ | $<0.01$ | | |
| Reaction Time | $\bar{X}$ | | $<0.05$ | | | |
| Response Initiation Time (Stimulus Cycle) | $\bar{X}$ | ONLY RECORDED FOR R.I.T. STIMULUS | | | | |
| Movement Time (Stimulus Cycle) | $\bar{X}$ | ONLY RECORDED FOR M.T. STIMULUS | | | | |

Table 20

$X^2$ Test    Probability Values

| Dependent Variable \ Independent Variable | DELAYS (1 and 2) | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | <0.01 in R.I.T. | <0.01 in R.I.T. | | |

Table 21

| Independent Variable / Dependent Variable | FORTNIGHTS | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | | | | |
| Reaction Time $\bar{X}$ | | | $<0.01$ | | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | | | | | |
| Movement Time (Stimulus Cycle) $\bar{X}$ | | | | $<0.05$ | $<0.05$ |

Table 22

S = Subjects
D = Days of Week
P =Periods

| Dependent Variable | | INTERACTIONS | | |
|---|---|---|---|---|
| | | S x D | S x P | D x P |
| Cycle Time - $\bar{X}$ | Subjects Combined | | | $<0.01$ |
| | Subjects 1 - 4 | | | |
| - Average S.D. | Subjects Combined | | | |
| | Subjects 1 - 4 | | | |
| - % > M+ 2 S.D. | Subjects Combined | | $<0.05$ | $<0.05$ |
| | Subjects 1 - 4 | | | |

No Statistical Significance for Individual Subjects

Table 23

| INTERACTIONS | Dependent Variable |
|---|---|
| | Reaction Time $\bar{X}$ (Stimulus Cycle) Subjects Combined |
| S x P | |
| S x D | |
| S x E | $<0.01$ |
| S x F | |
| S x G | $<0.01$ |
| P x D | |
| P x E | |
| P x F | $<0.05$ |
| P x G | |
| SPE | |
| SPF | |
| SPG | |

No Statistical Significance for Individual Subjects

S = Subject
P = Period
D = Day of Experiment
E = Day of Week
F = Fortnight
G = R.I.T./M.T.

Table 24

| INTERACTIONS | Dependent Variable | |
|---|---|---|
| | Response Initiation Time $\bar{X}$ (Stimulus Cycle) Subjects Combined | Movement Time $\bar{X}$ (Stimulus Cycle) Subjects Combined |
| S x P | $<0.001$ | |
| S x D | $<0.001$ | |
| S x E | $<0.05$ | |
| S x F | | |
| P x D | $<0.001$ | |
| P x E | | |
| P x F | | |
| SPE | $<0.001$ | |
| SPF | | |

Response Initiation Time (Stimulus Cycle) SUBJECT 2 P x E $<0.01$

S = Subject
P = Period
D = Day of Experiment
E = Day of Week
F = Fortnight

Table 25

| INTERACTIONS | Dependent Variable |
|---|---|
| | Cycle Broken Subjects Combined |
| A x C | |
| E x F | |
| D x E | |
| D x F | |
| DEF | |
| A x B | <0.001 |
| A x D | |
| A x E | <0.001 |
| A x F | |
| AEF | |
| ADE | |
| ADF | |
| ADEF | <0.001 |
| B x C | <0.01 |
| C x D | |
| C x E | |
| C x F | |
| CEF | |
| CDE | |
| CDF | |
| CDEF | <0.001 |

No Statistical Significances for Subjects Individually

A = Subject
C = Period
E = R.I.T./M.T.
F = Fortnight 1/2
D = Day of Week
B = Day of Experiment

Table 26

Figs. 6 - 11

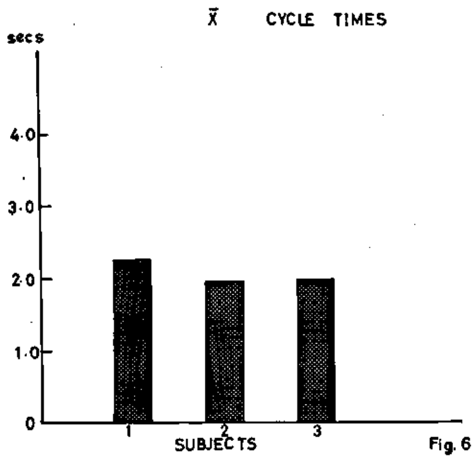


Fig. 6

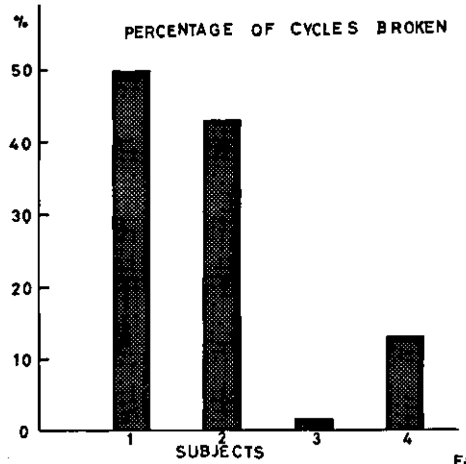


Fig. 9

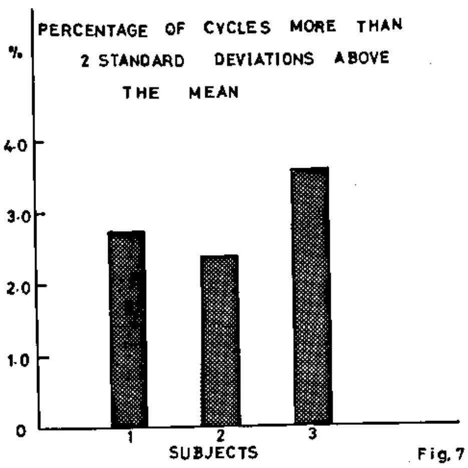


Fig. 7

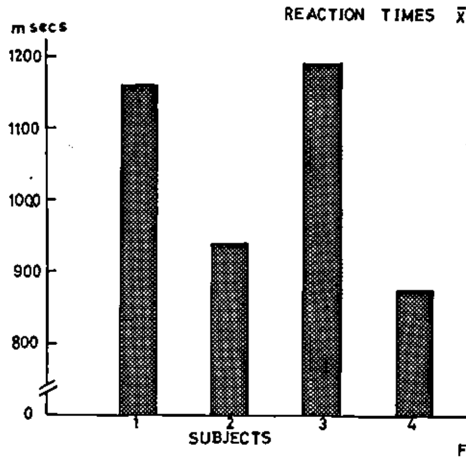


Fig. 10

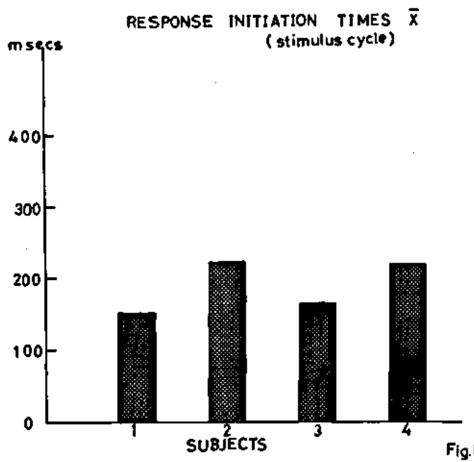


Fig. 8

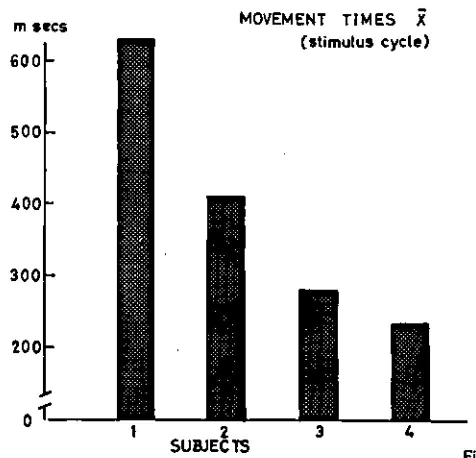


Fig. 11

Figs. 12 - 15

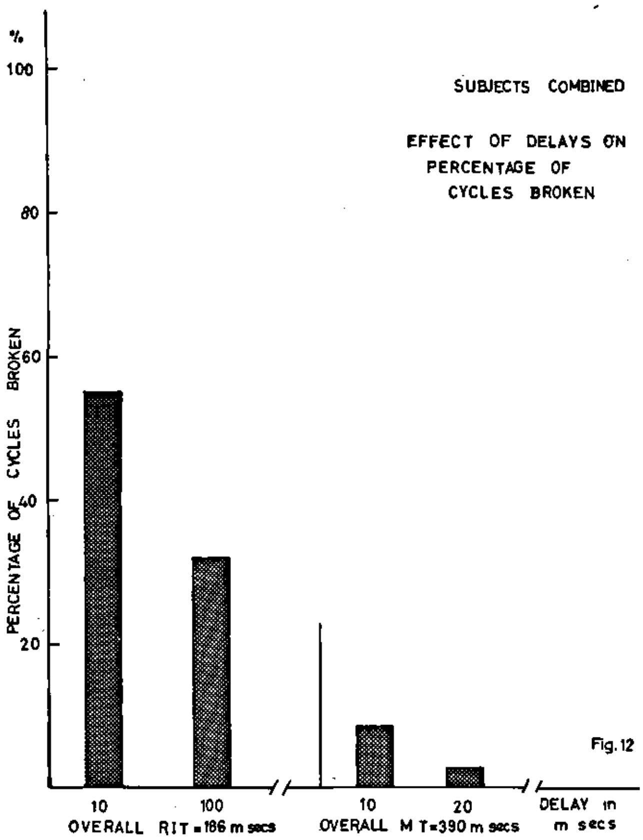



Fig. 12

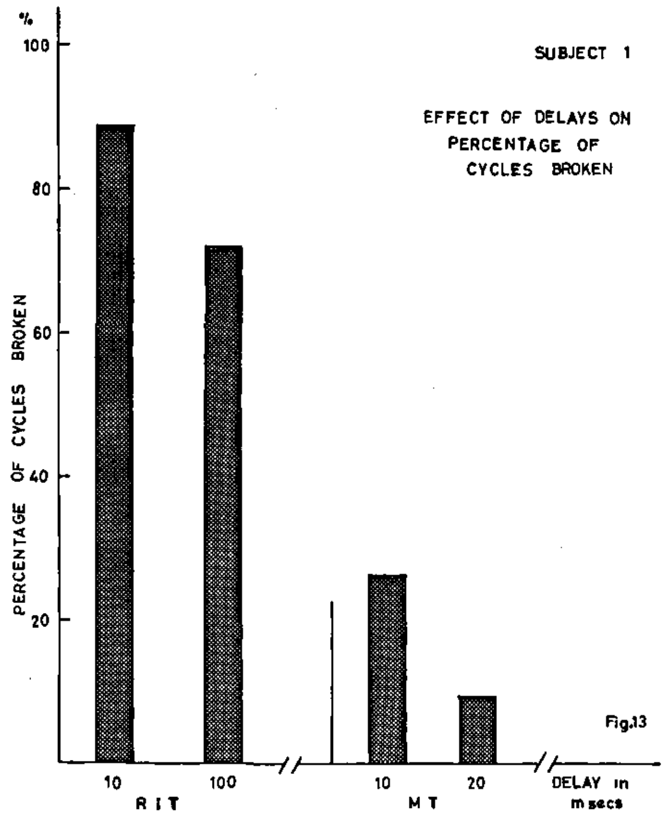



Fig.13

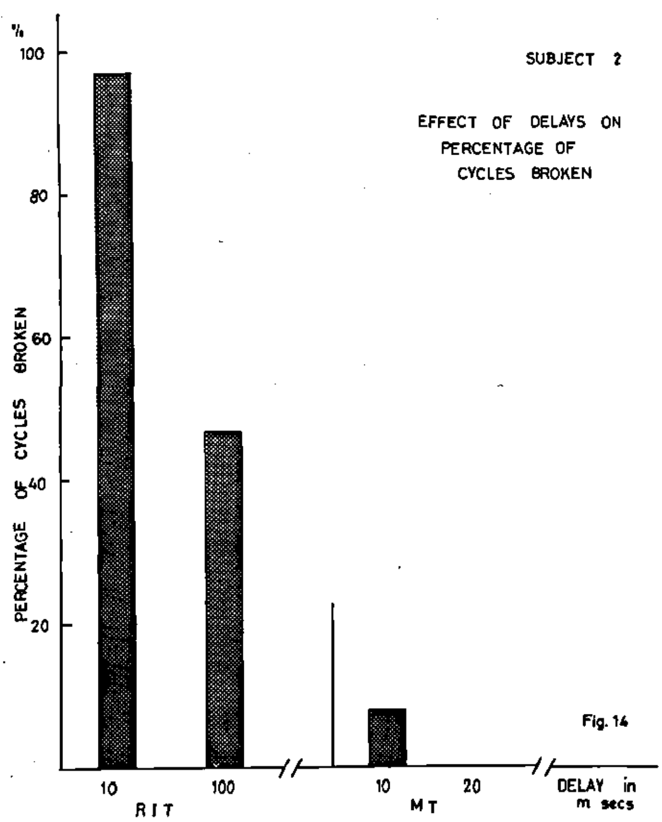



Fig. 14

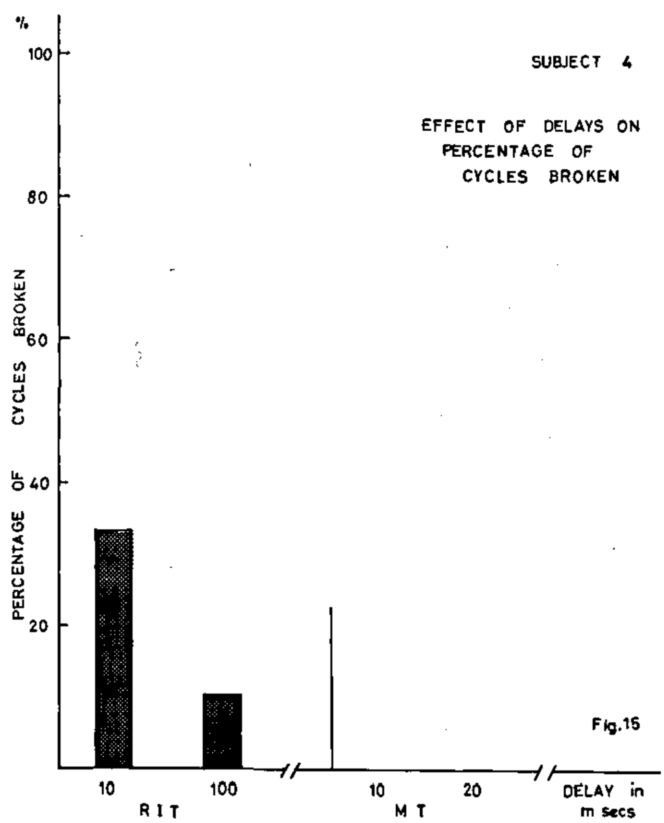



Fig.15

Figs. 16 - 19

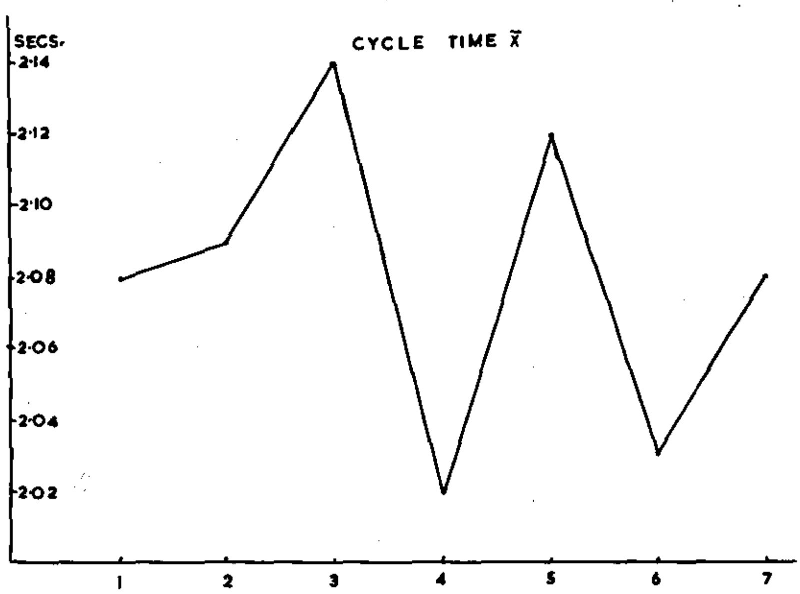


Fig.17

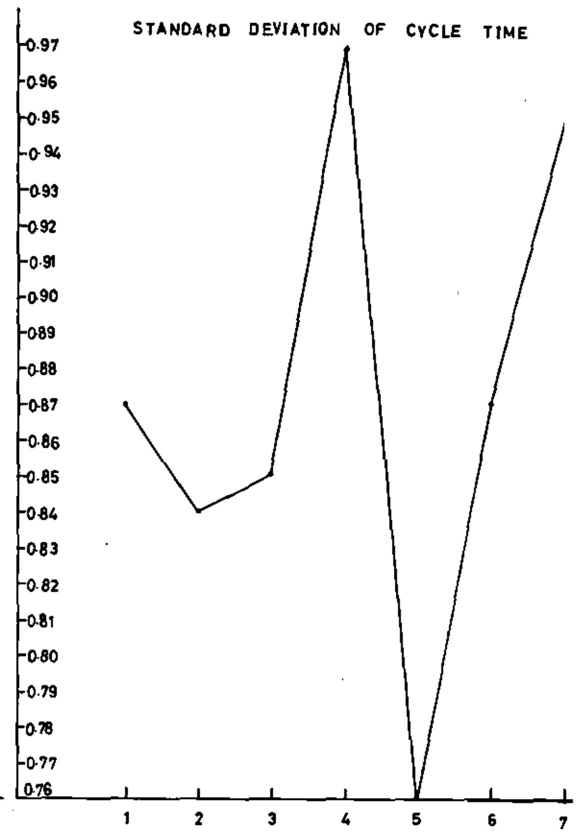


Fig.18

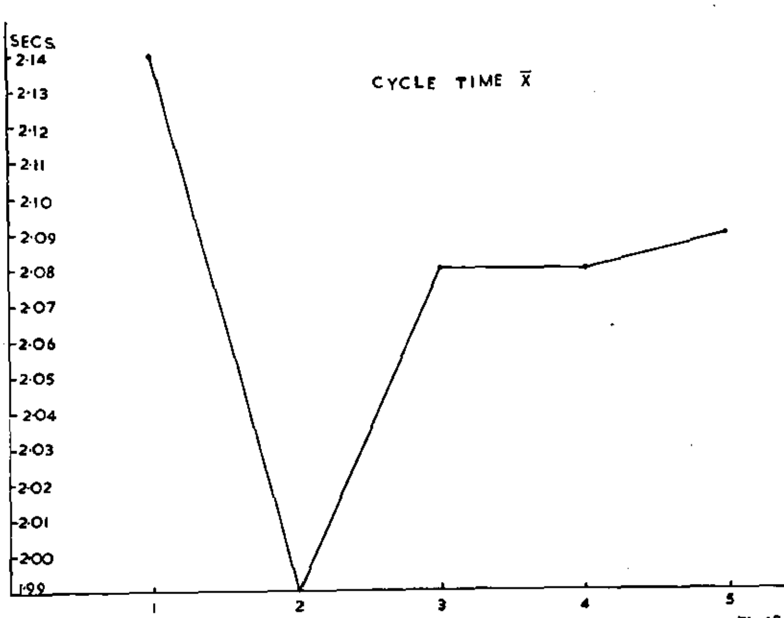


Fig.16

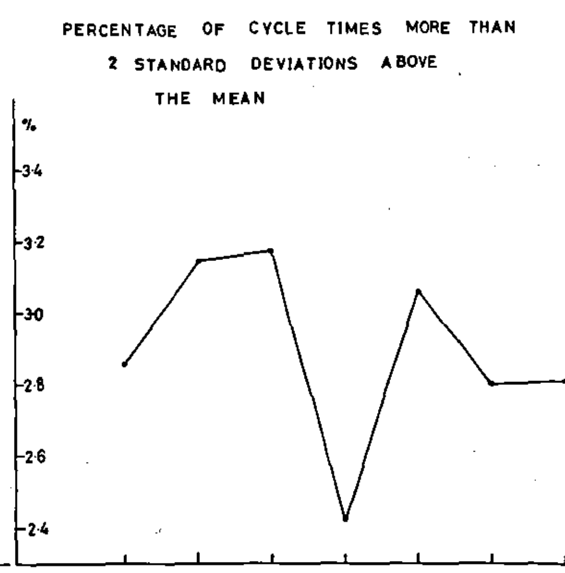


Fig.19

Figs. 20 - 23

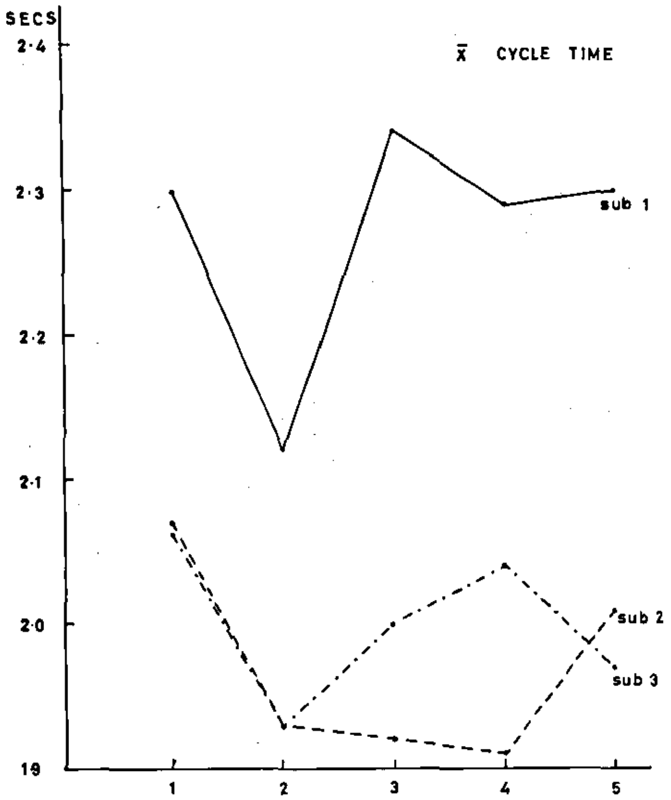


Fig.20

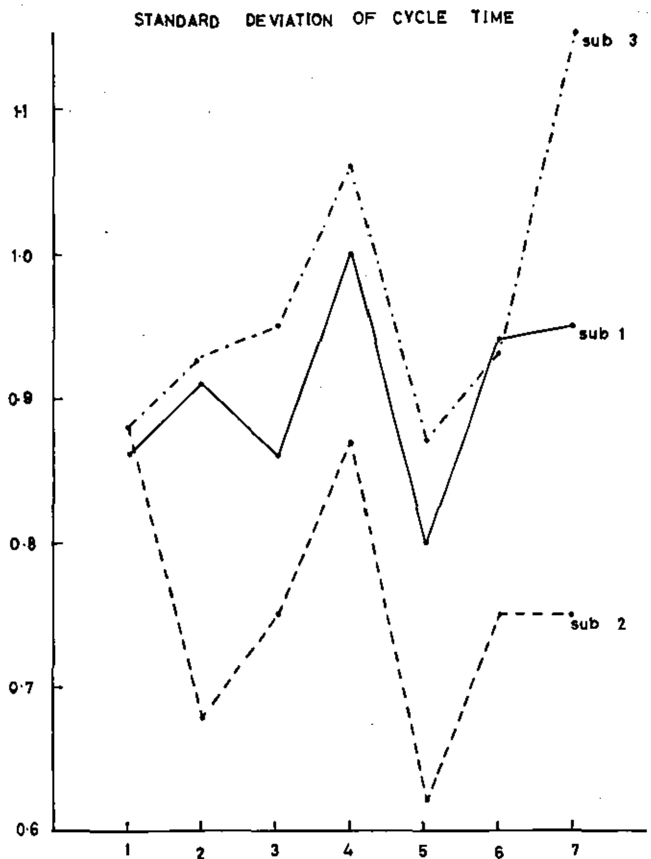


Fig. 22

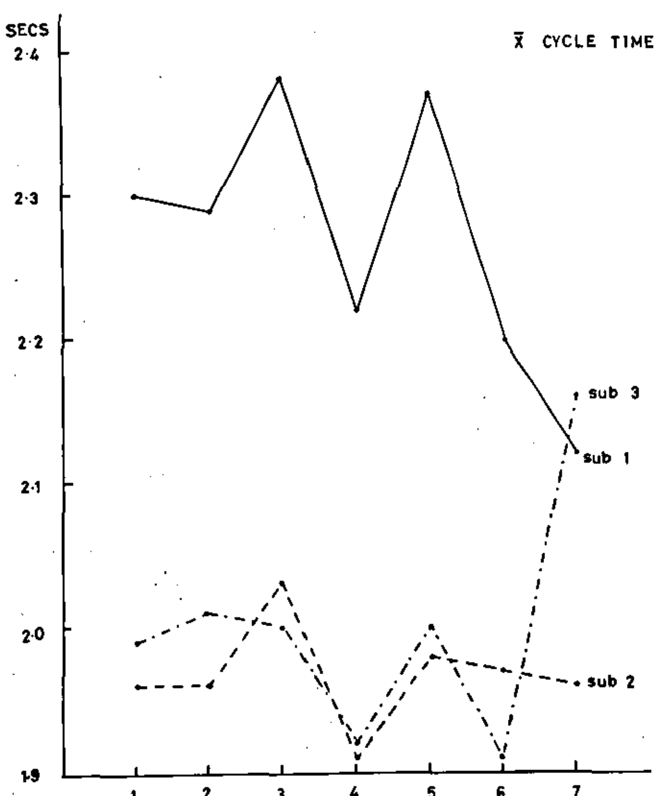


Fig. 21

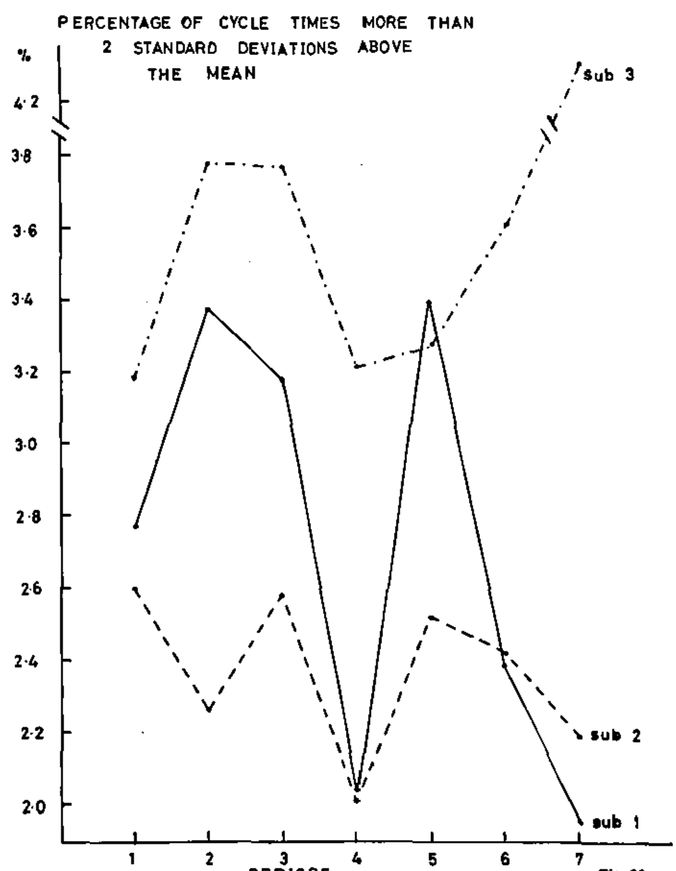


Fig. 23

Figs. 24 - 32

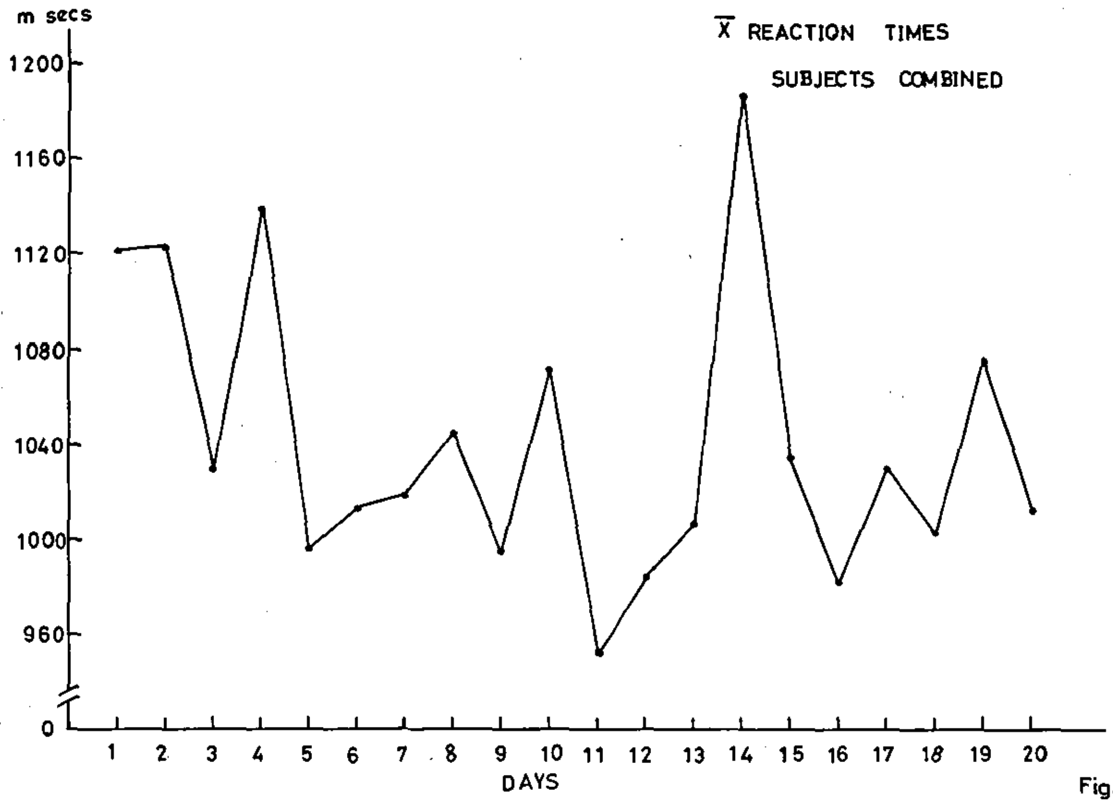

m secs
X̄ REACTION TIMES
SUBJECTS COMBINED
1200
1160
1120
1080
1040
1000
960
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DAYS

Fig. 31

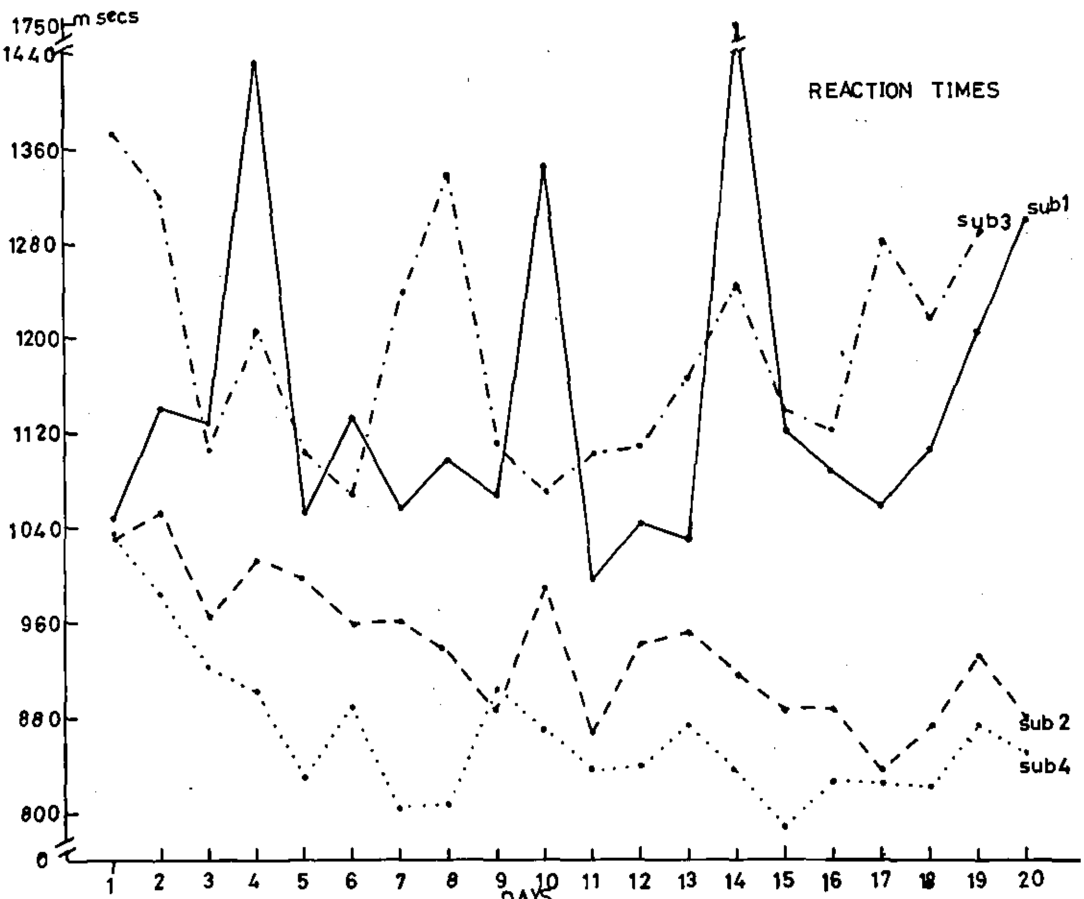

1750
m secs
1440
REACTION TIMES
1360
1280
1200
1120
1040
960
880
800
0
sub3
sub1
sub 2
sub4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DAYS

Fig 32

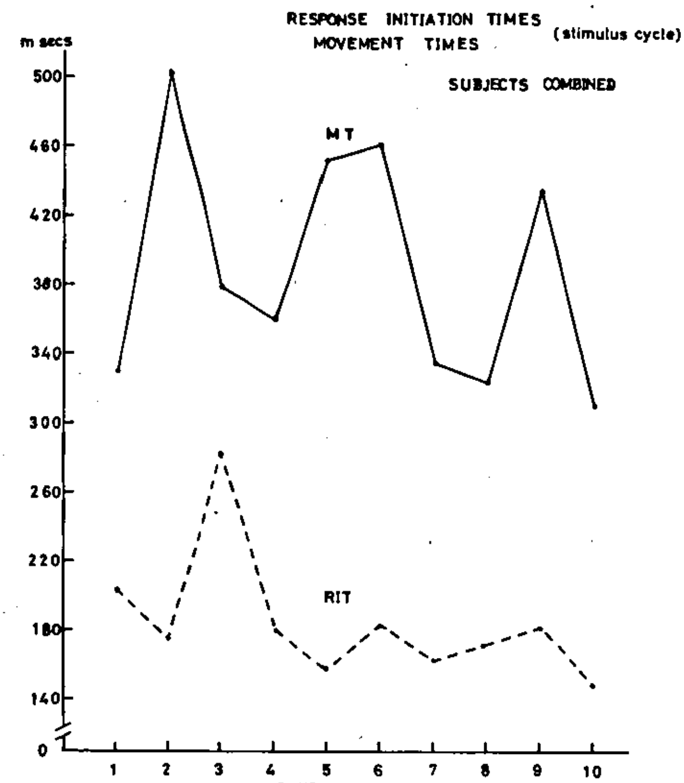



Fig. 28

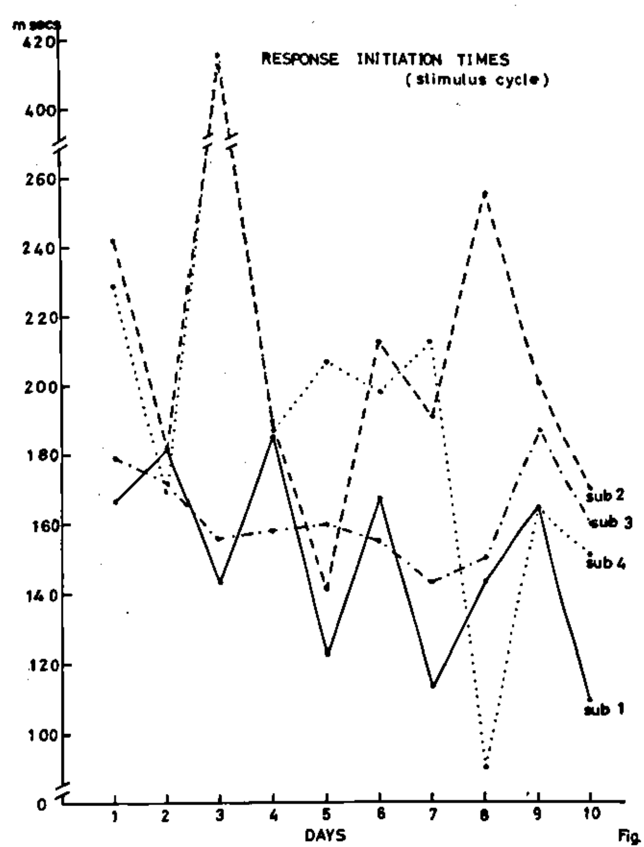



Fig. 29

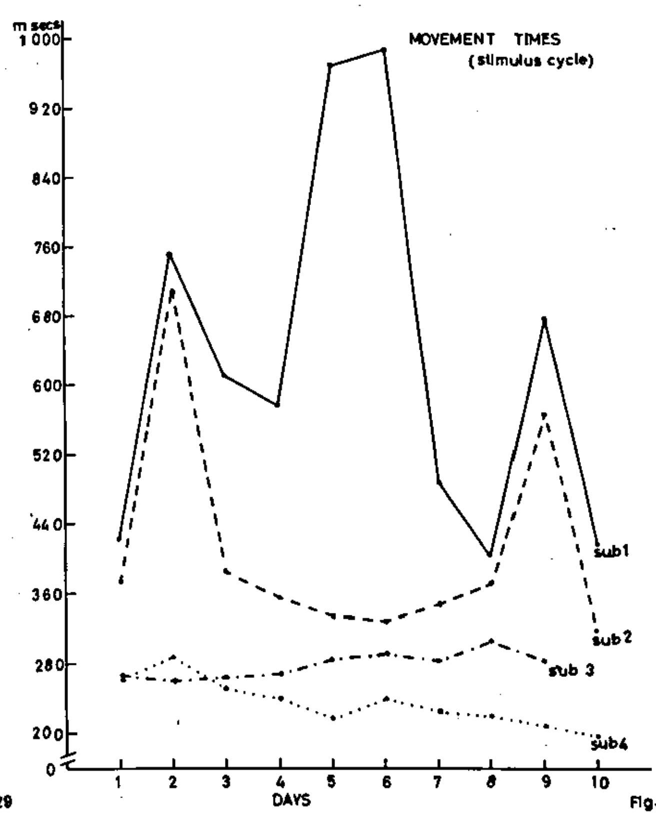



Fig. 30

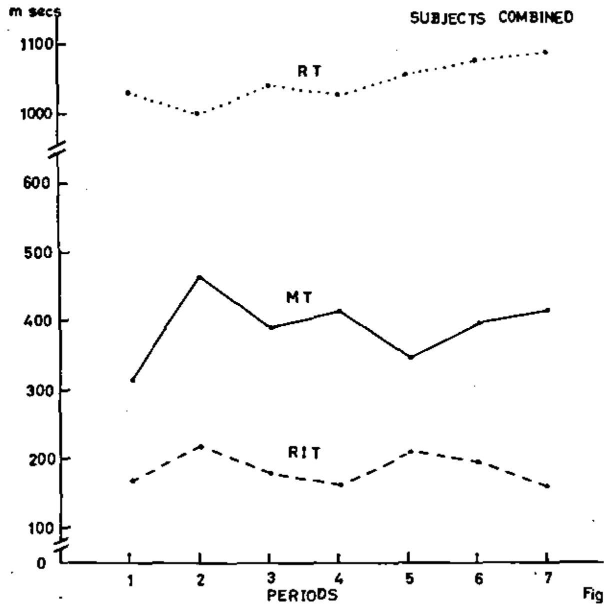



Fig. 24

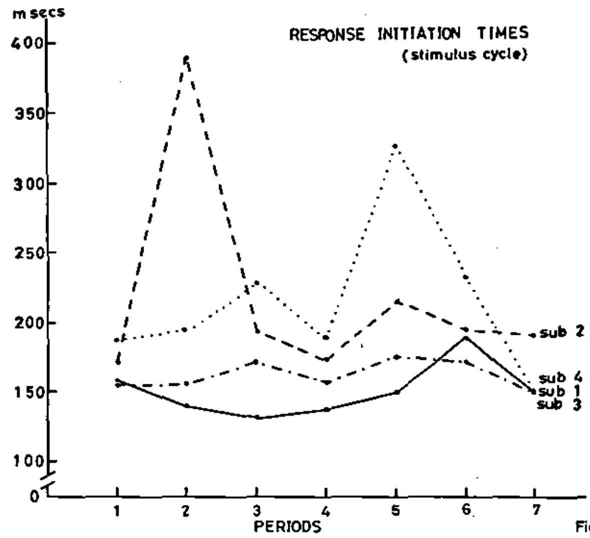



Fig. 26

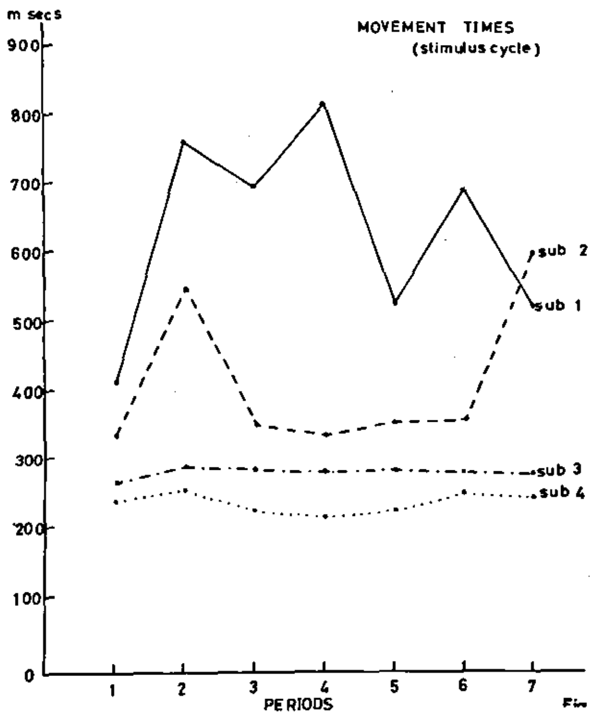



Fig. 25

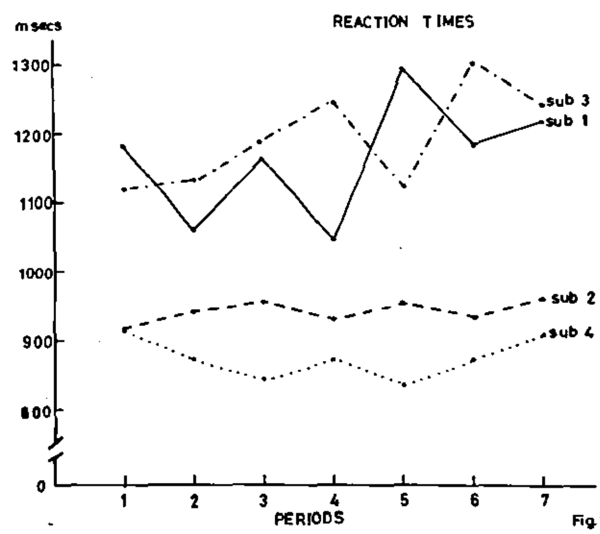



Fig. 27

# APPENDIX II

Tables and Figures of Results
for Main Experiment

Table 28 continued......

| | | | Table |
|---|---|---|---|
| Cycle Time - Average S.D. | Rest Break/No Rest Break x Periods | Subjects Combined<br>Subjects 1 - 4 | 60 |
| Cycle Time - %>M+2 S.D. | Rest Break/No Rest Break x Periods | Subjects Combined<br>Subjects 1 - 4 | 61 |
| Cycle Time | Rest Break/No Rest Break | Subjects Combined<br>Subjects 1 - 4 | 61a |

Probability Values

| Dependent Variable | Independent Variable | | | Table |
|---|---|---|---|---|
| Cycle Broken | | Subjects | | 62 |
| Reaction Time - $\bar{X}$ | | " | | " |
| Response Initiation Time - $\bar{X}$ (Stimulus Cycle) | | " | | " |
| Movement Time - $\bar{X}$ (Stimulus Cycle) | | " | | " |
| Response Initiation Time - $\bar{X}$, Average S.D., %>M+2 S.D. | | " | | " |
| Movement Time - $\bar{X}$, Average S.D., %>M+2 S.D. | | " | | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | | " | | " |
| Cycle Broken | Days of Experiment | Subjects Combined ) Subjects 1 - 4 ) | | 63 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Response Initiation Time - $\bar{X}$. Average S.D., %>M+2 S.D. | " | " | " | " |
| Movement Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Broken | Days of Week | Subjects Combined ) Subjects 1 - 4 ) | | 64 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Response Initiation Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Movement Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |

| Dependent Variable | Independent Variable | | | Table |
|---|---|---|---|---|
| Cycle Broken | Weeks | Subjects Combined )<br>Subjects 1 - 4 ) | | 65 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Response Initiation Time - $\bar{X}$ Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Movement Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Response Initiation Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | Residual (Weeks) | Subjects Combined )<br>Subjects 1 - 4 ) | | 66 |
| Movement Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Cycle Broken | Periods | Subjects Combined )<br>Subjects 1 - 4 ) | | 67 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Response Initiation Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Movement Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., $\% > M+2$ S.D. | " | " | " | " |

| Dependent Variable | Independent Variable | | | Table |
|---|---|---|---|---|
| Cycle Broken | Stimulus Delay RIT/MT | Subjects Combined )<br>Subjects 1 - 4 ) | | 68 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Cycle Broken | Delays | Subjects Combined )<br>Subjects 1 - 4 ) | | 69 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Cycle Time - $\bar{X}$ | Rest Break/ No Rest Break | Subject 4 | | 70 |
| Response Initiation Time - $\bar{X}$ (Stimulus Cycle) | " | " | | " |
| Response Initiation Time - $\bar{X}$, Average S.D., %>M+2S.D. | Interactions | Subjects Combined | | 71 |
| Movement Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Response Initiation Time - $\bar{X}$, Average S.D., %>M+2 S.D. | Interactions | Subjects 1 - 4 | | 72 |
| Movement Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |
| Cycle Time - $\bar{X}$, Average S.D., %>M+2 S.D. | " | " | " | " |

| Dependent Variable | Independent Variable | | | Table |
|---|---|---|---|---|
| Cycle Broken | Interactions | Subjects | Combined | 73 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Cycle Broken | Interactions | Subjects | 1 - 4 | 74 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Response Initiation Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Movement Time - $\bar{X}$, (Stimulus Cycle) | " | " | " | " |
| Cycle Broken | Days of Week | Subjects Combined )<br>Subjects 1 - 4 ) | | 75 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Cycle Broken | Fortnights | Subjects Combined )<br>Subjects 1 - 4 ) | | 76 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Cycle Broken | Rest Break/ No Rest Break | Subjects Combined )<br>Subjects 1 - 4 ) | | 77 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Cycle Broken | Stimulus given in RIT/MT | Subjects Combined )<br>Subjects 1 - 4 ) | | 78 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Cycle Broken | Interactions | Subjects | Combined | 79 |
| Reaction Time - $\bar{X}$ | " | " | " | " |
| Cycle Broken | Interactions | Subjects | 1 - 4 | 80 |
| Reaction Time - $\bar{X}$ | " | " | " | " |

LIST OF FIGURES

# DATA TABLES

| PARAMETER | | | VALUE |
|---|---|---|---|
| | | | Subjects Combined |
| Cycle Time | sec | $\bar{X}$ | 3.10 |
| | | Average S.D. | 0.95 |
| | | %> M+ 2 S.D. | 3.9 |
| Response Initiation Time | msec | $\bar{X}$ | 111 |
| | | Average S.D. | 44 |
| | | %> M+ 2 S.D. | 2.90 |
| Movement Time | msec | $\bar{X}$ | 456 |
| | | Average S.D. | 62 |
| | | %> M+ 2 S.D. | 3.12 |
| Percentage of Cycles Broken | % | | 51 |
| Reaction Time | msec | $\bar{X}$ | 971 |
| Response Initiation Time (Stimulus Cycle) | msec | $\bar{X}$ | 118 |
| Movement Time (Stimulus Cycle) | msec | $\bar{X}$ | 933 |
| Strip Switch | | $\hat{\bar{X}}$ | 8 |

Table 27

| PARAMETERS | | | VALUE | | | |
|---|---|---|---|---|---|---|
| | | | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
| Cycle Time | sec | $\bar{X}$ | 2.91 | 2.91 | 2.74 | 3.84 |
| | | Average S.D. | 1.06 | 0.89 | 0.92 | 0.95 |
| | | % > M+ 2 S.D. | 4.07 | 3.71 | 3.95 | 3.88 |
| Response Initiation Time | m.sec | $\bar{X}$ | 87 | 116 | 83 | 155 |
| | | Average S.D. | 39 | 49 | 29 | 56 |
| | | % > M+2 S.D. | 2.94 | 2.75 | 3.18 | 2.75 |
| Movement Time | m.sec | $\bar{X}$ | 453 | 431 | 305 | 618 |
| | | Average S.D. | 39 | 83 | 39 | 84 |
| | | % > M+2 S.D. | 3.13 | 2.84 | 3.61 | 2.97 |
| Percentage of Cycles Broken | % | | 59 | 40 | 19 | 81 |
| Reaction Time | m.sec | $\bar{X}$ | 1339 | 942 | 604 | 955 |
| Response Initiation Time (Stimulus cycle) | m.sec | $\bar{X}$ | 85 | 125 | 95 | 165 |
| Movement Time (Stimulus cycle) | m.sec | $\bar{X}$ | 1259 | 748 | 444 | 1220 |
| Strip Switch | | $\hat{X}$ | 9 | 7 | 8 | 8 |

Table 28

| PARAMETER | | VALUE Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| I.Q. | | 114 | 113 | 111 | 116 |
| Manual Dexterity | secs | 197 | 198 | 169 | 175 |
| Personality - E.P.I. | N | 11 | 12 | 9 | 15 |
| | E | 23 | 11 | 11 | 6 |
| | L | 4 | 5 | 2 | 3 |
| 16. P.F. | M | 6 | 6 | 5 | 6 |
| | G | 6 | 9 | 3 | 5 |
| | Q3 | 4 | 6 | 7 | 5 |

Table 29

Percentage of Cycles Broken

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Signals Given in R.I.T. | | | | | |
| Delay: 10 m.sec | 75 | 93 | 71 | 40 | 94 |
| 50 m.sec | 65 | 76 | 62 | 22 | 96 |
| Total | 70 | 84 | 67 | 31 | 95 |
| Signals Given in M.T. | | | | | |
| Delay: 10 m.sec | 38 | 50 | 19 | 7 | 71 |
| 50 m.sec | 24 | 16 | 9 | 4 | 64 |
| Total | 31 | 33 | 14 | 6 | 67 |

Table 30

Percentage of Cycles Broken

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| FORTNIGHTS 1 | 63 | 61 | 68 | 30 | 95 |
| 2 | 53 | 61 | 46 | 18 | 85 |
| 3 | 47 | 65 | 31 | 16 | 76 |
| 4 | 39 | 48 | 16 | 5 | 71 |

Table 31

Percentage of Cycles Broken

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Rest Break | 50 | 51 | 37 | 27 | 79 |
| No Rest Break | 52 | 67 | 44 | 13 | 83 |

Table 32

Percentage of Cycles Broken

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| WEEK | 1 | 69 | 62 | 72 | 42 | 100 |
| | 2 | 57 | 60 | 62 | 17 | 90 |
| | 3 | 60 | 67 | 60 | 22 | 90 |
| | 4 | 45 | 55 | 32 | 12 | 80 |
| | 5 | 49 | 60 | 35 | 25 | 77 |
| | 6 | 44 | 70 | 27 | 7 | 70 |
| | 7 | 46 | 70 | 25 | 5 | 82 |
| | 8 | 31 | 25 | 7 | - | 60 |
| DAY OF WEEK | M | 56 | 66 | 44 | 27 | 86 |
| | T | 48 | 58 | 33 | 11 | 84 |
| | W | 55 | 62 | 44 | 25 | 86 |
| | T | 45 | 50 | 36 | 16 | 75 |
| | F | 50 | 58 | 45 | 16 | 75 |

Table 33

Percentage of Cycles Broken

| CONDITIONS | | Subject Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| Period | 1 | 57 | 70 | 45 | 23 | 87 |
| | 2 | 51 | 55 | 45 | 23 | 77 |
| | 3 | 50 | 55 | 35 | 20 | 87 |
| | 4 | 52 | 55 | 40 | 23 | 87 |
| | 5 | 53 | 62 | 47 | 20 | 77 |
| | 6 | 46 | 52 | 40 | 11 | 75 |
| | 7 | 49 | 62 | 35 | 20 | 75 |
| | 8 | 48 | 57 | 35 | 11 | 82 |

Table 34

Effect of Length of Residual Movement Time
on Percentages of Cycles Broken

| CONDITIONS | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|
| | Percentage of Cycles Broken | | | |
| $(\bar{X}$ M.T.) - Stimulus Delay | | | | |
| 255 | | | 4 | |
| 295 | | | 7 | |
| 381 | | 9 | | |
| 403 | 16 | | | |
| 421 | | 19 | | |
| 443 | 50 | | | |
| 568 | | | | 64 |
| 608 | | | | 71 |

Table 35

Effect of Length of Residual Movement Time on Percentage of Cycles Broken

| Conditions | Sub.1 | Sub.2 | Sub.3 | Sub.4 | Cond. | Sub.1 | Sub.2 | Sub.3 | Sub.4 | Cond. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residual Movement Time | Percent.of Cycles Broken | | | | R.M.T. | Percent.of Cycles Broken | | | | R.M.T. | Percent.of Cycles Broken | | | |
| 235 | | | 12 | | 374 | 25 | | | | 513 | | 37 | | |
| 246 | | | 17 | | 375 | | 8 | | | 516 | | | | 42 |
| 251 | | | 0 | | 376 | | 17 | | | 530 | | 50 | | |
| 252 | | | 0 | | 377 | | 0 | | | 550 | | | | 37 |
| 256 | | | 0 | | 386 | 17 | 0 0 | | | 556 | | | | 50 |
| 266 | | | 0 | | 398 | 12 | | | | 559 | | | | 42 |
| 275 | | | 25 | | 405 | 63 | | | | 571 | | | | 75 |
| 277 | | | 0 | | 414 | 25 83 | | | | 577 | | | | 38 |
| 286 | | | 8 | | 415 | | 25 | | | 586 | | | | 83 |
| 291 | | | 13 | | 424 | 13 | | | | 587 | | | | 92 |
| 292 | | | 8 | | 426 | | 12 | | | 590 | | | | 62 |
| 296 | | | 12 | | 437 | 17 | | | | 598 | | | | 100 |
| 301 | | 0 | | | 438 | 50 | | | | 599 | | | | 67 |
| 306 | | | 0 | | 454 | 58 | | | | 611 | | | | 75 |
| 317 | | | 0 | | 464 | 50 | | | | 617 | | | | 75 |
| 336 | | 0 | | | 468 | 0 | | | | 626 | | | | 75 |
| 337 | | 12 | | | 473 | | 25 | | | 627 | | | | 75 |
| 341 | | 0 | | | 477 | 58 | | | | 638 | | | | 100 |
| 346 | 0 | 0 | | | 490 | | 25 | | | | | | | |
| 365 | 25 | | | | 508 | 25 | | | | | | | | |

Tabl 35a

| | | Y=A.X+B | $Y = A e^{(BX)} + C$ | | | Y=A.X+B | $Y = A e^{(BX)} + C$ |
|---|---|---|---|---|---|---|---|
| X.Val. | Y.Obs. | Y.Est | Y.Est | X.Val | Y.Obs | Y.Est. | Y.Est. |
| 235 | 12.00 | - 8.4 | 2.5 | 424 | 13 | 30.4 | 23.8 |
| 246 | 17 | - 6.1 | 3.3 | 426 | 12 | 30.8 | 24.1 |
| 251 | 0 | - 5.1 | 3.7 | 437 | 17 | 33.1 | 26.1 |
| 252 | 0 | - 4.9 | 3.7 | 438 | 50 | 33.3 | 26.3 |
| 256 | 0 | - 4.1 | 4.0 | 454 | 58 | 36.6 | 29.4 |
| 266 | 0 | - 2.0 | 4.8 | 464 | 50 | 38.7 | 31.5 |
| 275 | 25 | - 2.0 | 5.5 | 468 | 0 | 39.5 | 32.3 |
| 277 | 0 | 0.2 | 5.7 | 473 | 25 | 40.5 | 33.4 |
| 286 | 8 | 2.1 | 6.5 | 477 | 58 | 41.3 | 34.3 |
| 291 | 13 | 3.1 | 6.9 | 490 | 25 | 44.0 | 37.3 |
| 292 | 8 | 3.3 | 7.0 | 508 | 25 | 44.0 | 41.9 |
| 296 | 12 | 4.1 | 7.4 | 513 | 38 | 48.7 | 43.2 |
| 301 | 0 | 5.2 | 7.8 | 516 | 42 | 49.3 | 44 |
| 306 | 0 | 6.2 | 8.3 | 530 | 50 | 52.2 | 48 |
| 317 | 0 | 8.4 | 9.4 | 550 | 37 | 56.3 | 54.1 |
| 336 | 0 | 12.4 | 11.4 | 556 | 50 | 57.6 | 56.1 |
| 337 | 13 | 12.6 | 11.5 | 559 | 42 | 58.2 | 57.1 |
| 341 | 0 | 13.4 | 12.0 | 571 | 75 | 60.6 | 61.3 |
| 346 | 0,0 | 14.4 | 12.6 | 577 | 38 | 61.9 | 63.5 |
| 365 | 25 | 18.3 | 14.9 | 586 | 83 | 63.7 | 66.9 |
| 374 | 25 | 20.2 | 16.1 | 587 | 92 | 63.9 | 67.3 |
| 375 | 8 | 20.4 | 16.2 | 590 | 62 | 64.6 | 68.5 |
| 376 | 17 | 20.6 | 16.4 | 598 | 100 | 66.2 | 71.7 |
| 377 | 0 | 20.8 | 16.5 | 599 | 67 | 66.4 | 72.1 |
| 386 | 17,0,0 | 22.6 | 17.8 | 6611 | 75 | 68.9 | 77.2 |
| 398 | 12 | 25.1 | 19.6 | 617 | 75 | 70.1 | 79.9 |
| 405 | 63 | 26.5 | 20.6 | 626 | 75 | 71.9 | 84.1 |
| 414 | 25,83 | 28.4 | 22.1 | 627 | 75 | 72.2 | 84.6 |
| 415 | 25 | 28.6 | 22.3 | 638 | 100 | 74.4 | 89.9 |

Y=A.X+B (A=0.2055
(B=56.7014

$Y = A.e^{(BX)} + C$ (A=4.2393
(B=0.4970
(C=11.0864

Table 35b

Effect of Length of Residual Response Initiation Time Plus Movement Time on Percentage of Cycles Broken

| CONDITIONS | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|
| | Percentage of Cycles Broken | | | |
| (R.I.T.+M.T.) - Stimulus Delay | | | | |
| 338 | | | 22 | |
| 378 | | | 40 | |
| 490 | 77 | | | |
| 497 | | 62 | | |
| 530 | 92 | | | |
| 537 | | 71 | | |
| 723 | | | | 96 |
| 763 | | | | 94 |

Table 36

$\bar{X}$ Response Initiation Times (m.secs) (Stimulus Cycle compared with Non-Stimulus Cycle)

| Variable \ Subjects | Sub.1 | Sub.2 | Sub.3 | Sub.4 | Subs. Comb. |
|---|---|---|---|---|---|
| R.I.T. Non-Stimulus Cycle | 87.43 | 116.21 | 82.54 | 155.0 | 111.19 |
| R.I.T. Stimulus Cycle:- | | | | | |
| Overall | 87.05 | 121.57 | 84.66 | 150.98 | 111.74 |
| 10 m.s. Delay | 81.09 | 125.67 | 80.28 | 157.81 | 112.00 |
| 50 m.s. Delay | 93.02 | 117.47 | 89.02 | 144.15 | 111.48 |
| Cycle Broken | 92.30 | 130.41** | 115.68** | 150.53 | 124.15** |
| Cycle Not Broken | 58.68* | 103.69 | 70.55** | 159.43 | 82.29** |
| 10 m.s. Delay Cycle Broken | 81.04 | 134.91* | 97.86* | 157.77 | 120.67* |
| 10 m.s. Delay Cycle Not Broken | 81.67 | 102.74 | 68.44** | 158.43 | 85.56** |
| 50 m.s. Delay Cycle Broken | 105.98 | 125.30 | 148.00** | 143.49 | 128.17** |
| 50 m.s. Delay Cycle Not Broken | 51.42** | 104.43 | 72.18* | 161.24 | 79.96** |

** Statistical Significance 1% level )
* " " 5% level )

The means of all R.I.T's in the Stimulus Cycle, for all conditions, were tested against the mean times in the Non-Stimulus Cycle. The t-test was used.

Table 36a

Location on Strip Switch (Percentage Use)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3. | Subject 4 |
|---|---|---|---|---|---|
| Location on Strip Switch | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0.2 | 0 | 0.6 | 0 | 0 |
| 3 | 0.4 | 0 | 1 | 1 | 0 |
| 4 | 0.4 | 0 | 1 | 0.36 | 0.31 |
| 5 | 1 | 1 | 3 | 0.36 | 2 |
| 6 | 12 | 9 | 30 | 2 | 7 |
| 7 | 25 | 15 | 46 | 11 | 26 |
| 8 | 35 | 29 | 17 | 60 | 37 |
| 9 | 21 | 33 | 2 | 26 | 25 |
| 10 | 4 | 13 | 0 | 0 | 4 |

Table 37

| RESPONSE INITIATION TIME (Stimulus Cycle) | | MOVEMENT TIME (Stimulus Cycle) | | REACTION TIME | |
|---|---|---|---|---|---|
| Range (m.sec.) | % | Range (M.sec) | % | Range (M.sec) | % |
| 0 - 25 | 2.87 | 200 - 300 | 12.58 | 400 - 500 | 0.86 |
| 25 - 50 | 10.31 | 300 - 400 | 13.67 | 500 - 600 | 12.27 |
| 50 - 75 | 16.80 | 400 - 500 | 12.58 | 600 - 700 | 11.25 |
| 75 - 100 | 18.14 | 500 - 600 | 5.78 | 700 - 800 | 14.77 |
| 100 - 125 | 13.44 | 600 - 700 | 1.95 | 800 - 900 | 17.11 |
| 125 - 150 | 11.80 | 700 - 800 | 1.09 | 900 - 1000 | 11.95 |
| 150 - 175 | 7.19 | 800 - 900 | 1.80 | 1000 - 1100 | 6.72 |
| 175 - 200 | 5.23 | 900 - 1000 | 4.92 | 1100 - 1200 | 5.47 |
| 200 - 225 | 4.06 | 1000 - 1100 | 5.16 | 1200 - 1300 | 3.52 |
| 225 - 250 | 1.96 | 1100 - 1200 | 7.73 | 1300 - 1400 | 1.95 |
| 250 - 275 | 1.48 | 1200 - 1300 | 6.80 | 1400 - 1500 | 1.41 |
| 275 - 300 | 1.41 | 1300 - 1400 | 4.37 | 1500 - 1600 | 1.17 |
| | | 1400 - 1500 | 2.89 | 1600 - 1700 | 1.56 |
| | | 1500 - 1600 | 3.28 | 1700 - 1800 | 0.86 |
| | | 1600 - 1700 | 1.41 | 1800 - 1900 | 1.09 |
| | | 1700 - 1800 | 1.80 | 1900 - 2000 | 1.25 |
| | | 1800 - 1900 | 1.41 | | |
| | | 1900 - 2000 | 1.25 | | |

Table 38

$\bar{X}$ Response Initiation Time (Stimulus Cycle) (m.sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| WEEK | 1 | 136 | 140 | 134 | 171 | 101 |
| | 2 | 134 | 101 | 125 | 96 | 216 |
| | 3 | 118 | 79 | 148 | 100 | 144 |
| | 4 | 108 | 69 | 134 | 83 | 146 |
| | 5 | 113 | 74 | 128 | 87 | 162 |
| | 6 | 117 | 67 | 124 | 69 | 210 |
| | 7 | 108 | 73 | 98 | 59 | 203 |
| | 8 | 110 | 80 | 109 | - | 142 |

$\bar{X}$ Movement Time (Stimulus Cycle) (m.sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| WEEK | 1 | 1347 | 2146 | 1195 | 740 | 1305 |
| | 2 | 1105 | 1655 | 1059 | 408 | 1297 |
| | 3 | 1062 | 1523 | 826 | 455 | 1444 |
| | 4 | 860 | 1107 | 624 | 365 | 1347 |
| | 5 | 794 | 967 | 642 | 483 | 1086 |
| | 6 | 780 | 1038 | 632 | 329 | 1119 |
| | 7 | 780 | 1000 | 553 | 325 | 1244 |
| | 8 | 669 | 637 | 449 | - | 920 |

Table 39

Reaction Time (m.sec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| FORTNIGHTS | | | | | |
| 1 | 1087 | 1905 | 964 | 595 | 882 |
| 2 | 956 | 1212 | 907 | 623 | 1084 |
| 3 | 885 | 1074 | 926 | 606 | 934 |
| 4 | 955 | 1165 | 973 | 580 | 918 |

Table 40

Reaction Time (m.sec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| Rest Break | 1022 | 1432 | 970 | 607 | 977 |
| No Rest Break | 924 | 1245 | 915 | 602 | 933 |

Table 41

$\bar{X}$ Reaction Time (m.sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| WEEK | 1 | 1133 | 2148 | 985 | 576 | 824 |
| | 2 | 1040 | 1662 | 944 | 614 | 941 |
| | 3 | 926 | 1257 | 876 | 608 | 962 |
| | 4 | 987 | 1167 | 938 | 637 | 1206 |
| | 5 | 911 | 1172 | 909 | 608 | 955 |
| | 6 | 859 | 976 | 943 | 605 | 913 |
| | 7 | 870 | 1086 | 897 | 580 | 915 |
| | 8 | 1071 | 1243 | 1048 | - | 921 |

Table 42

$\bar{X}$ Reaction Time (M.sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| PERIOD | 1 | 920 | 1284 | 865 | 582 | 906 |
| | 2 | 988 | 1345 | 932 | 609 | 1018 |
| | 3 | 954 | 1426 | 866 | 588 | 890 |
| | 4 | 962 | 1402 | 933 | 601 | 867 |
| | 5 | 1003 | 1323 | 1040 | 648 | 957 |
| | 6 | 986 | 1351 | 957 | 620 | 971 |
| | 7 | 961 | 1328 | 935 | 588 | 948 |
| | 8 | 997 | 1252 | 1012 | 595 | 1080 |
| DAY OF WEEK | M | 971 | 1324 | 977 | 599 | 937 |
| | T | 942 | 1266 | 952 | 606 | 901 |
| | W | 982 | 1428 | 936 | 607 | 909 |
| | T | 1014 | 1400 | 954 | 613 | 1039 |
| | F | 949 | 1276 | 894 | 595 | 987 |

Table 43

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| R.I.T. | 915 | 1254 | 868 | 582 | 922 |
| M.T. | 1029 | 1423 | 1017 | 627 | 986 |
| Delay: | | | | | |
| R.I.T. 10m.sec | 917 | 1235 | 865 | 573 | 961 |
| 50m.sec | 913 | 1274 | 871 | 590 | 884 |
| M.T. 10m.sec | 1009 | 1341 | 1044 | 611 | 981 |
| 50m.sec | 1048 | 1506 | 991 | 644 | 993 |

R.I.T. = Stimulus given in Response Initiation Time
M.T. = Stimulus given in Movement Time

Table 43a

Cycle Time (sec)

| CONDITIONS | | SUBJECTS COMBINED | | |
|---|---|---|---|---|
| | | $\bar{X}$ | Average S.D. | % > M+2 S.D. |
| WEEK | 1 | 3.18 | 0.84 | 3.30 |
| | 2 | 3.28 | 0.98 | 3.86 |
| | 3 | 3.19 | 0.94 | 3.92 |
| | 4 | 3.04 | 0.93 | 3.93 |
| | 5 | 2.91 | 0.95 | 3.83 |
| | 6 | 3.13 | 1.04 | 4.19 |
| | 7 | 3.03 | 0.96 | 3.96 |
| | 8 | 3.05 | 0.99 | 4.21 |

Table 44

Cycle Time (sec)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. |
| WEEK | 1 | 3.12 | 0.95 | 3.53 | 3.07 | 0.68 | 2.53 | 2.96 | 0.82 | 3.75 | 3.61 | 0.93 | 3.40 |
| | 2 | 2.84 | 0.99 | 3.73 | 3.28 | 0.87 | 3.89 | 2.81 | 0.99 | 3.60 | 3.89 | 1.11 | 4.13 |
| | 3 | 2.91 | 1.03 | 4.00 | 3.02 | 0.92 | 3.99 | 2.68 | 0.87 | 3.65 | 4.04 | 0.94 | 4.06 |
| | 4 | 2.94 | 0.99 | 4.03 | 2.87 | 0.83 | 3.60 | 2.72 | 1.00 | 4.03 | 3.79 | 0.89 | 4.09 |
| | 5 | 2.84 | 1.08 | 3.70 | 2.81 | 0.91 | 3.71 | 2.65 | 0.90 | 4.32 | 3.83 | 0.84 | 3.49 |
| | 6 | 2.92 | 1.14 | 4.25 | 2.89 | 1.08 | 4.37 | 2.78 | 1.00 | 4.38 | 3.91 | 0.94 | 3.78 |
| | 7 | 2.90 | 1.15 | 4.54 | 2.73 | 0.89 | 3.78 | 2.59 | 0.87 | 3.86 | 3.91 | 0.95 | 3.65 |
| | 8 | 2.77 | 1.09 | 4.59 | 2.68 | 0.94 | 3.83 | - | - | - | 3.71 | 0.94 | 4.20 |

Table 45

Cycle Time (sec)

| CONDITIONS | | Subjects Combined | | |
|---|---|---|---|---|
| | | $\bar{X}$ | Average S.D. | % > M+ 2 S.D. |
| PERIOD | 1 | 3.17 | 0.94 | 3.97 |
| | 2 | 3.10 | 0.94 | 3.99 |
| | 3 | 3.07 | 0.92 | 3.83 |
| | 4 | 3.11 | 0.97 | 3.91 |
| | 5 | 3.09 | 0.97 | 3.82 |
| | 6 | 3.08 | 0.95 | 4.01 |
| | 7 | 3.10 | 0.98 | 3.81 |
| | 8 | 3.08 | 0.96 | 3.83 |

Table 46

Cycle Time (sec)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. |
| PERIOD | 1 | 2.90 | 0.98 | 3.92 | 2.96 | 0.82 | 3.84 | 2.78 | 0.87 | 3.78 | 4.08 | 1.09 | 4.39 |
| | 2 | 2.87 | 1.02 | 4.25 | 2.91 | 0.87 | 3.74 | 2.75 | 0.89 | 3.07 | 3.89 | 0.97 | 4.31 |
| | 3 | 2.87 | 1.00 | 3.84 | 2.90 | 0.85 | 3.73 | 2.72 | 0.90 | 3.87 | 3.79 | 0.91 | 3.91 |
| | 4 | 2.91 | 1.07 | 4.00 | 2.90 | 0.88 | 3.75 | 2.76 | 0.95 | 4.11 | 3.88 | 0.99 | 3.82 |
| | 5 | 2.89 | 1.10 | 4.12 | 2.88 | 0.87 | 3.49 | 2.76 | 0.97 | 3.94 | 3.84 | 0.97 | 3.76 |
| | 6 | 2.91 | 1.10 | 4.18 | 2.91 | 0.91 | 3.87 | 2.72 | 0.92 | 4.20 | 3.77 | 0.86 | 3.80 |
| | 7 | 2.98 | 1.11 | 4.20 | 2.94 | 0.96 | 3.54 | 2.73 | 0.96 | 4.05 | 3.74 | 0.90 | 3.51 |
| | 8 | 2.93 | 1.09 | 4.09 | 2.92 | 0.95 | 3.72 | 2.71 | 0.90 | 3.98 | 3.75 | 0.90 | 3.57 |

Table 47

Cycle Time (sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| DAY OF WEEK | M | 3.16 | 2.97 | 2.92 | 2.75 | 3.91 |
| | T | 3.08 | 2.89 | 2.90 | 2.79 | 3.76 |
| $\bar{X}$ | W | 3.05 | 2.92 | 2.90 | 2.73 | 3.69 |
| | T | 3.15 | 2.90 | 2.88 | 2.81 | 3.92 |
| | F | 3.06 | 2.87 | 2.97 | 2.62 | 3.94 |
| DAY OF WEEK | M | 0.94 | 1.04 | 0.88 | 0.87 | 0.98 |
| | T | 0.92 | 1.03 | 0.83 | 0.95 | 0.89 |
| Average S.D. | W | 0.94 | 1.06 | 0.90 | 0.96 | 0.83 |
| | T | 0.99 | 1.15 | 0.89 | 0.95 | 0.97 |
| | F | 0.97 | 1.01 | 0.93 | 0.85 | 1.10 |
| DAY OF WEEK | M | 3.97 | 4.15 | 3.62 | 4.13 | 4.02 |
| | T | 3.83 | 3.95 | 3.66 | 4.06 | 3.70 |
| % > M+ 2 S.D. | W | 3.80 | 4.01 | 3.64 | 3.73 | 3.81 |
| | T | 3.98 | 4.29 | 3.80 | 3.91 | 3.96 |
| | F | 3.92 | 4.00 | 3.82 | 3.96 | 3.90 |

Table 48

Response Initiation Time (msec.)

| CONDITIONS | Subjects Combined | | |
|---|---|---|---|
| | $\bar{X}$ | Average S.D. | % > M+ 2 S.D. |
| WEEK 1 | 123 | 41 | 2.12 |
| 2 | 115 | 49 | 3.44 |
| 3 | 112 | 40 | 2.75 |
| 4 | 104 | 41 | 2.94 |
| 5 | 109 | 43 | 2.56 |
| 6 | 110 | 45 | 3.13 |
| 7 | 104 | 45 | 3.38 |
| 8 | 112 | 45 | 2.83 |

Table 49

Response Initiation Time (msec)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | %>M+ 2.S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %>M+ 2 S.D. |
| WEEK | 1 | 136 | 46 | 1.5 | 132 | 46 | 2.00 | 120 | 27 | 1.5 | 105 | 45 | 3.5 |
| | 2 | 100 | 51 | 4.0 | 125 | 50 | 2.75 | 86 | 34 | 3.0 | 148 | 62 | 4.0 |
| | 3 | 93 | 41 | 2.75 | 138 | 51 | 2.75 | 83 | 27 | 2.5 | 133 | 43 | 3.0 |
| | 4 | 77 | 38 | 4.00 | 120 | 52 | 1.75 | 80 | 29 | 3.5 | 141 | 46 | 2.5 |
| | 5 | 75 | 36 | 3.00 | 115 | 52 | 2.75 | 78 | 28 | 3.0 | 169 | 58 | 1.5 |
| | 6 | 64 | 32 | 3.00 | 109 | 52 | 3.50 | 67 | 26 | 3.25 | 201 | 68 | 2.75 |
| | 7 | 78 | 38 | 3.00 | 91 | 42 | 3.25 | 65 | 31 | 5.5 | 183 | 68 | 1.75 |
| | 8 | 76 | 32 | 2.25 | 99 | 43 | 3.25 | - | - | - | 160 | 60 | 3.00 |

Table 50

Response Initiation Time (msec.)

| CONDITIONS | | SUBJECTS COMBINED | | |
|---|---|---|---|---|
| | | X | Average S.D. | % > M+ 2 S.D. |
| PERIOD | 1 | 118 | 44 | 3.03 |
| | 2 | 112 | 47 | 3.16 |
| | 3 | 108 | 43 | 2.58 |
| | 4 | 107 | 44 | 3.23 |
| | 5 | 110 | 42 | 2.39 |
| | 6 | 108 | 42 | 3.55 |
| | 7 | 114 | 45 | 2.65 |
| | 8 | 112 | 43 | 2.58 |

Table 51

Response Initiation Time (msec)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. |
| PERIOD | 1 | 104 | 41 | 3.00 | 126 | 47 | 2.50 | 86 | 29 | 3.14 | 151 | 56 | 3.50 |
| | 2 | 84 | 36 | 3.25 | 117 | 53 | 3.50 | 87 | 29 | 4.29 | 157 | 65 | 1.75 |
| | 3 | 78 | 36 | 3.00 | 112 | 48 | 2.25 | 80 | 29 | 2.57 | 156 | 55 | 2.50 |
| | 4 | 87 | 46 | 4.25 | 110 | 48 | 2.25 | 82 | 30 | 3.71 | 146 | 51 | 2.75 |
| | 5 | 86 | 41 | 2.00 | 117 | 46 | 1.75 | 84 | 30 | 3.14 | 152 | 51 | 2.75 |
| | 6 | 88 | 40 | 3.00 | 114 | 47 | 4.50 | 78 | 26 | 3.14 | 150 | 51 | 3.50 |
| | 7 | 86 | 37 | 2.25 | 115 | 51 | 2.50 | 83 | 29 | 2.57 | 168 | 62 | 3.25 |
| | 8 | 87 | 36 | 2.75 | 119 | 48 | 2.75 | 80 | 28 | 2.86 | 159 | 59 | 2.00 |

Table 52

Response Initiation Time (msec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| DAY OF WEEK | M | 118 | 94 | 123 | 88 | 161 |
| | T | 110 | 83 | 120 | 85 | 148 |
| $\underline{X}$ | W | 111 | 92 | 117 | 83 | 149 |
| | T | 111 | 86 | 115 | 80 | 158 |
| | F | 106 | 82 | 105 | 77 | 148 |
| DAY OF WEEK | M | 45 | 40 | 49 | 30 | 59 |
| | T | 43 | 36 | 51 | 30 | 56 |
| Average S.D. | W | 44 | 41 | 48 | 31 | 53 |
| | T | 43 | 42 | 48 | 26 | 54 |
| | F | 43 | 37 | 47 | 27 | 59 |
| DAY OF WEEK | M | 2.78 | 2.66 | 2.19 | 3.21 | 3.13 |
| | T | 2.98 | 2.81 | 2.03 | 4.29 | 2.97 |
| | W | 2.90 | 3.75 | 2.66 | 2.68 | 2.50 |
| % > M+ 2 S.D. | T | 2.94 | 2.81 | 3.13 | 3.39 | 2.50 |
| | F | 2.86 | 2.66 | 3.75 | 2.32 | 2.66 |

Table 53

Movement Time (msec.)

| CONDITIONS | | Subjects Combined | | |
|---|---|---|---|---|
| | | $\bar{X}$ | Average S.D. | % > M+ 2 S.D. |
| WEEKS | 1 | 499 | 55 | 3.19 |
| | 2 | 498 | 68 | 3.56 |
| | 3 | 462 | 60 | 3.31 |
| | 4 | 446 | 58 | 3.50 |
| | 5 | 432 | 51 | 2.25 |
| | 6 | 440 | 64 | 3.06 |
| | 7 | 433 | 69 | 2.94 |
| | 8 | 438 | 76 | 3.17 |

Table 54

Movement Time (msec.)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. |
| WEEK | 1 | 518 | 43 | 3.75 | 523 | 53 | 1.75 | 306 | 38 | 4.00 | 648 | 84 | 3.25 |
| | 2 | 487 | 58 | 4.50 | 540 | 82 | 3.25 | 327 | 50 | 3.50 | 637 | 84 | 3.00 |
| | 3 | 474 | 52 | 4.50 | 436 | 58 | 2.50 | 316 | 37 | 3.25 | 621 | 94 | 3.00 |
| | 4 | 464 | 42 | 3.75 | 386 | 63 | 1.75 | 296 | 34 | 4.00 | 636 | 94 | 4.50 |
| | 5 | 448 | 34 | 2.00 | 396 | 63 | 1.25 | 285 | 25 | 3.75 | 600 | 81 | 2.00 |
| | 6 | 424 | 33 | 2.00 | 425 | 85 | 3.25 | 302 | 62 | 4.25 | 609 | 75 | 2.75 |
| | 7 | 415 | 28 | 2.50 | 387 | 130 | 3.25 | 301 | 26 | 2.50 | 627 | 91 | 3.50 |
| | 8 | 396 | 24 | 2.00 | 351 | 131 | 5.75 | - | - | - | 566 | 72 | 1.75 |

Table 55

Movement Time (msec.)

| CONDITIONS | | SUBJECTS COMBINED | | |
|---|---|---|---|---|
| | | $\bar{X}$ | Average S.D. | %> M+ 2 S.D. |
| PERIOD | 1 | 458 | 55 | 2.97 |
| | 2 | 463 | 65 | 2.84 |
| | 3 | 457 | 65 | 3.36 |
| | 4 | 453 | 60 | 3.23 |
| | 5 | 455 | 57 | 2.84 |
| | 6 | 452 | 63 | 2.52 |
| | 7 | 458 | 64 | 3.55 |
| | 8 | 456 | 69 | 3.68 |

Table 56

Movement Time (msec.)

| CONDITIONS | | Subject 1 | | | Subject 2 | | | Subject 3 | | | Subject 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. | $\bar{X}$ | Av. S.D. | % > M+ 2 S.D. |
| PERIOD | 1 | 463 | 45 | 3.75 | 410 | 55 | 1.25 | 298 | 38 | 3.71 | 641 | 79 | 3.25 |
| | 2 | 449 | 33 | 2.25 | 428 | 73 | 2.25 | 323 | 74 | 4.29 | 634 | 82 | 2.75 |
| | 3 | 444 | 34 | 3.75 | 436 | 90 | 3.00 | 306 | 42 | 4.29 | 624 | 91 | 2.50 |
| | 4 | 452 | 34 | 2.50 | 425 | 84 | 3.50 | 307 | 28 | 4.00 | 608 | 88 | 3.00 |
| | 5 | 456 | 35 | 3.50 | 431 | 79 | 2.25 | 306 | 38 | 3.14 | 608 | 75 | 2.50 |
| | 6 | 449 | 44 | 2.00 | 433 | 83 | 2.75 | 300 | 25 | 2,29 | 606 | 96 | 3.00 |
| | 7 | 458 | 46 | 3.00 | 439 | 95 | 3.75 | 297 | 26 | 3.71 | 619 | 84 | 3.75 |
| | 8 | 456 | 45 | 4.25 | 443 | 106 | 4.00 | 301 | 39 | 3.43 | 603 | 81 | 3.00 |

Table 57

Movement Time (msec.)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| DAY OF WEEK | M | 459 | 463 | 436 | 308 | 610 |
| | T | 460 | 454 | 450 | 305 | 610 |
| $\bar{X}$ | W | 454 | 456 | 430 | 304 | 605 |
| | T | 463 | 452 | 435 | 313 | 633 |
| | F | 447 | 441 | 402 | 293 | 632 |
| DAY OF WEEK | M | 63 | 35 | 97 | 39 | 80 |
| | T | 64 | 35 | 106 | 30 | 81 |
| Average S.D. | W | 62 | 46 | 72 | 39 | 89 |
| | T | 73 | 50 | 87 | 57 | 96 |
| | F | 48 | 31 | 55 | 29 | 76 |
| DAY OF WEEK | M | 2.94 | 1.72 | 2.81 | 3.93 | 3.44 |
| | T | 3.43 | 3.91 | 3.59 | 3.04 | 3.13 |
| % > M+ 2 S.D. | W | 3.15 | 3.28 | 2.03 | 4.11 | 3.28 |
| | T | 3.27 | 3.91 | 3.44 | 3.57 | 2.19 |
| | F | 2.82 | 2.81 | 2.34 | 3.39 | 2.81 |

Table 58

$\bar{X}$ Cycle Time (sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| REST BREAK PERIOD | 1 | 3.17 | 2.92 | 2.92 | 2.87 | 4.08 |
| | 2 | 3.11 | 2.91 | 2.89 | 2.85 | 3.84 |
| | 3 | 3.01 | 2.84 | 2.83 | 2.78 | 3.64 |
| | 4 | 3.05 | 2.91 | 2.85 | 2.80 | 3.71 |
| | 5 | 3.04 | 2.87 | 2.81 | 2.81 | 3.76 |
| | 6 | 2.98 | 2.89 | 2.85 | 2.70 | 3.55 |
| | 7 | 3.04 | 3.01 | 2.85 | 2.75 | 3.61 |
| | 8 | 3.02 | 2.97 | 2.85 | 2.73 | 3.58 |
| NO REST BREAK PERIOD | 1 | 3.18 | 2.88 | 3.00 | 2.72 | 4.08 |
| | 2 | 3.10 | 2.82 | 2.94 | 2.67 | 3.93 |
| | 3 | 3.12 | 2.90 | 2.96 | 2.68 | 3.92 |
| | 4 | 3.17 | 2.91 | 2.95 | 2.73 | 4.03 |
| | 5 | 3.13 | 2.92 | 2.96 | 2.72 | 3.90 |
| | 6 | 3.17 | 2.94 | 2.98 | 2.74 | 3.95 |
| | 7 | 3.16 | 2.95 | 3.04 | 2.71 | 3.83 |
| | 8 | 3.14 | 2.87 | 2.99 | 2.70 | 3.88 |

Table 59

Average S.D. of Cycle Time (sec)

| CONDITIONS | | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|---|
| REST BREAK | | | | | | |
| PERIOD | 1 | 0.98 | 0.96 | 0.80 | 1.03 | 1.19 |
| | 2 | 0.96 | 1.05 | 0.91 | 0.92 | 0.97 |
| | 3 | 0.86 | 0.94 | 0.78 | 0.85 | 0.87 |
| | 4 | 0.92 | 1.00 | 0.84 | 0.89 | 0.94 |
| | 5 | 0.96 | 1.07 | 0.78 | 1.03 | 1.00 |
| | 6 | 0.88 | 1.05 | 0.86 | 0.85 | 0.71 |
| | 7 | 0.90 | 1.02 | 0.87 | 0.90 | 0.80 |
| | 8 | 0.93 | 1.13 | 0.88 | 0.84 | 0.81 |
| NO REST BREAK | | | | | | |
| PERIOD | 1 | 0.91 | 1.01 | 0.84 | 0.78 | 1.01 |
| | 2 | 0.91 | 0.98 | 0.83 | 0.87 | 0.97 |
| | 3 | 0.97 | 1.08 | 0.93 | 0.94 | 0.95 |
| | 4 | 1.02 | 1.15 | 0.91 | 1.00 | 1.02 |
| | 5 | 0.98 | 1.15 | 0.96 | 0.92 | 0.94 |
| | 6 | 1.01 | 1.15 | 0.96 | 0.98 | 0.97 |
| | 7 | 1.06 | 1.22 | 1.05 | 1.01 | 0.99 |
| | 8 | 0.99 | 1.04 | 1.02 | 0.94 | 0.97 |

Table 60

Percentage of Cycle Times over 2 S.D.
Above the Mean

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| REST BREAK | | | | | |
| PERIOD 1 | 4.12 | 3.89 | 3.93 | 3.57 | 5.20 |
| 2 | 3.94 | 4.12 | 3.51 | 3.93 | 4.28 |
| 3 | 3.72 | 3.74 | 3.44 | 4.07 | 3.74 |
| 4 | 3.73 | 3.83 | 3.32 | 4.02 | 3.85 |
| 5 | 3.75 | 4.04 | 3.25 | 4.12 | 3.66 |
| 6 | 3.87 | 4.04 | 3.64 | 4.22 | 3.63 |
| 7 | 3.56 | 3.96 | 3.04 | 3.96 | 3.34 |
| 8 | 3.73 | 4.09 | 3.34 | 4.15 | 3.37 |
| NO REST BREAK | | | | | |
| PERIOD 1 | 3.85 | 3.94 | 3.76 | 3.90 | 3.80 |
| 2 | 4.04 | 4.42 | 3.98 | 3.48 | 4.34 |
| 3 | 3.94 | 3.97 | 4.02 | 3.72 | 4.05 |
| 4 | 4.09 | 4.20 | 4.21 | 4.17 | 3.80 |
| 5 | 3.89 | 4.22 | 3.75 | 3.80 | 3.85 |
| 6 | 4.14 | 4.36 | 4.11 | 4.18 | 3.94 |
| 7 | 4.07 | 4.51 | 4.09 | 4.13 | 3.64 |
| 8 | 3.94 | 4.09 | 4.13 | 3.85 | 3.73 |

Table 61

$\bar{X}$ Cycle Times (sec)

| CONDITIONS | Subjects Combined | Subject 1 | Subject 2 | Subject 3 | Subject 4 |
|---|---|---|---|---|---|
| REST BREAK | 3.05 | 2.91 | 2.86 | 2.78 | 3.72 |
| NO REST BREAK | 3.15 | 2.90 | 2.98 | 2.71 | 3.94 |

Table 61a

# PROBABILITY TABLES

| Dependent Variable \ Independent Variable | | SUBJECTS |
|---|---|---|
| Cycle Broken | | $<0.001$ |
| Reaction Time $\bar{X}$ | | $<0.001$ |
| Response Initiation Time $\bar{X}$ (Stimulus Cycle) | | $<0.001$ |
| Movement Time $\bar{X}$ (Stimulus Cycle) | | $<0.001$ |
| Response Initiation Time | $\bar{X}$ | $<0.001$ |
| | Average S.D. | $<0.001$ |
| | $\% >$ M+ 2 S.D. | |
| Movement Time | $\bar{X}$ | $<0.001$ |
| | Average S.D. | $<0.001$ |
| | $\% >$ M+ 2 S.D. | |
| Cycle Time | $\bar{X}$ | $<0.001$ |
| | Average S.D. | $<0.001$ |
| | $\% >$ M+ 2 S.D. | $<0.001$ |

Table 62

| Dependent Variable | Independent Variable | DAYS OF EXPERIMENT | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Reaction Time $\bar{X}$ | | <0.001 | <0.001 | <0.01 | <0.05 | >0.05 |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | | <0.001 | <0.001 | <0.05 | <0.01 | <0.001 |
| Movement Time (Stimulus Cycle) $\bar{X}$ | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Response Initiation Time | $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| | Average S.D. | <0.01 | <0.01 | <0.01 | >0.05 | <0.001 |
| | % > M+ 2 S.D. | >0.05 | >0.05 | >0.05 | >0.05 | >0.05 |
| Movement Time | $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| | Average S.D. | <0.001 | <0.01 | <0.001 | <0.01 | >0.05 |
| | % > M+ 2 S.D. | >0.05 | >0.05 | <0.01 | >0.05 | >0.05 |
| Cycle Time | $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| | Average S.D. | <0.001 | <0.001 | <0.001 | <0.05 | <0.001 |
| | % > M+ 2 S.D. | <0.001 | <0.001 | <0.001 | >0.05 | <0.001 |

Table 63

| Dependent Variable \ Independent Variable | DAYS OF WEEK | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | $<0.01$ | | | | |
| Reaction Time $\bar{X}$ | | | | | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | | | | | |
| Movement Time (Stimulus Cycle) $\bar{X}$ | $<0.01$ | | | | |
| Response Initiation Time $\bar{X}$ | $<0.01$ | $<0.05$ | $<0.05$ | | |
| Response Initiation Time Average S.D. | | | | | |
| Response Initiation Time % $>$ M+ 2 S.D. | | | | | |
| Movement Time $\bar{X}$ | | $<0.001$ | $<0.05$ | | |
| Movement Time Average S.D. | $<0.05$ | $<0.01$ | | $<0.05$ | |
| Movement Time % $>$ M+ 2 S.D. | | $<0.05$ | | | |
| Cycle Time $\bar{X}$ | | | | | |
| Cycle Time Average S.D. | | $<0.05$ | | | |
| Cycle Time % $>$ M+ 2 S.D. | | | | | |

Table 64

| Dependent Variable \ Independent Variable | | WEEKS | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | $<0.001$ | $<0.01$ | $<0.001$ | $<0.01$ | $<0.01$ |
| Reaction Time $\bar{X}$ | | $<0.001$ | $<0.001$ | | | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | | $<0.05$ | $<0.01$ | | $<0.01$ | $<0.001$ |
| Movement Time (Stimulus Cycle) $\bar{X}$ | | $<0.001$ | $<0.001$ | $<0.001$ | $<0.01$ | $<0.01$ |
| Response Initiation Time | $\bar{X}$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| | Average S.D. | $<0.05$ | $<0.001$ | $<0.05$ | | $<0.001$ |
| | % $>$ M+ 2 S.D. | | | | $<0.05$ | |
| Movement Time | $\bar{X}$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.01$ | $<0.05$ |
| | Average S.D. | | $<0.001$ | $<0.01$ | $<0.05$ | |
| | % $>$ M+ 2 S.D. | | $<0.05$ | $<0.05$ | | |
| Cycle Time | $\bar{X}$ | $<0.01$ | $<0.001$ | $<0.01$ | $<0.05$ | |
| | Average S.D. | | $<0.01$ | $<0.001$ | | |
| | % $>$ M+ 2 S.D. | $<0.01$ | $<0.01$ | $<0.001$ | $<0.05$ | |

Table 65

| Dependent Variable \ Independent Variable | | Residual (Weeks) Shows effect of weeks without interference from Rest Break/No Rest Break | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Response Initiation Time | $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| | Average S.D. | <0.05 | <0.001 | <0.05 | | <0.001 |
| | %>M+ 2 S.D. | | | | | |
| Movement Time | $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.05 | <0.05 |
| | Average S.D. | | <0.001 | <0.01 | | |
| | %>M+ 2 S.D. | | <0.05 | <0.05 | | |
| Cycle Time | $\bar{X}$ | <0.01 | <0.001 | <0.01 | | |
| | Average S.D. | | <0.05 | <0.001 | | |
| | %>M+ 2 S.D. | <0.01 | <0.01 | <0.01 | <0.05 | |

Table 66

| Dependent Variable \ Independent Variable | | PERIODS | | | | |
|---|---|---|---|---|---|---|
| | | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | | | | | |
| Reaction Time | $\bar{X}$ | | | | | |
| Response Initiation Time (Stimulus Cycle) | $\bar{X}$ | | $<0.05$ | | | |
| Movement Time (Stimulus Cycle) | $\bar{X}$ | $<0.05$ | $<0.05$ | | | |
| Response Initiation Time | $\bar{X}$ | $<0.001$ | $<0.001$ | | | $<0.05$ |
| | Average S.D. | | | | | $<0.05$ |
| | % $>$ M+ 2 S.D. | | | | | |
| Movement Time | $\bar{X}$ | | $<0.05$ | $<0.05$ | $<0.05$ | $<0.01$ |
| | Average S.D. | | | $<0.05$ | $<0.01$ | |
| | % $>$ M+ 2 S.D. | | | | | |
| Cycle Time | $\bar{X}$ | $<0$ 001 | | | | $<0.001$ |
| | Average S.D. | | $<0.05$ | | | $<0.05$ |
| | % $>$ M+ 2 S.D. | | | | | |

Table 67

| Dependent Variable / Independent Variable | Stimulus delay tion or Movement Response Initia- Time. | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| Reaction Time $\bar{X}$ | $<0.001$ | $<0.01$ | $<0.01$ | $<0.01$ | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | $<0.01$ | | | | $<0.05$ |
| Movement Time (Stimulus Cycle) $\bar{X}$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.01$ | |

Table 68

| Dependent Variable \ Independent Variable | 10 m.sec or 50 m.sec Delay for Stimulus | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1. | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | $<0.001$ | $<0.001$ | $<0.05$ | $<0.01$ | |
| Reaction Time $\bar{X}$ | | $<0.05$ | | $<0.05$ | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | | | | | |
| Movement Time (Stimulus Cycle) $\bar{X}$ | $<0.001$ | $<0.001$ | | $<0.05$ | |

Table 69

| Dependent Variable \ Independent Variable | Rest Breaks<br>No Rest Breaks |
|---|---|
| | Subject 4 |
| Cycle Times $\bar{X}$ | $<0.01$ |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | $<0.05$ |

No other significant results for this Independent Variable.

Table 70

| INTERACTIONS | DEPENDENT VARIABLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Response Initiation Time | | | Movement Time | | | Cycle Time | | |
| | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. | $\bar{X}$ | Av. S.D. | %> M+ 2 S.D. | $\bar{X}$ | Av. S.D | %> M+ 2 S.D. |
| S x D | $<0.001$ | $<0.001$ | $<0.05$ | $<0.001$ | $<0.001$ | $<0.01$ | $<0.001$ | $<0.001$ | $<0.001$ |
| S x E | | | | $<0.01$ | $<0.05$ | | | | |
| S x W | $<0.001$ | $<0.001$ | | $<0.001$ | $<0.001$ | $<0.05$ | $<0.01$ | | $<0.05$ |
| S x B | | | | | | | | | |
| S x P | $<0.01$ | $<0.05$ | | $<0.001$ | $<0.001$ | | $<0.001$ | $<0.01$ | |
| D x P | | | | | | | $<0.001$ | $<0.001$ | $<0.01$ |
| P x E | | | | | | | | | |
| W x P | $<0.05$ | | | | | | | | |
| B x P | | | | | | | $<0.05$ | $<0.01$ | |
| SPE | | | | | | | $<0.001$ | $<0.05$ | $<0.05$ |
| SPW | | | | $<0.05$ | | | $<0.05$ | $<0.05$ | |
| SPB | | | | | | | | | |

"S" = Subject

D = Day of Experiment

E = Day of Week

W = Week

B = Rest Break/No Rest Break

P = Period

Table 71

| Dependent Variables | | Subjects | Interactions | | |
|---|---|---|---|---|---|
| | | | E x P | W x P | B x P |
| Response Initiation Time | $\bar{X}$ | Sub.1 | | <0.05 | |
| | | Sub.3 | | <0.05 | <0.01 |
| | Average S.D. | Sub.2 | <0.05 | | |
| | % >M.+ 2 S.D. | Sub.4 | | <0.05 | |
| Movement Time | $\bar{X}$ | Sub.4 | | <0.05 | |
| | Average S.D. | Sub.3 | <0.05 | | |
| | % >M.+ 2 S.D. | | | | |
| Cycle Time | $\bar{X}$ | Sub.4 | <0.01 | | |
| | Average S.D. | Sub.3 | | | <0.05 |
| | | Sub.4 | <0.05 | <0.05 | |
| | % >M.+ 2 S.D. | | | | |

D = Day of Experiment
W = Week of Experiment
P = Period of Day
E = Day of Week
B = Rest Break/No Rest Break

11 Significant Results out of a possible 108. It may be that most of them are truely chance. Where there were no significant results, Subjects have not been entered in the table.

Table 72

| Dependent Variables | Interactions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | S x D | S x W | S x B | S x G | S x H | D x P | D x H | P x H | SBP | SGP |
| Cycle Broken | $<0.001$ | $<0.001$ | | $<0.001$ | $<0.01$ | | | | | $<0.05$ |
| Reaction Time $\bar{X}$ | $<0.001$ | $<0.001$ | | | | | $<0.05$ | | $<0.05$ | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | $<0.001$ | $<0.001$ | $<0.05$ | | | | | | | |
| Movement Time (Stimulus Cycle) $\bar{X}$ | $<0.001$ | $<0.001$ | | $<0.001$ | $<0.001$ | $<0.05$ | | $<0.05$ | | $<0.05$ |

No Statistical Significance for the Following:

S x E, S x P, E x P, W x P, B x P, G x P,

E x H, W x H, B x H, G x H, SEP, SWP, SPH.

S = Subjects
D = Day of Experiment
E = Day of Week
W = Weeks
B = Rest Break/No Rest Break
G = Stimulus given in R.I.T. or M.T.
P = Periods
H = Delay (10m.sec or 50 m.sec)

19 Significant Results out of a possible 92.

Table 73

| Dependent Variables | Subjects | Interactions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | D x H | ExH | W x H | BxH | GxH | ExP | W x P | BxP | G x P |
| Cycle Broken | Sub.1 | | | | | | | | | $<0.05$ |
| | Sub.3 | $<0.05$ | | | | | | | | |
| Reaction Time $\bar{X}$ | Sub.3 | | | $<0.05$ | | | | | | |
| Response Initiation Time (Stimulus Cycle) $\bar{X}$ | Sub.1 | | | | | | | $<0.05$ | | |
| | Sub.3 | $<0.05$ | | | | | | | | |
| Movement Time (Stimulus Cycle) $\bar{X}$ | Sub.1 | $<0.01$ | | | | | | | | $<0.05$ |

D = Day of Experiment
E = Day of Week
W = Week of Experiment
B = Rest Break/No Rest Break
G = Stimulus given in R.I.T or M.T.
P = Period of Day
H = Stimulus Delay (10m.sec or 50 m.sec)

7 Significant Results out of a possible 144. Factors without any significant results have not been entered in the table.

Table 74

| Dependent Variable / Independent Variable | DAYS OF WEEK | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken<br>Reaction Time $\bar{X}$ | NO STATISTICAL SIGNIFICANCES | | | | |

Cycle Broken - Subjects Combined. Probability Value for
Day of Week = 0.0L. in previous analysis

Table 75

| Dependent Variable \ Independent Variable | FORTNIGHTS | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | $<0.001$ | | $<0.001$ | $<0.05$ | $<0.01$ |
| Reaction Time $\bar{X}$ | $<0.001$ | $<0.001$ | | | |

Table 76

| Dependent Variable \ Independent Variable | REST BREAKS / NO REST BREAKS | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | | $<0.01$ | | $<0.05$ | |
| Reaction Time $\bar{X}$ | $<0.001$ | $<0.01$ | | | |

Table 77

Dependent Variable = "G" Stimulus given in R.I.T. and M.T.

Only one change from the initial analysis

Subject 1. Reaction Time - Probability Value <0.001
Previous value <0.01

| Independent Variable / Dependent Variable | Stimulus given in R.I.T. or M.T. | | | | |
|---|---|---|---|---|---|
| | Subs. Comb. | Sub.1 | Sub.2 | Sub.3 | Sub.4 |
| Cycle Broken | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Reaction Time $\bar{X}$ | <0.001 | <0.001 | <0.001 | <0.01 | |

Table 78

| INTERACTIONS | Dependent Variables | |
|---|---|---|
| | Cycle Broken | Reaction Time $\bar{X}$ |
| S x E | | |
| S x F | $<0.001$ | $<0.001$ |
| S x B | $<0.001$ | |
| S x G | $<0.001$ | |
| E x H | | |
| F x H | | |
| B x H | | |
| G x H | | |

Reaction Time.

E x H = Probability Value of $<0.05$ in other analysis $\therefore$ necessary to recalculate for this analysis but as expected significance was less. In fact it did not reach an acceptable level.

Table 79

| INTERACTIONS | Dependent Variables | |
|---|---|---|
| | Cycle Broken Subjects 1-4 | Reaction Time $\bar{X}$ Subjects 1 - 4 |
| E x H | NO STATISTICAL SIGNIFICANCE | NO STATISTICAL SIGNIFICANCE |
| F x H | NO STATISTICAL SIGNIFICANCE | NO STATISTICAL SIGNIFICANCE |
| B x H | NO STATISTICAL SIGNIFICANCE | NO STATISTICAL SIGNIFICANCE |
| G x H | NO STATISTICAL SIGNIFICANCE | NO STATISTICAL SIGNIFICANCE |

<u>Reaction Time</u>

For Subject 3 W x H (Week by Delay) had probability Value = $<0.05$ for Reaction (e.g. previous analysis) therefore it was necessary to recalculate for this analysis. The likelihood was that the significance would be less within the D x H (Day by Delay) Heirarchy as indeed it was.

<u>Cycle Broken.</u>

D x H was significant $<0.05$ for Subject 3 in previous analyses $\therefore$ it was necessary to recalculate the D x H hierarchy - the likelihood was as above.

Table 80

Figs. 38 - 43

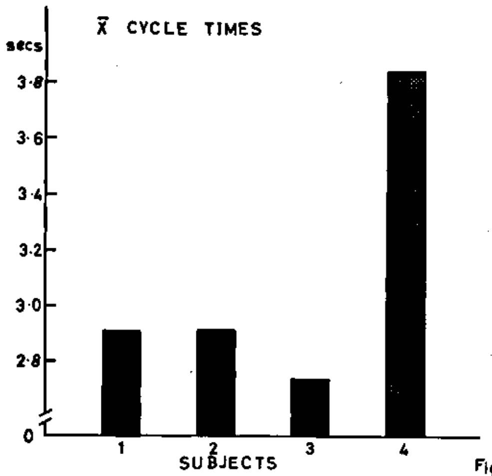



Fig. 38

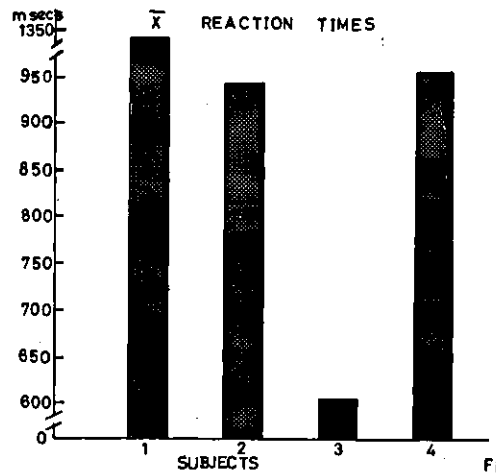



Fig. 41

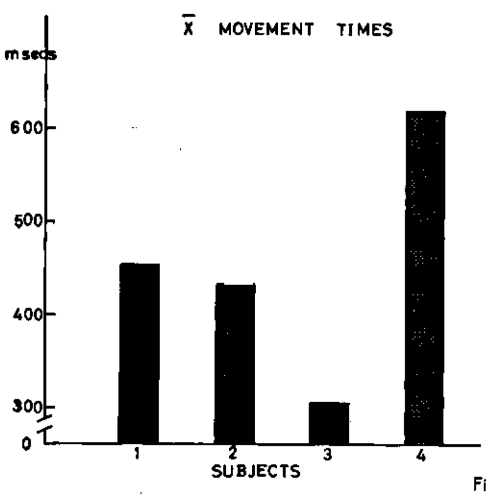
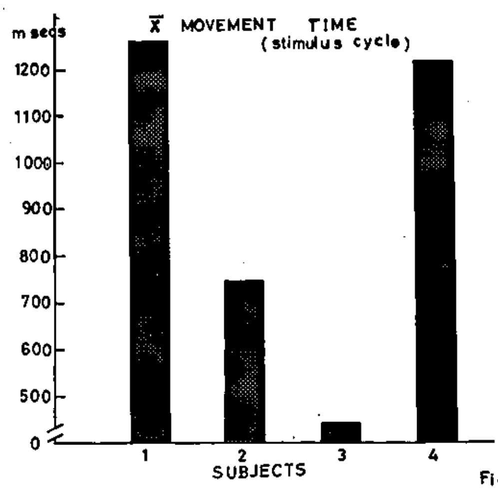



Fig. 39

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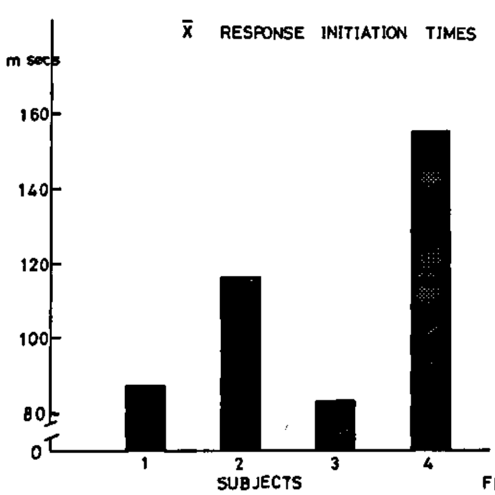


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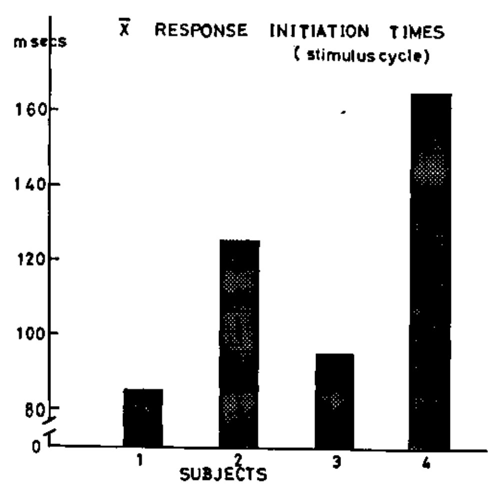
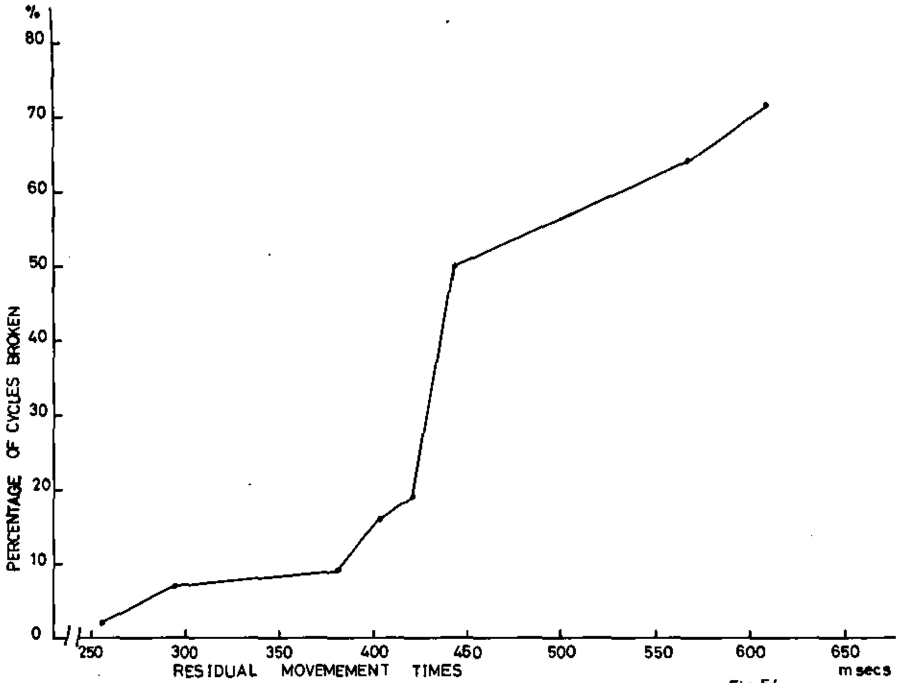



Fig. 43

Figs. 44 - 55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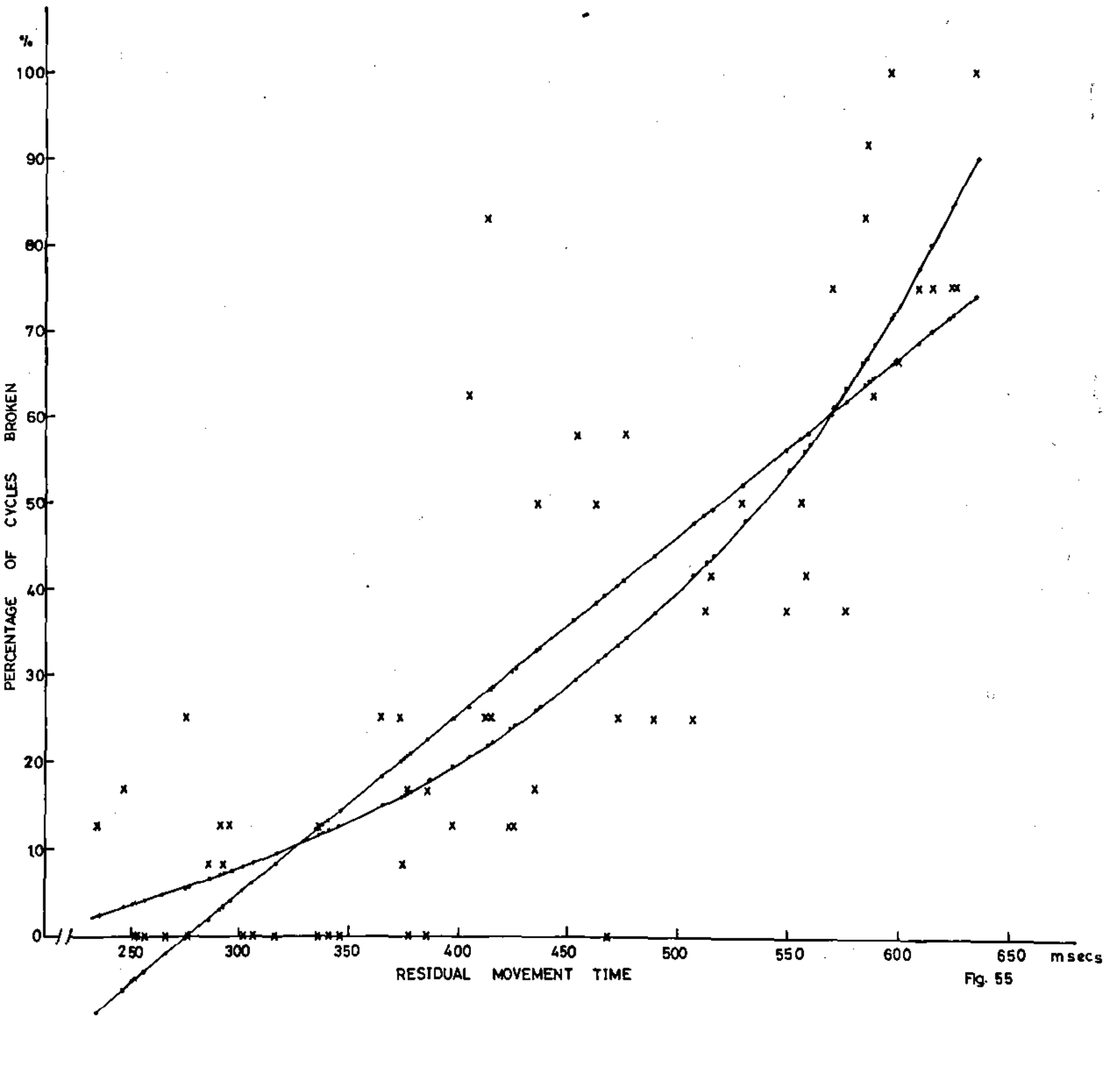
70
60
50
40
30
20
10
0
PERCENTAGE OF CYCLES BROKEN
250
300
350
400
450
500
550
600
650
RESIDUAL MOVEMEMENT TIMES
msecs

Fig.54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550
600
650
msecs
RESIDUAL MOVEMENT TIME

Fig. 55

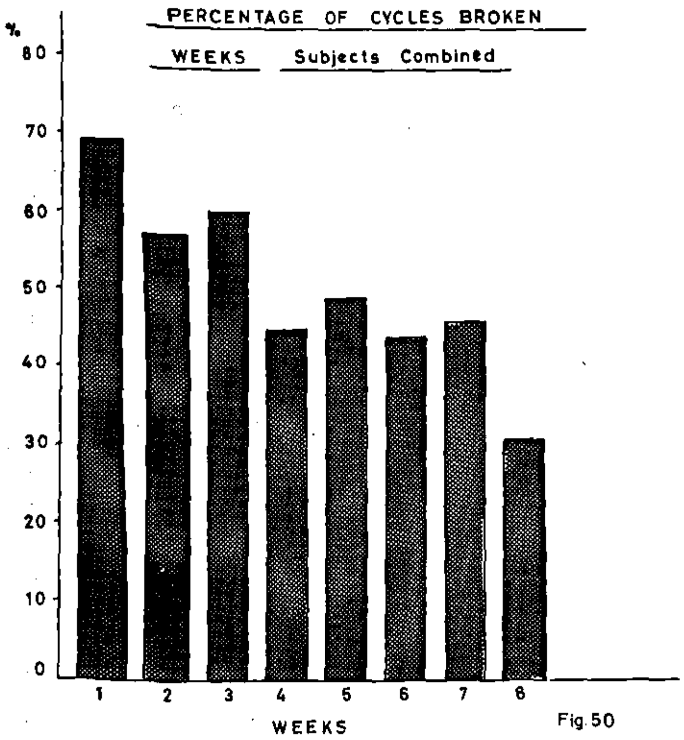
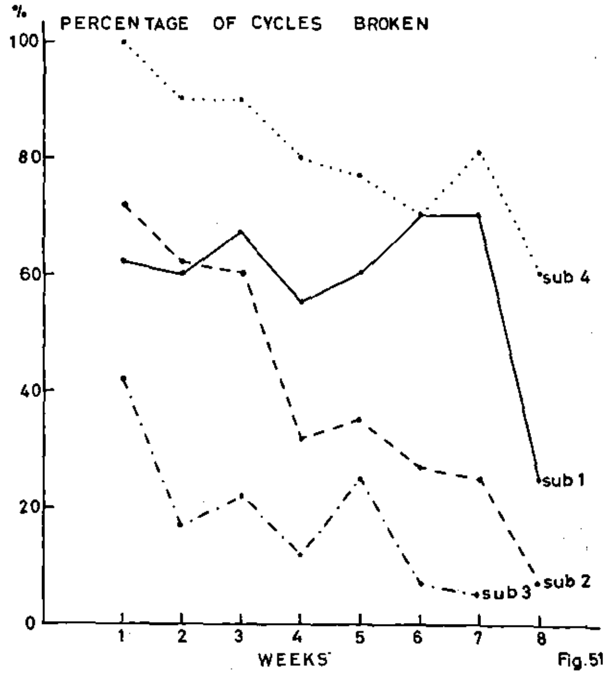


Fig.50



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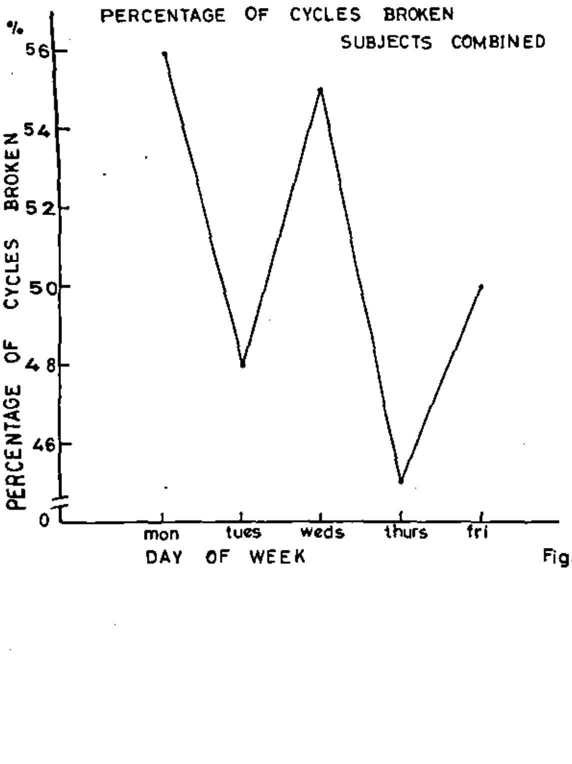

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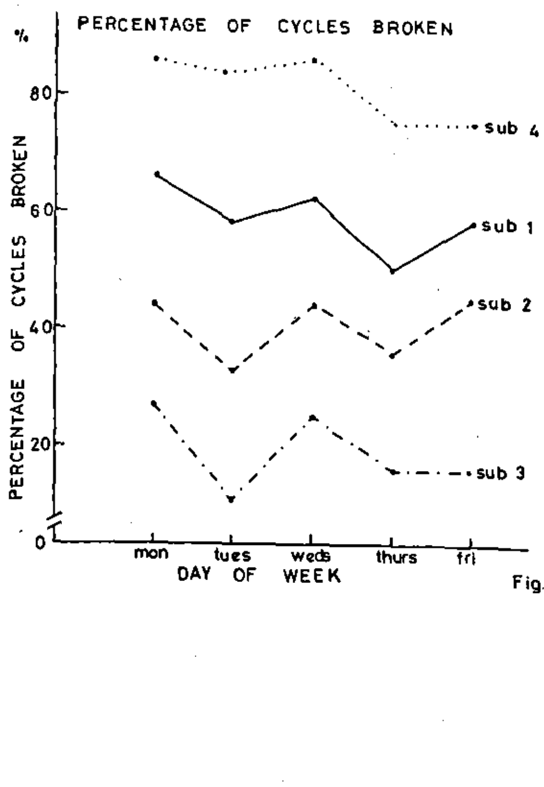
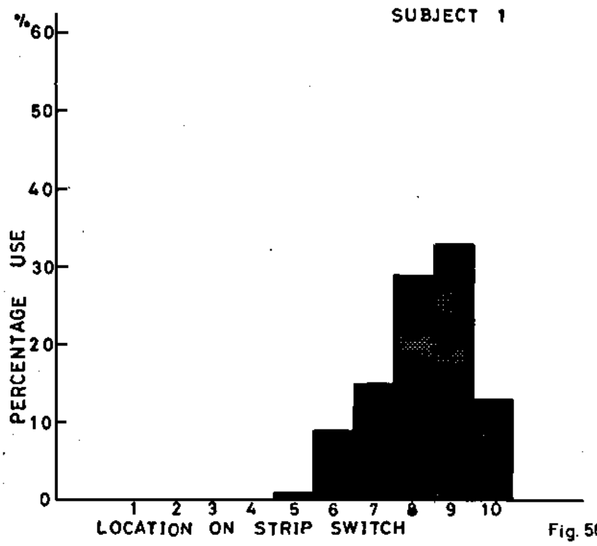


Fig.53

Figs. 56 - 59

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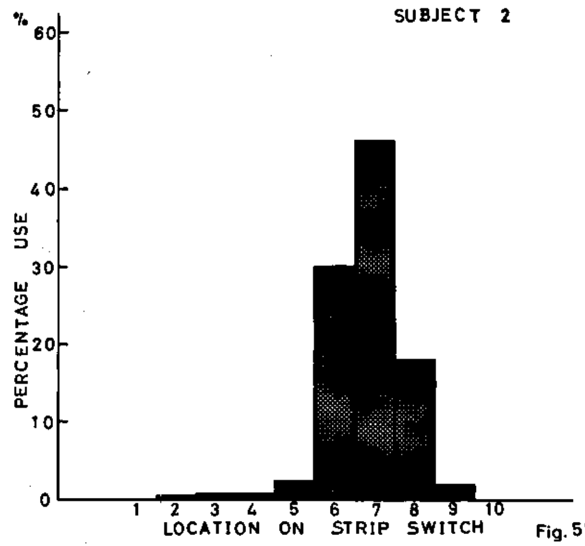


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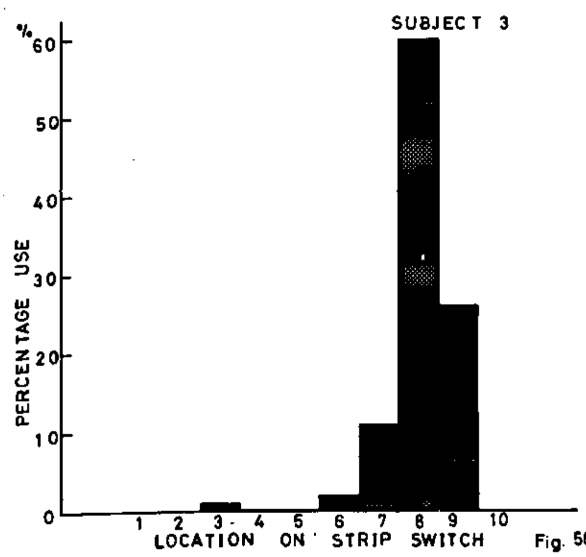


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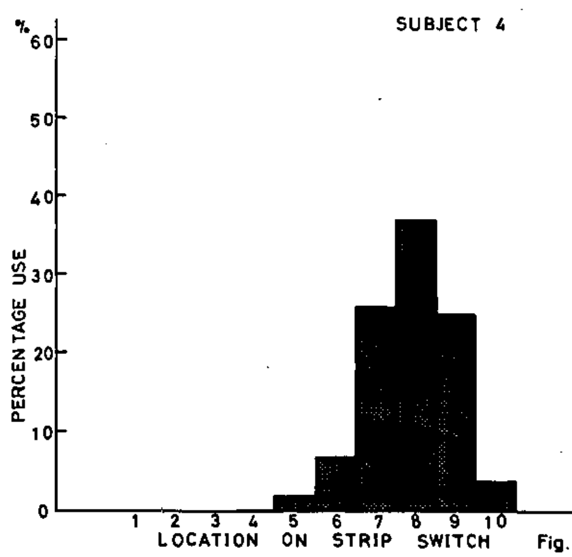


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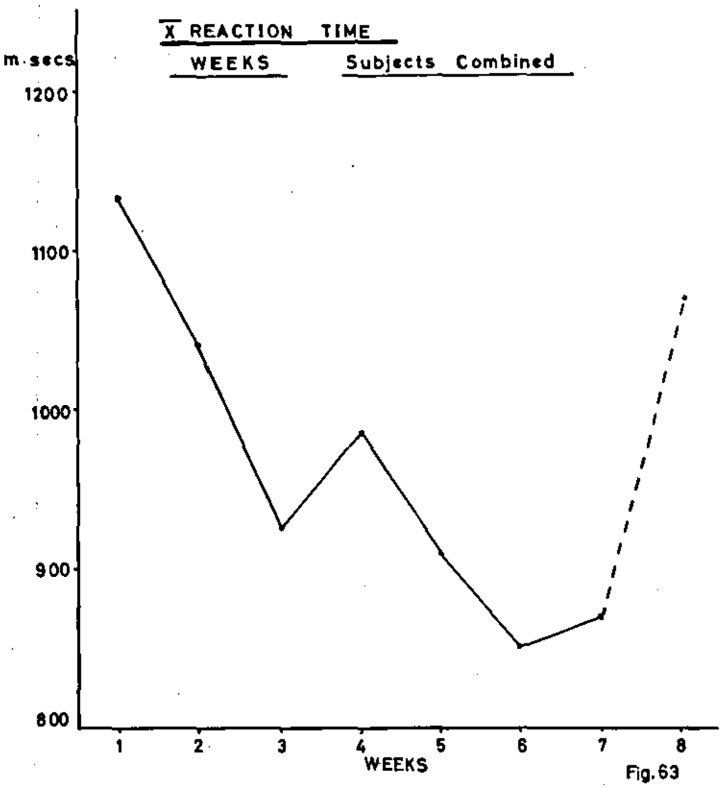
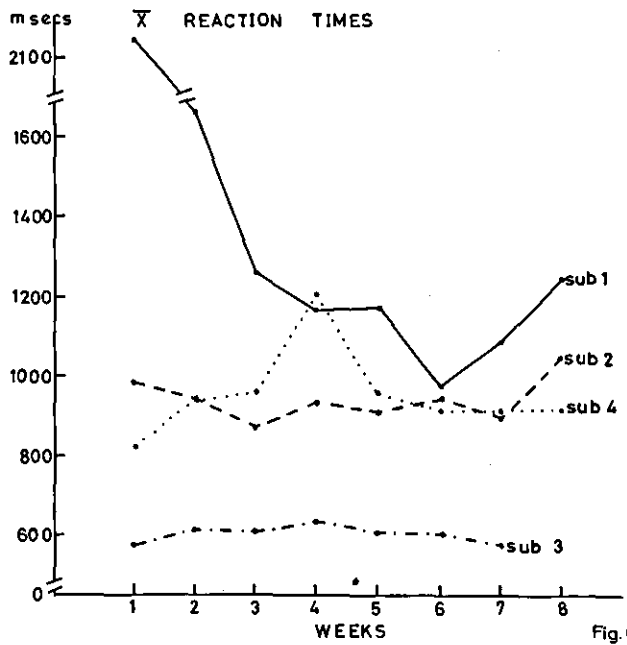

X̄ REACTION TIME
WEEKS
Subjects Combined
m.secs
1200
1100
1000
900
800
1
2
3
4
5
6
7
8
WEEKS

Fig. 63


m secs
X̄ REACTION TIMES
2100
1600
1400
1200
1000
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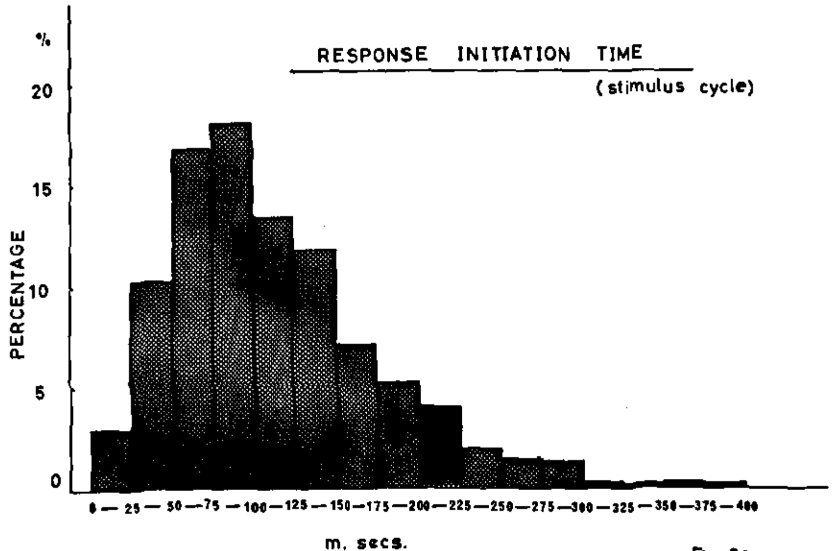
sub 1
sub 2
sub 4
sub 3
1
2
3
4
5
6
7
8
WEEKS

Fig. 64

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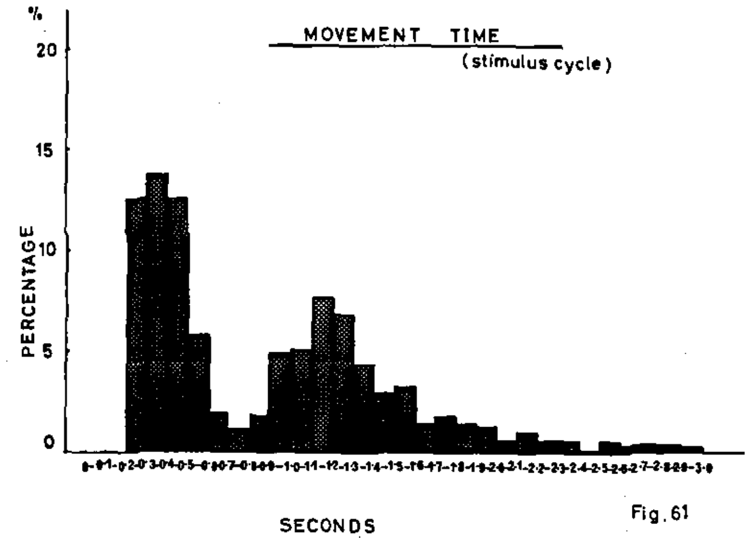



Fig. 61

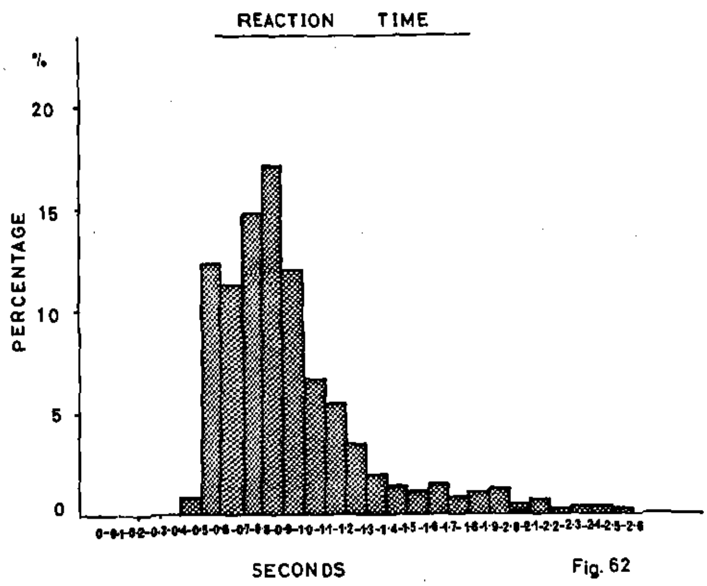



Fig. 62

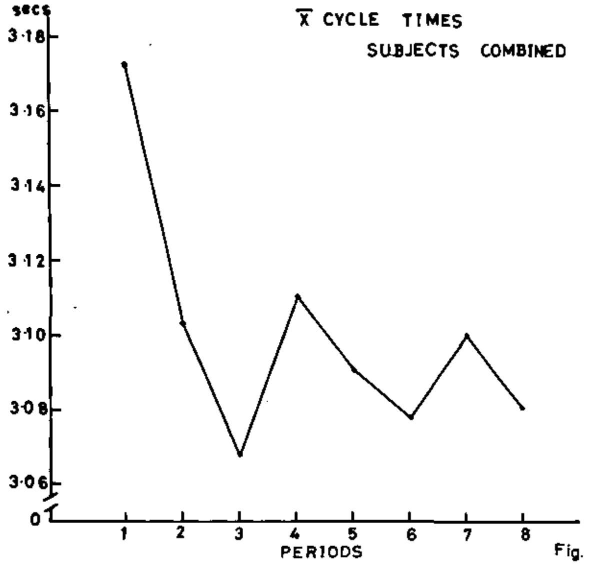



Fig. 71

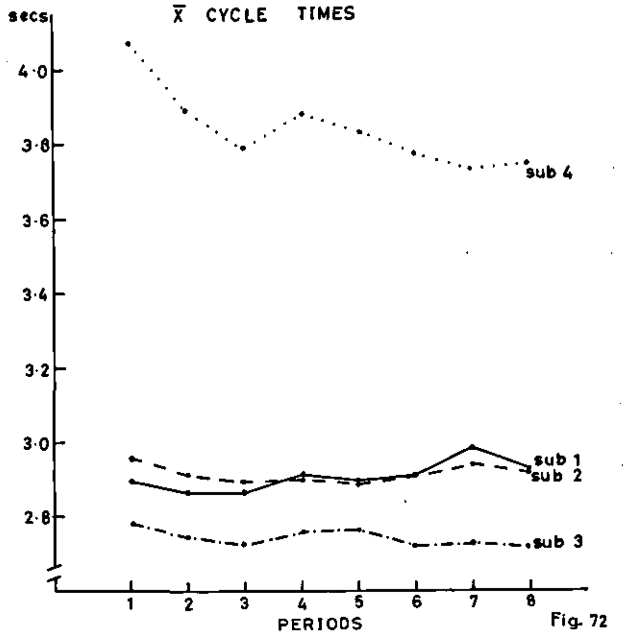



Fig. 72

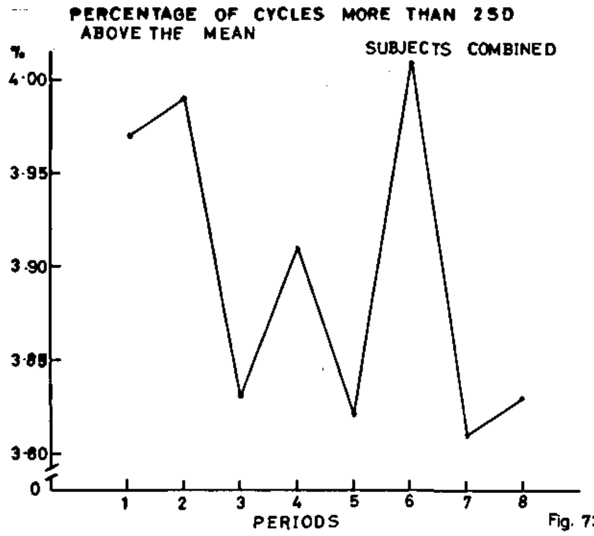



Fig. 73

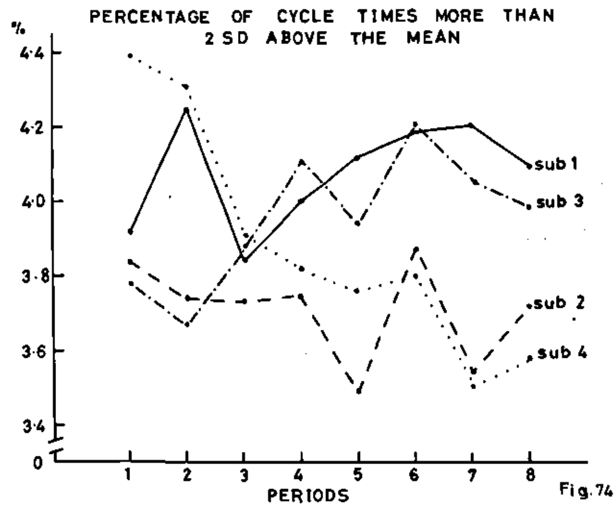



Fig. 74

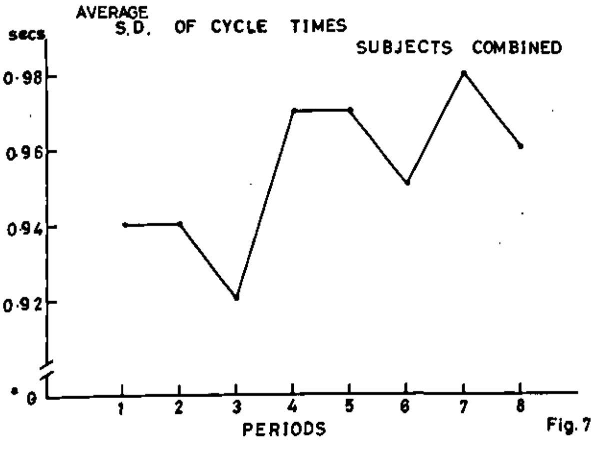
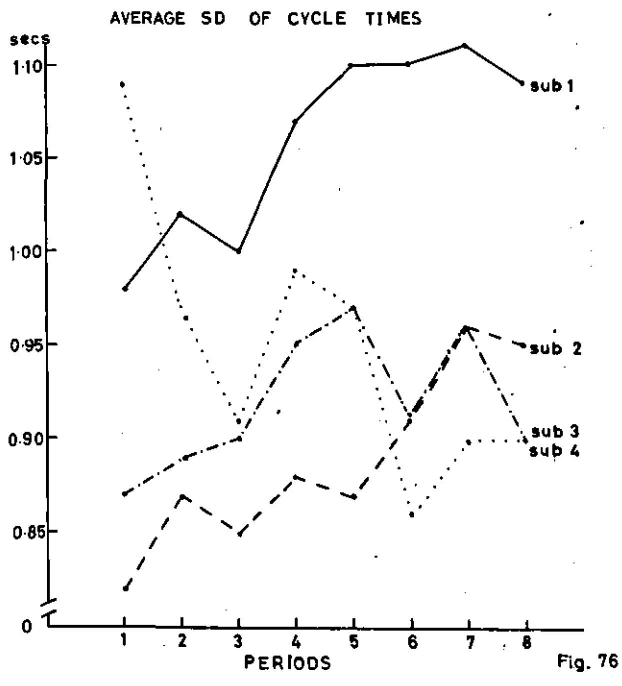



Fig. 75

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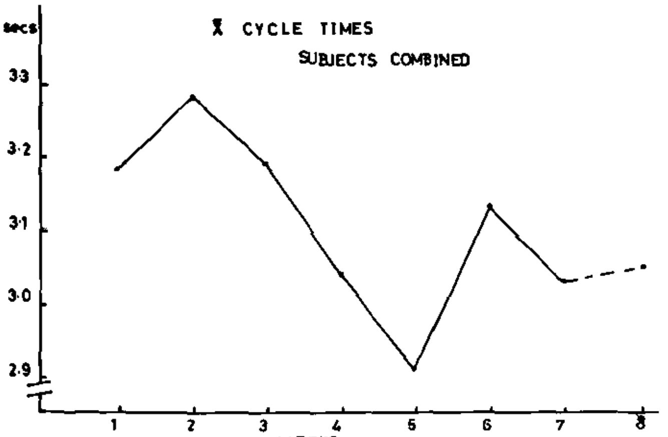
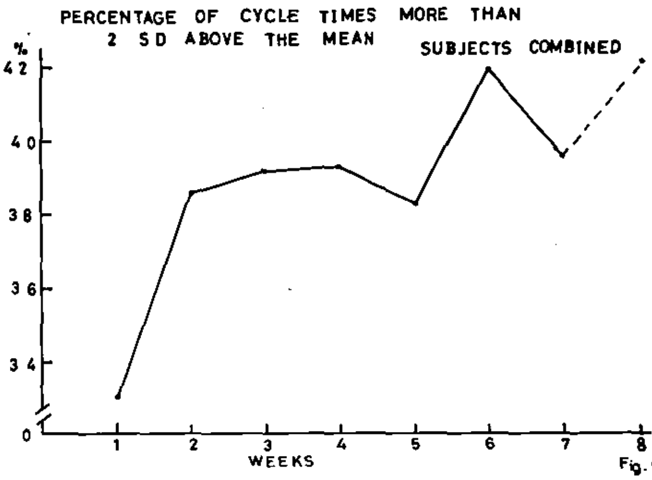



Fig 65

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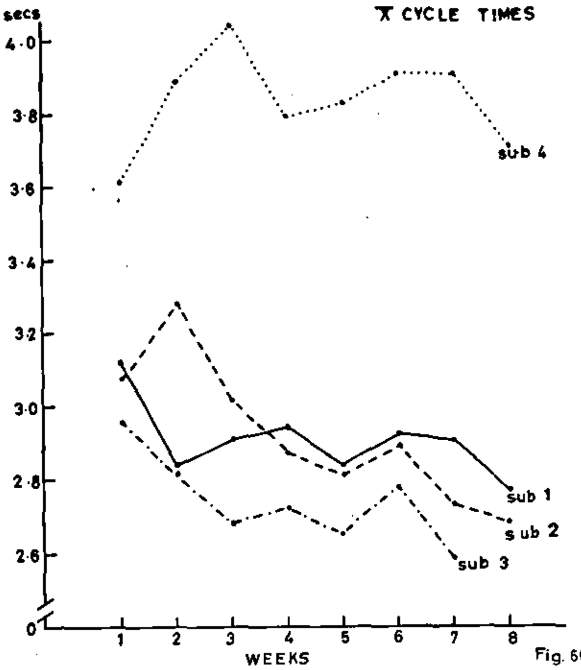


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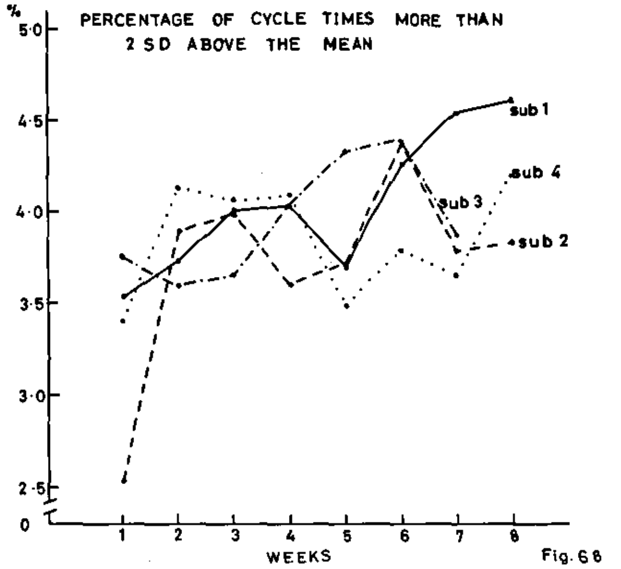


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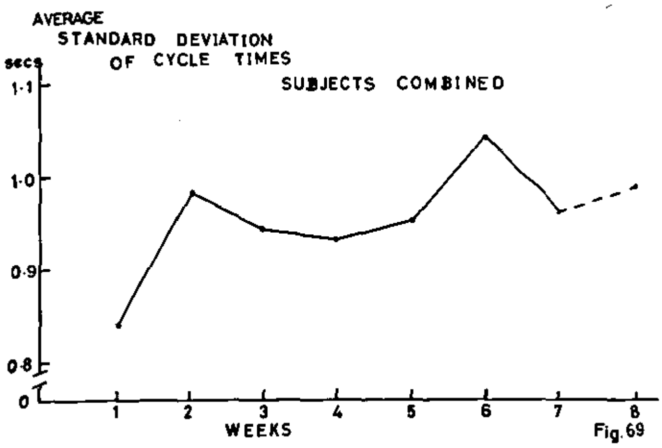


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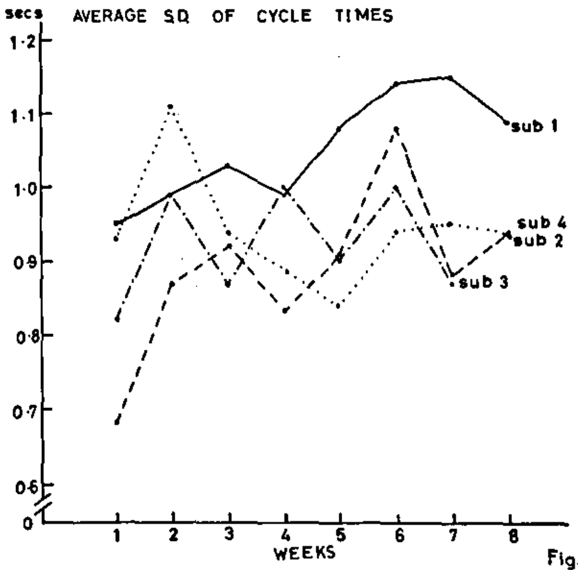
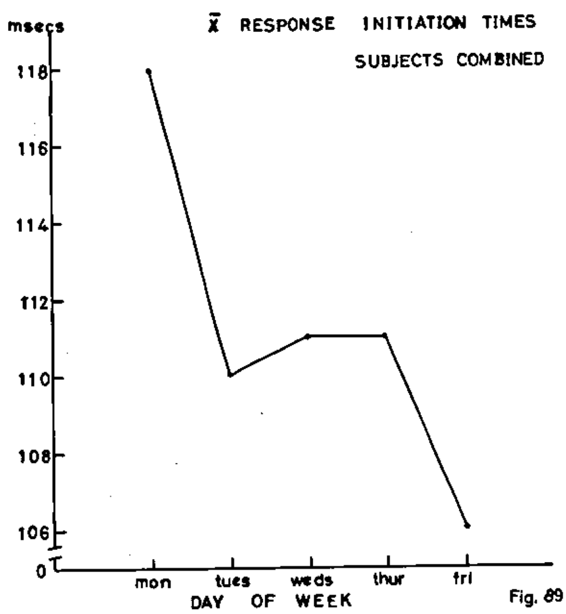



Fig. 70

Figs. 77 - 92

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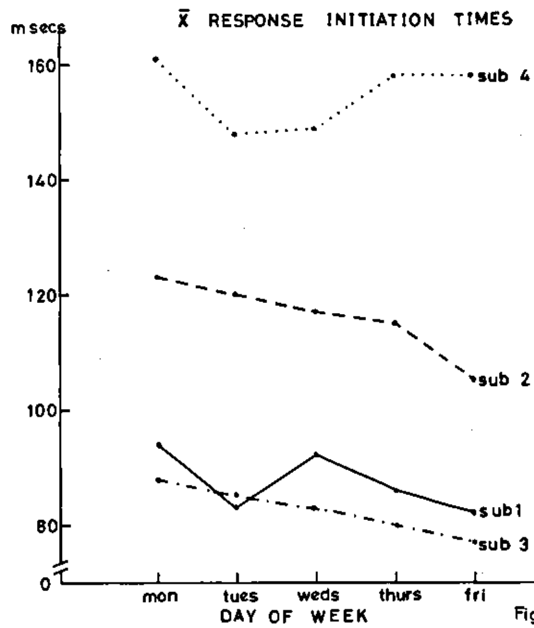


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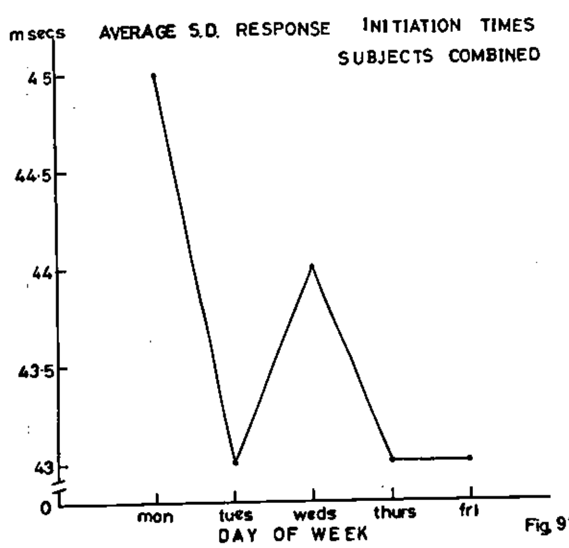


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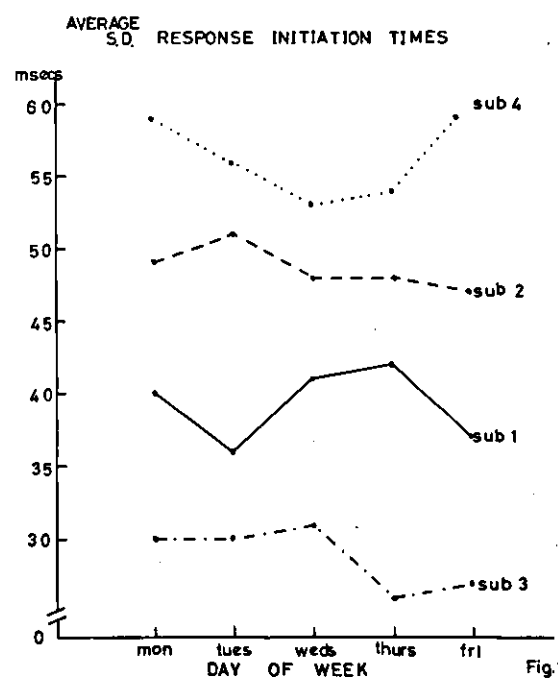


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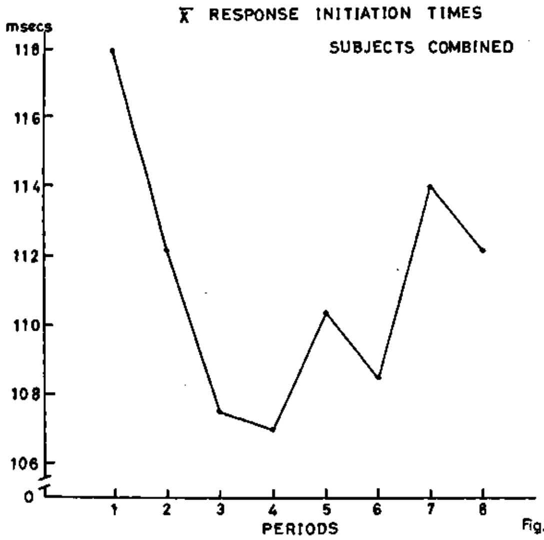

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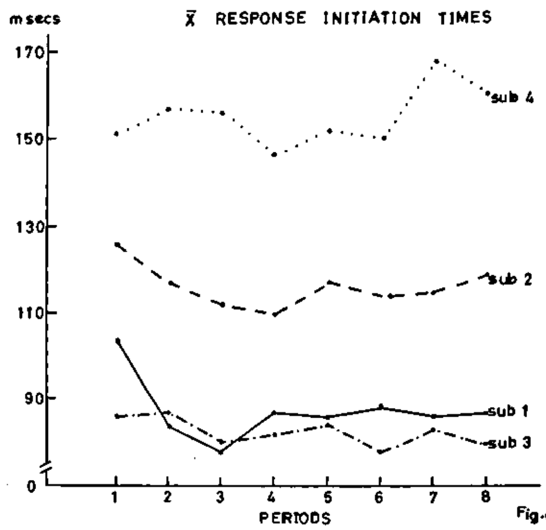

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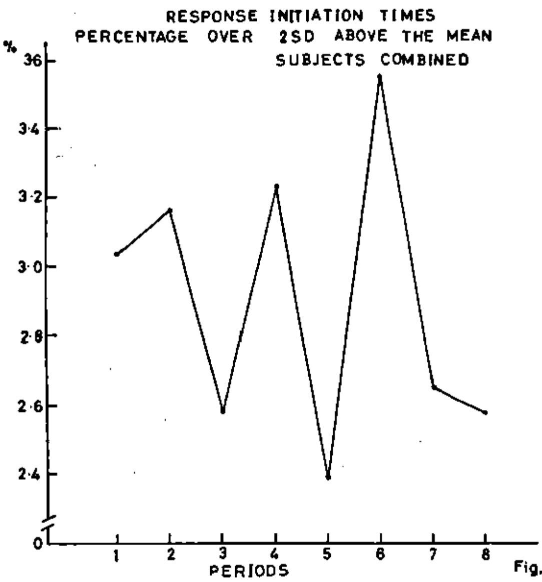

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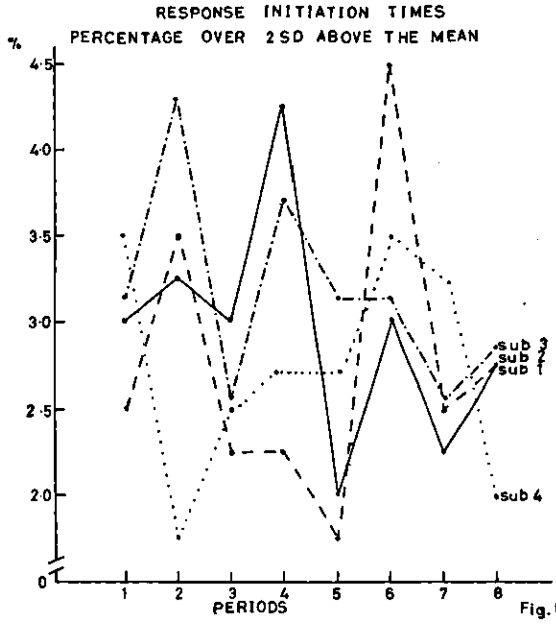

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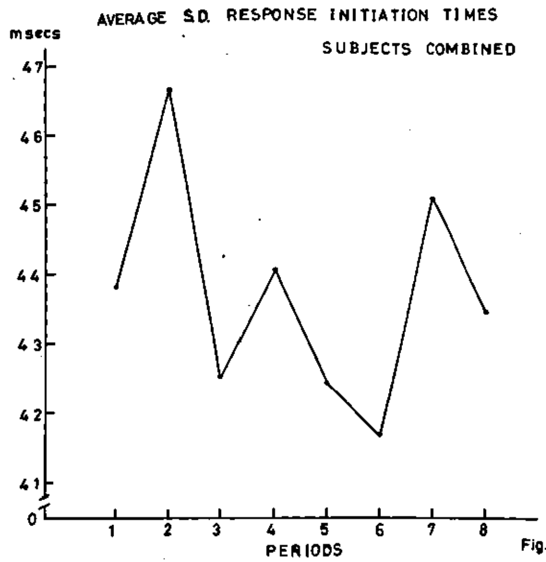

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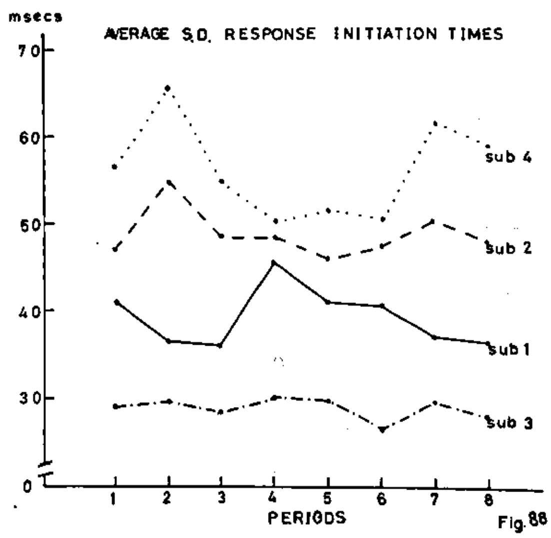

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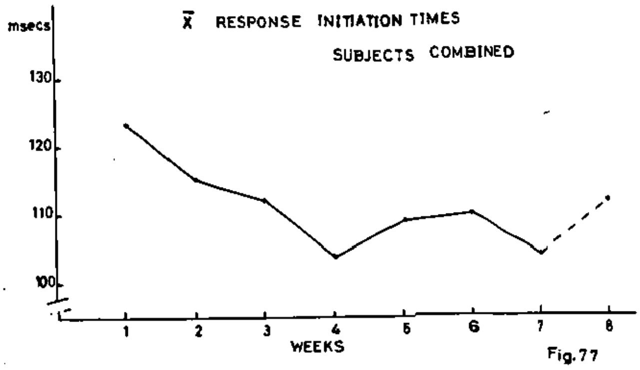

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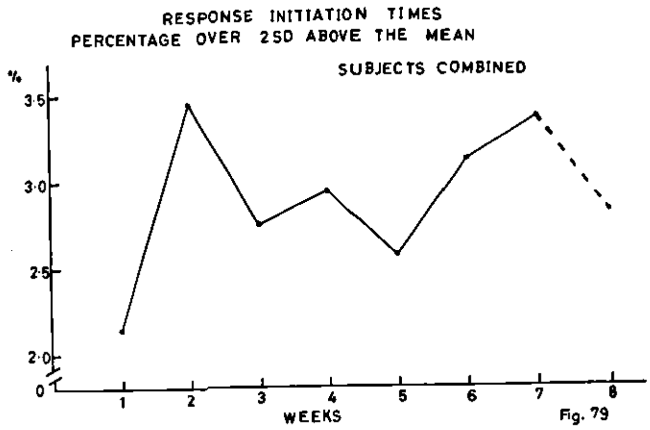

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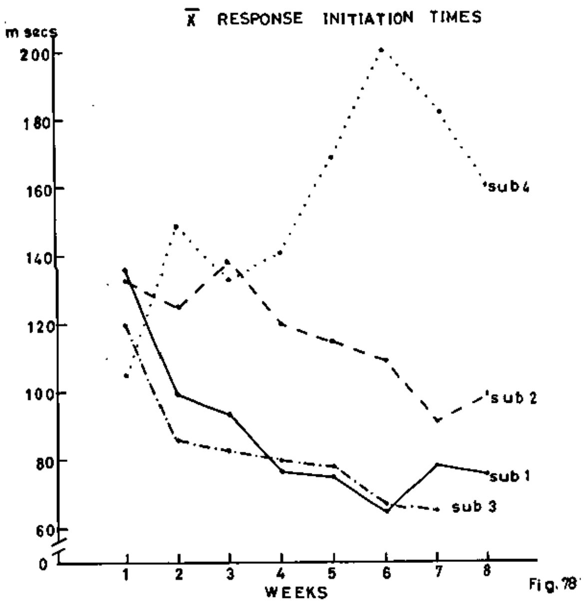

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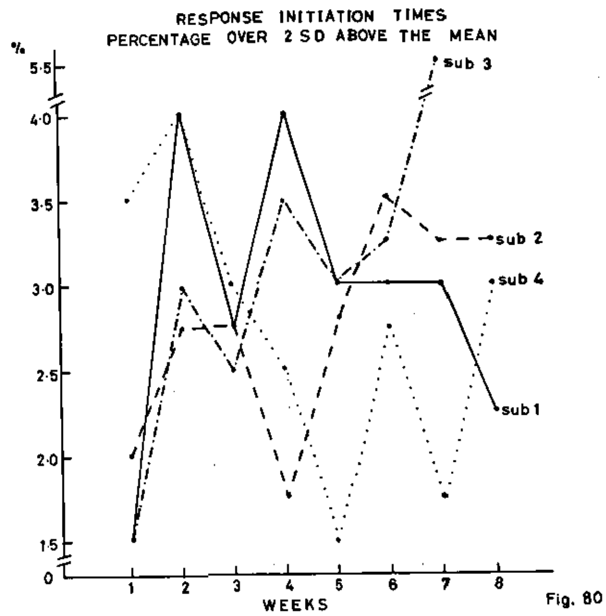

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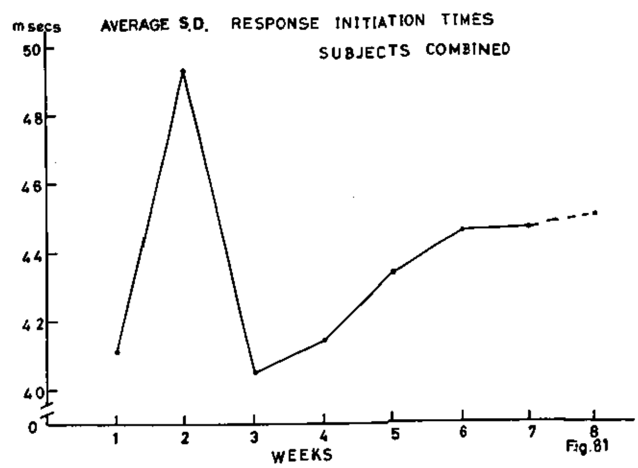

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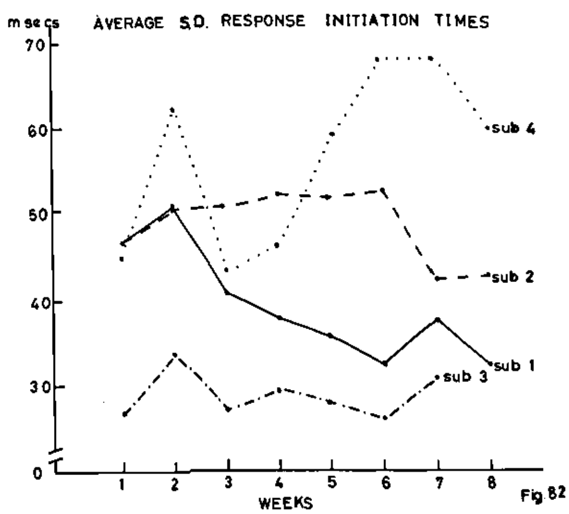


Fig. 82

Figs. 93 - 108

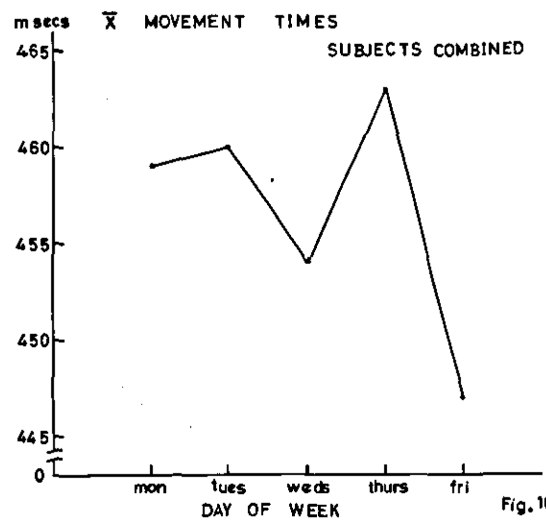



Fig. 105

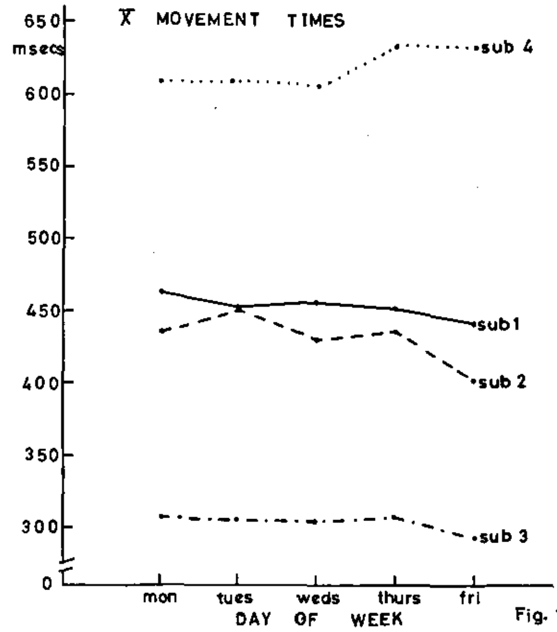
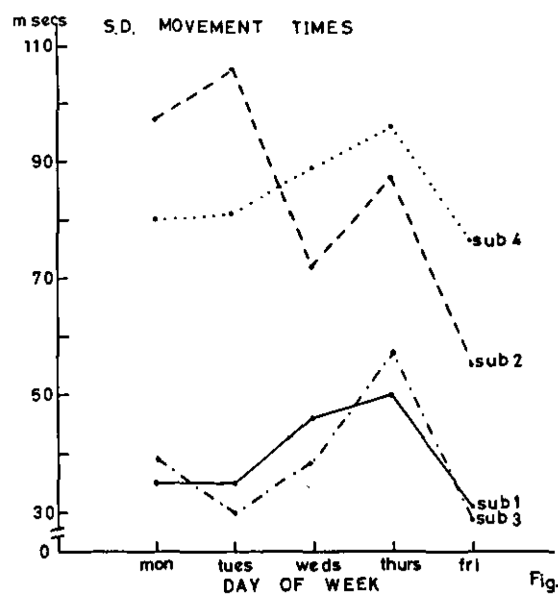



Fig. 106


Fig. 107

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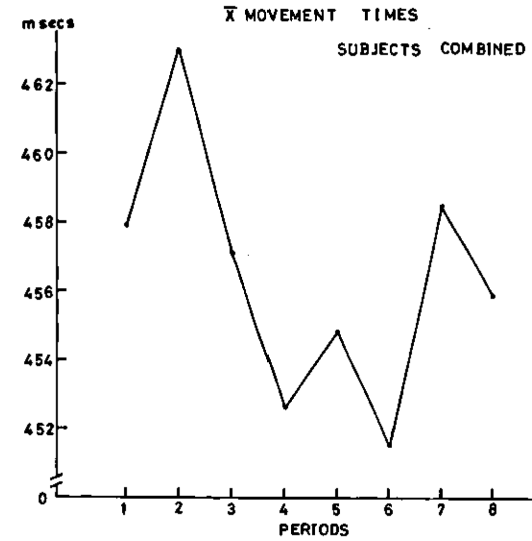

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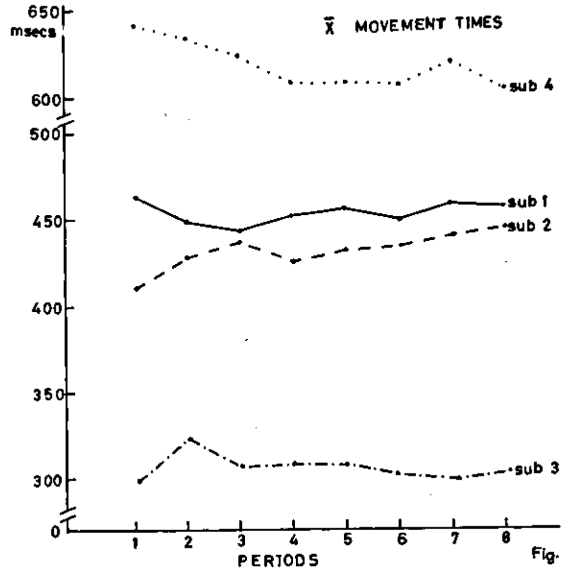

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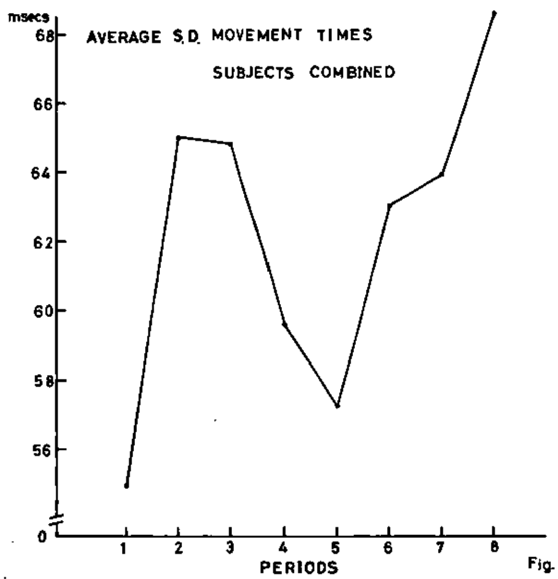

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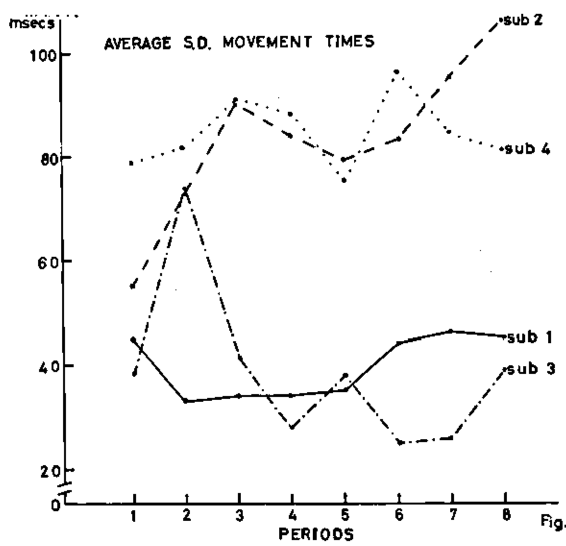

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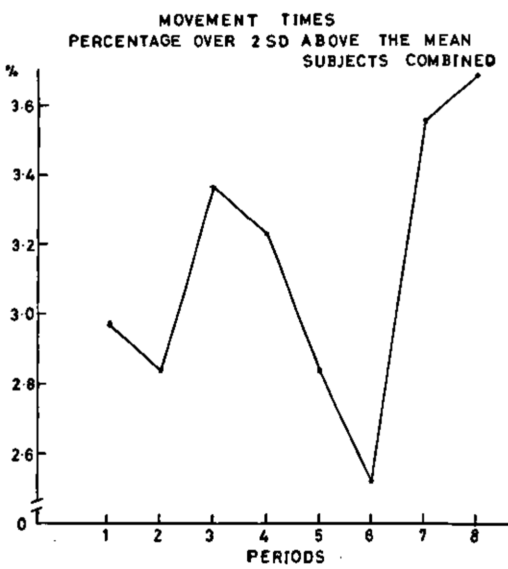

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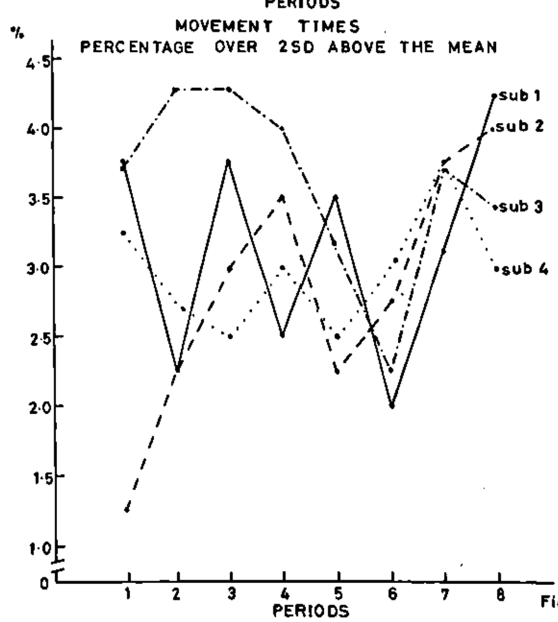

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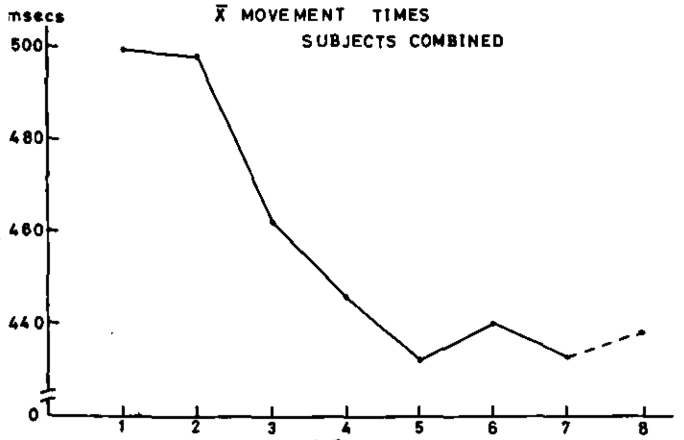


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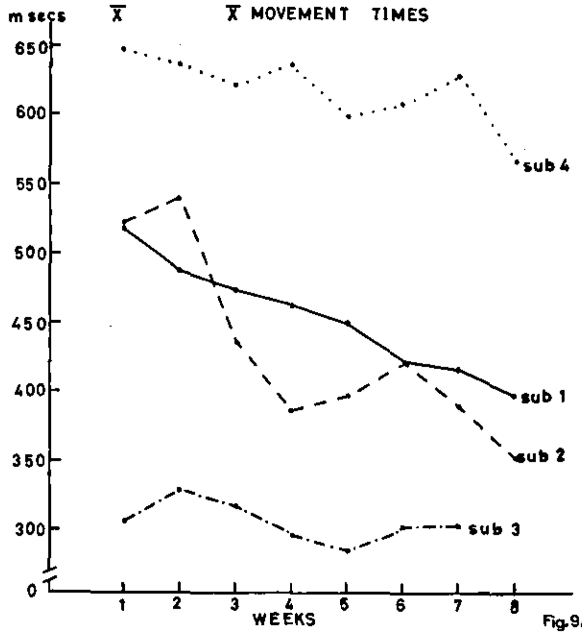


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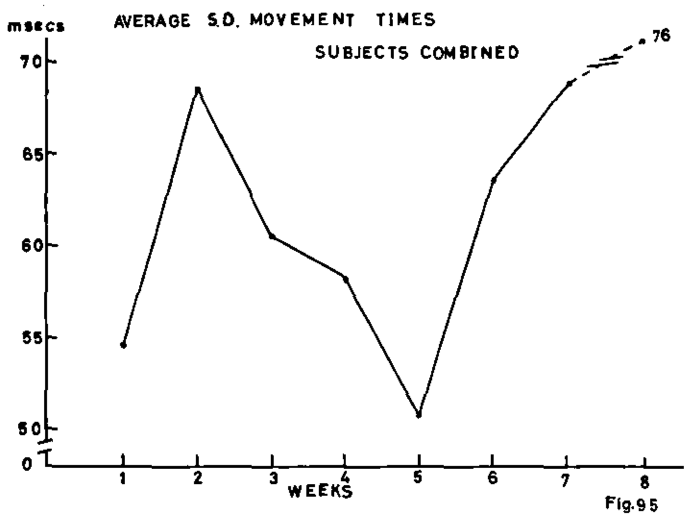


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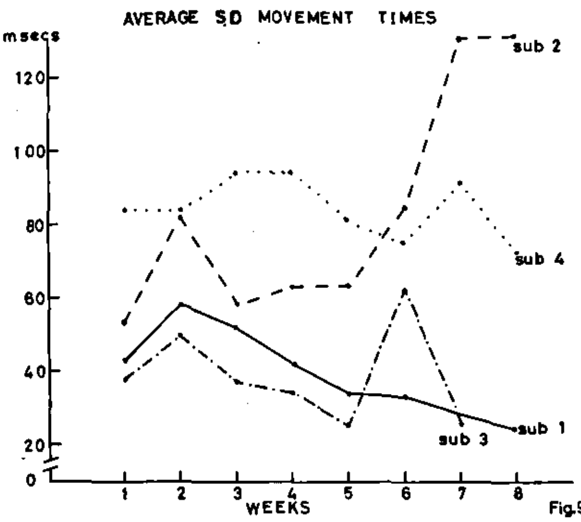


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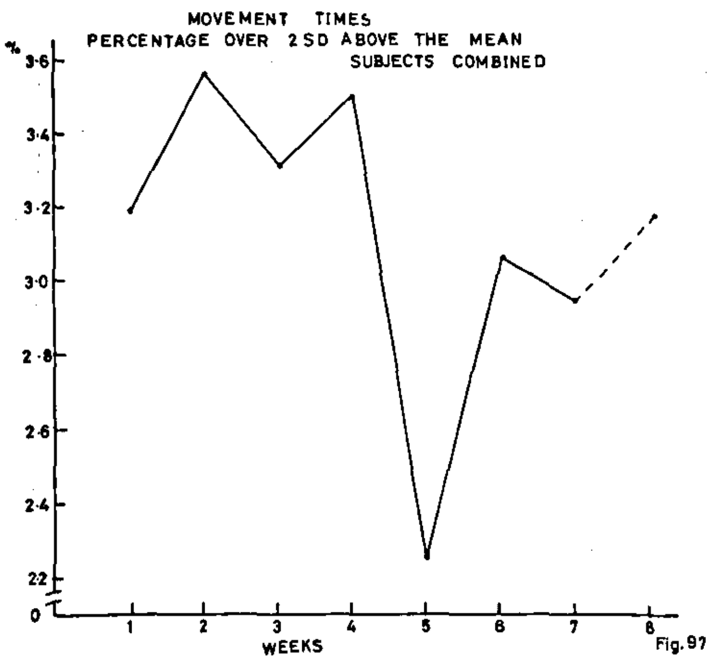


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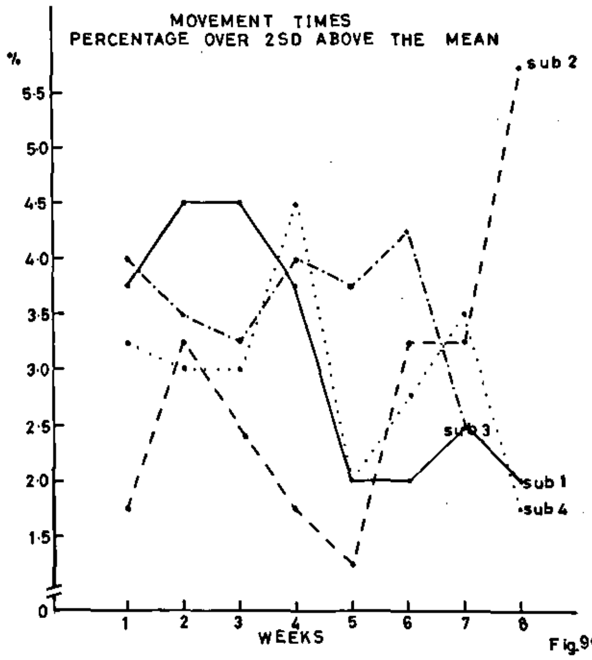



Fig. 98

Figs. 109 - 123

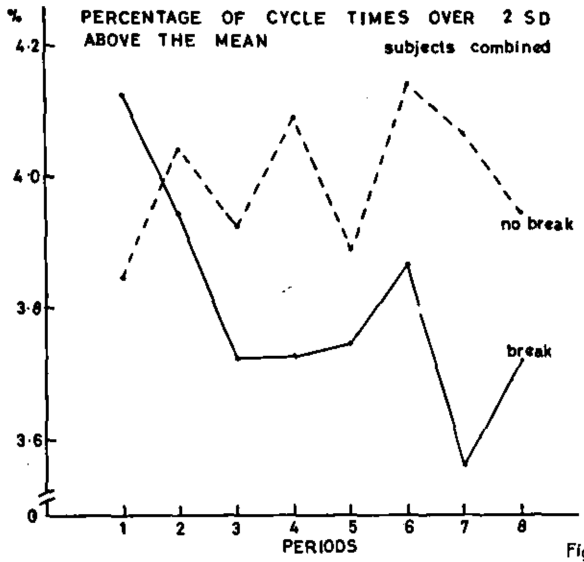



Fig. 119

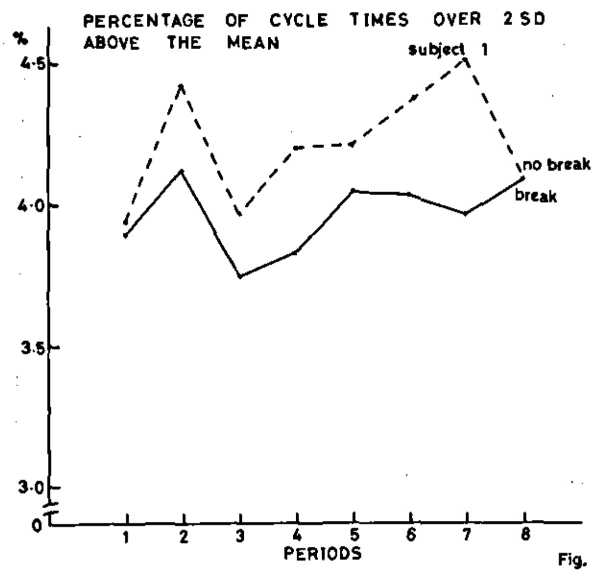
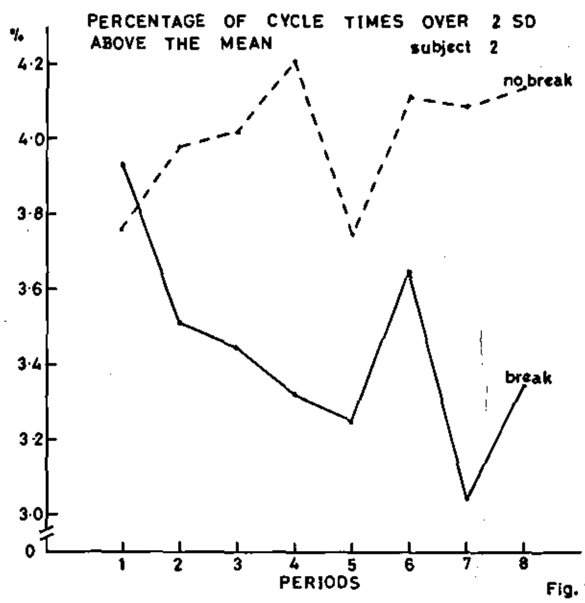



Fig. 120

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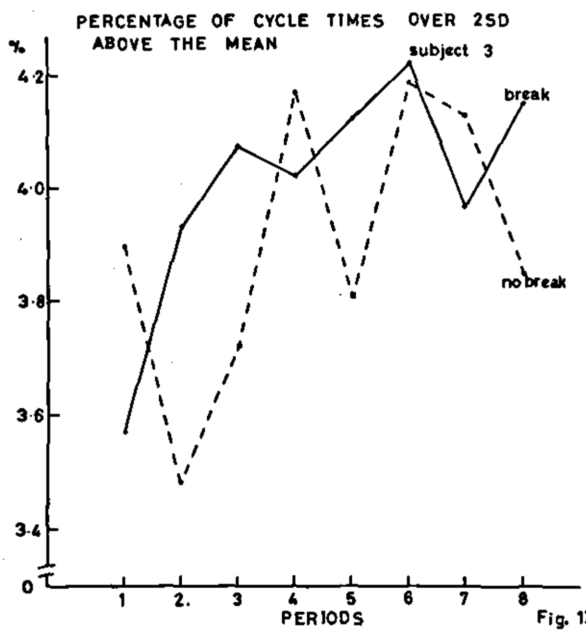


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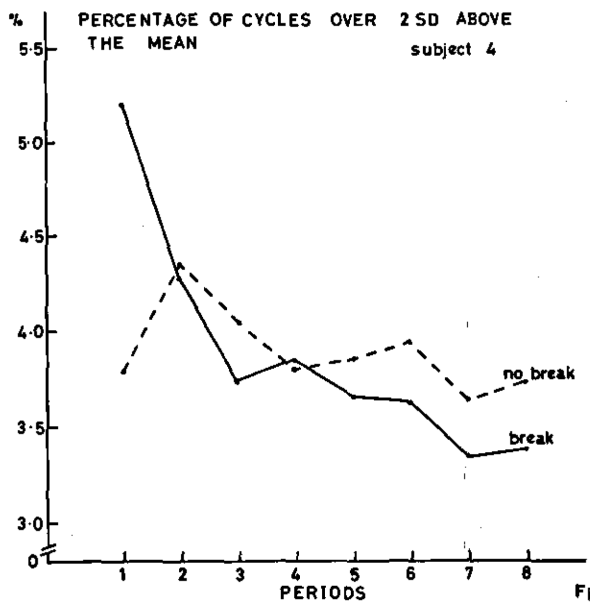


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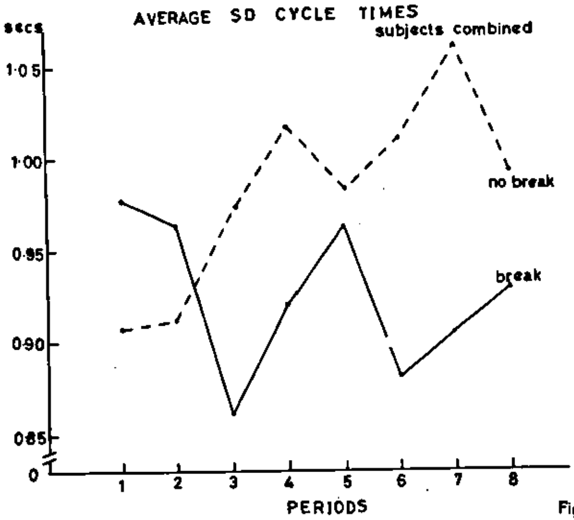
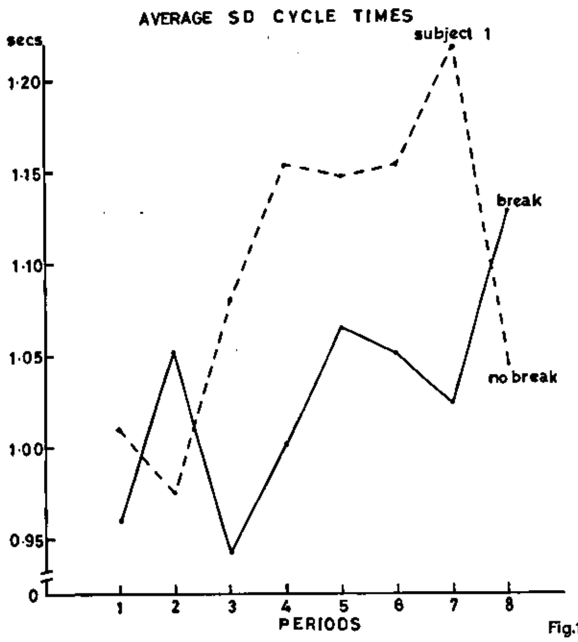



Fig. 114

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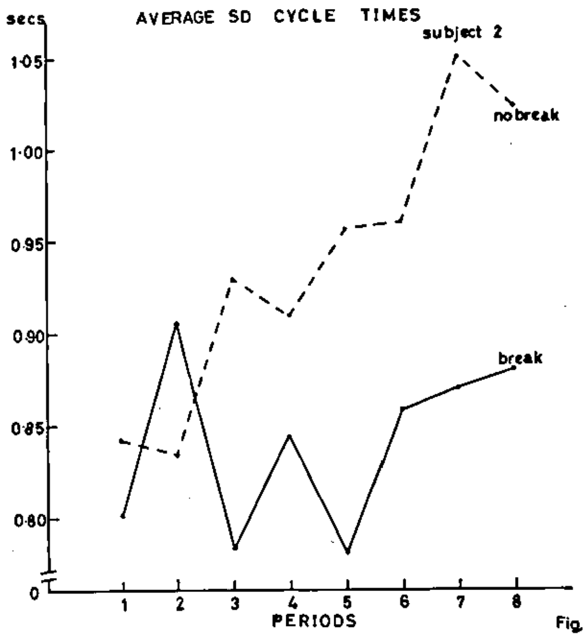


Fig. 116

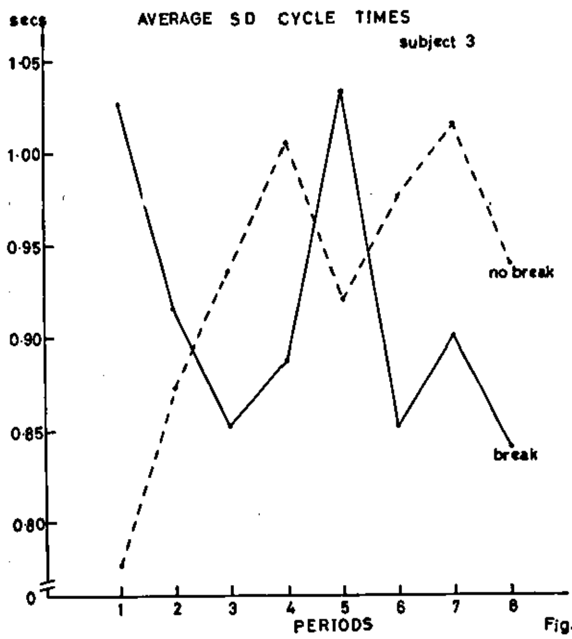


Fig. 117

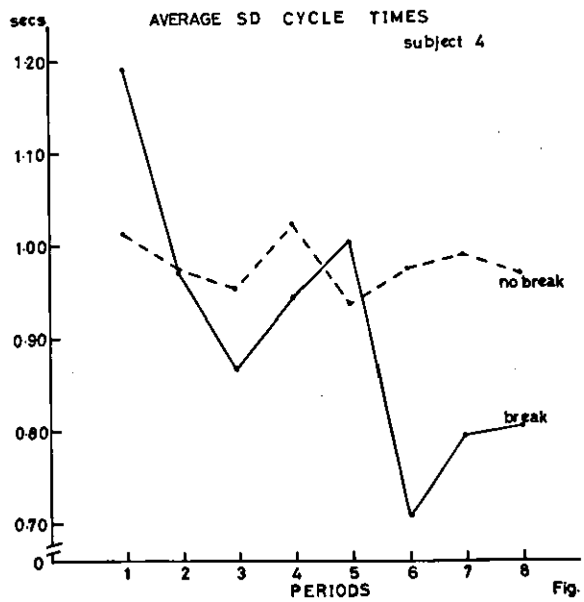


Fig. 118

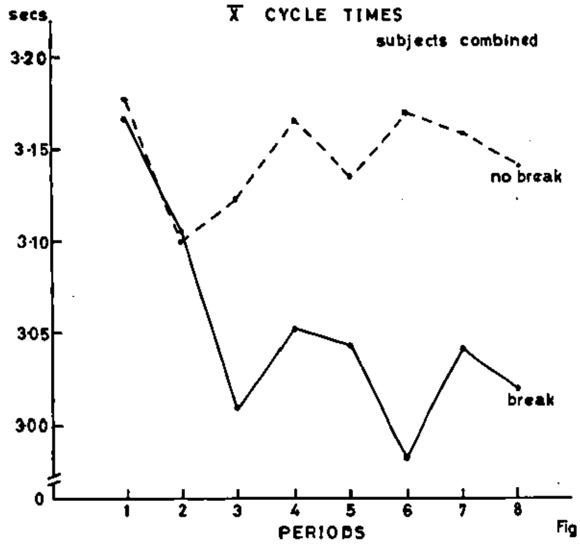


Fig. 109

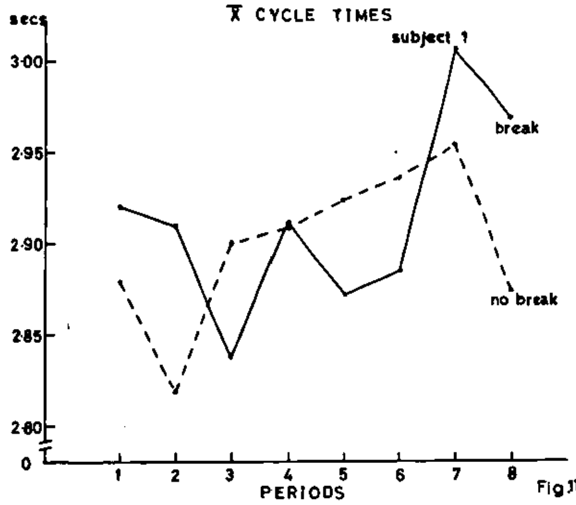


Fig. 110

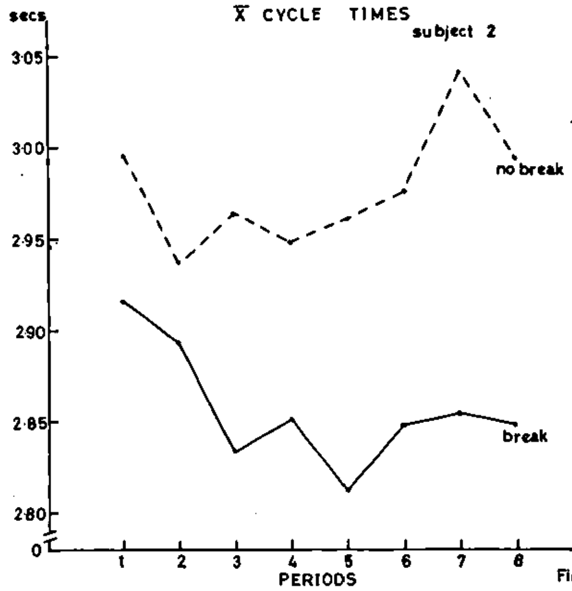


Fig. 111

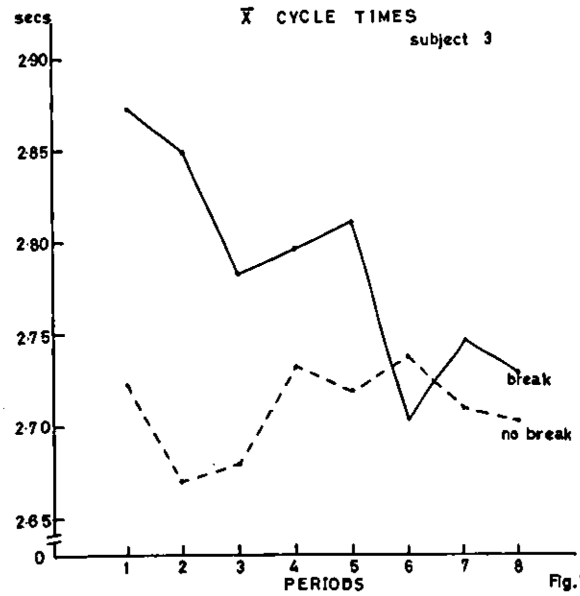


Fig. 112


Fig. 113

# APPENDIX III

Notes on the Tests given the Subjects in Preliminary Experiment and Copies of Score Sheets

# CONTENTS

## NOTES ON TESTS

The WAIS consists of eleven tests. Six are grouped into the Verbal Scale; the remaining five comprise the Performance Scale; all eleven tests are combined to make the full scale.

| Verbal Tests | Performance Tests |
|---|---|
| Information | Digit Symbol |
| Comprehension | Picture Completion |
| Arithmetic | Block Design |
| Similarities | Picture Arrangement |
| Digit Span | Object Assembly |
| Vocabulary | |

The WAIS Intelligent Quotient, whether based on verbal, performance or full scale is obtained from a direct comparison of the subjects' test results with those of persons in his chronological age group. Separate tables of I.Q. have been developed for ten different age groups. Thus the I.Q. assigned to a person in his twenties is based on a group of the same age; the fifty year olds I.Q. is similarly based on an older group.

The WAIS norms were based on groups considered representative of United States adults. (Some questions in the test are changed when testing British adults). Norms were developed for each of seven age groups ranging from 16 to 64 years. Equal numbers of men and women were included in each age group. Cases were assigned to geographic regions of the country in proportion to their populations. Cases were selected to give the proper urban-rural proportions for each age group. The sample included whites and non-whites in the ratios found in the 1950 census in the United States. Cases were selected from occupational categories in accordance with the incidence of these categories in the population. Five levels of education were distinguished according to the number of school years completed. Separate educational distributions were determined for each sex and for every age group. Every effort was therefore made to make the sample, on which the test norms are based, unbiased.

Eysenck Personality Inventory

The E.P.I. sets out to measure two major dimensions of personality, extroversion ("E") and neuroticism ("N"). It contains a Lie Scale ("L") which may be used to eliminate subjects showing "desirability response set" i.e. it is useful for detecting individuals "acting good".

Eysenck and Eysenck (1964) describe the typical extravert as being sociable, liking parties, craving excitement, being optimistic and not always reliable. They describe the typical introvert as being quiet, reserved, controlled and reliable. These descriptions are idealised end points of a continuum.

The number of subjects involved in the construction of the E.P.I. was in excess of 30,000 and included representative samples of the whole population as well as groups varying in age, class and sex. The retest reliabilities for different forms of the test are high, between 0.80 and 0.97.

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name SUBJECT 1.
Birth Date Feb 1st 1912 (MO. DAY YR.) Age 54 Sex F Marital: S (M) D W (CIRCLE ONE)
Nat. BRITISH Color White Tested by [illegible]
Place of Examination Loughborough University Date 15-7-66
Occupation Housewife Education 14 yrs R.S. Primary

| TABLE OF SCALED SCORE EQUIVALENTS* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

| SUMMARY | | |
|---|---|---|
| TEST | Raw Score | Scaled Score |
| Information | 15 | 10 |
| Comprehension | 25 | 17 |
| Arithmetic | 16 | 15 |
| Similarities | 10 | 8 |
| Digit Span | 12 | 11 |
| Vocabulary | 55 | 12 |
| Verbal Score | | 73 |
| Digit Symbol | 38 | 7 |
| Picture Completion | 14 | 10 |
| Block Design | 28 | 9 |
| Picture Arrangement | 22 | 9 |
| Object Assembly | 15 | 5 |
| Performance Score | | 40 |
| Total Score | | |

VERBAL SCORE 73 IQ 115
PERFORMANCE SCORE 40 IQ 99
FULL SCALE SCORE 113 IQ 108

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

| I. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 4 | 11. Height 5'7" | 0 | 21. Members of Parliament 200 | 0 |
| 2. Ball | | 12. Italy Milan | 0 | 22. Genesis Beginning of world. | 1 |
| 3. Months | | 13. Clothes [illegible] | 0 | 23. Temperature — | 0 |
| 4. Thermometer | | 14. Valentine's Day Feb 14th | 1 | 24. Iliad — | 0 |
| 5. Rubber Tree. | 1 | 15. Hamlet Sp | 1 | 25. Blood vessels — | 0 |
| 6. Prime Ministers 4 ✓ | 1 | 16. Vatican Home of Pope | 1 | 26. Koran — | 0 |
| 7. Longfellow Poet | 1 | 17. New York ,000 | 0 | 27. Faust — | 0 |
| 8. Weeks 52 | 1 | 18. Egypt — | 0 | 28. Ethnology | |
| 9. Gibraltar GB. | 1 | 19. Yeast Ferments | 1 | 29. Apocrypha | |
| 10. Brazil S.E. America | 1 | 20. Population 5 mil | 0 | | 15 |

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GR/7889/465/30T

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 4 |
| 2. Engine | | |
| 3. Envelope | Post | 2 |
| 4. Bad company | bad influence | 2 |
| 5. Cinema | Tell [illegible]. | 2 |
| 6. Taxes | Keep country [illegible] educational public services. | 2 |
| 7. Iron | do at right moment - opportunity | 2 |
| 8. Child employment | childs good - welfare of children. | 2 |
| 9. Forest | Sun. | 2 |
| 10. Deaf | Can't hear sound of voice | 2 |
| 11. Town land | value of income from it a cause of industrial [illegible] & [illegible] | 1 |
| 12. Marriage | recorded at somerset house - [illegible] | 2 |
| 13. Still waters | quiet person on the [illegible] see a different light | 1 |
| 14. Swallow | Just cause one little thing happens will ~~then expect all the happen~~ | 1 |
| | | 25 |

| 3. ARITHMETIC | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | 9/- | 10" | 0 1 |
| 4. 15" | 4/- | 0" | 0 1 |
| 5. 30" | 30/- | 1" | 0 1 |
| 6. 30" | 30 | 4" | 0 1 |
| ① 7. 30" | 6 | 4" | 0 1 |
| ⑧ 8 15" ~~8.~~9 30" | 1/4 | 4" | 0 1 |
| 10 ~~9.~~ 30" | 1010 | 6" | 0 1 |
| 11 ~~10.~~ 30" | 8/6 | 6" | 0 1 |
| 12 11. 60" | 600 | 4" | 0 1 1-10 2 |
| 12. 60" | | | 0 1 1-10 2 |
| 13. 60" | 45 | — | 0 1 1-15 2 |
| 14. 120" | 96 | 15" | 0 1 1-20 2 |
| | | | 16 |

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | skins | 1 |
| 2. Coat—Dress | clothes | 1 |
| 3. Axe—Saw | both used for cutting wood ~~hand~~ tools | 2 |
| 4. Dog—Lion | 4 legged animals. | 2 |
| 5. North—West | — | 0 |
| 6. Eye—Ear | three letter words. | 0 |
| 7. Air—Water | — | 0 |
| 8. Table—Chair | furniture | 2 |
| 9. Egg—Seed | both produced by something living in shell - [illegible] | 1 |
| 10. Poem—Statue | — | 0 |
| 11. Wood—Alcohol | — | 0 |
| 12. Praise—Punishment | both for something somebodys act in done | 1 |
| 13. Fly—Tree | — | 0 |
| | | 10 |

| 5. DIGIT SPAN | SCORE |
|---|---|
| **Digits Forward** | **Circle** |
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| **Digits Backward** | **Circle** |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 6 + B 6 = 12
Highest numbers circled

WAIS. Subject 1
1966

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 6 | |
| 2. Ship | | |
| 3. Penny | | |
| 4. Winter | 2 | last season of year – cold |
| 5. Repair | 2 | mend |
| 6. Breakfast | 2 | 1st meal |
| 7. Fabric | 2 | material |
| 8. Slice | 1 | portion of anything |
| 9. Assemble | 1 | get a no of people together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 2 | large very big |
| 12. Hasten | 2 | go quickly |
| 13. Sentence | 0 | paragraph of words – person time to serve [illegible] |
| 14. Regulate | 2 | space out – timing events to have coming |
| 15. Commence | 2 | begin |
| 16. Ponder | 2 | think wonder |
| 17. Cavern | 2 | cave |
| 18. Designate | 0 | — |
| 19. Domestic | 2 | person who does household work – of the kitchen etc |
| 20. Consume | 2 | eat |
| 21. Terminate | 2 | finish |
| 22. Obstruct | 2 | put in way |
| 23. Remorse | 2 | sorry for something one has done |
| 24. Sanctuary | 2 | place of safety |
| 25. Matchless | 1 | without goes with it – one on its own |
| 26. Reluctant | 2 | holds back, won't go etc |
| 27. Calamity | 1 | trouble – goes wrong |
| 28. Fortitude | 2 | strength – strong reliable |
| 29. Tranquil | 2 | peaceful |
| 30. Edifice | 0 | statue – monument |
| 31. Compassion | 2 | sorry for anyone |
| 32. Tangible | 0 | — |
| 33. Perimeter | 0 | inside |
| 34. Audacious | 0 | outspoken blunt |
| 35. Ominous | 1 | dark worrying |
| 36. Tirade | 0 | — |
| 37. Encumber | 2 | put on – loaded up with |
| 38. Plagiarize | 0 | — |
| 39. Impale | 0 | pinned in |
| 40. Travesty | 0 | — |
| | 55 | |

## 7. DIGIT SYMBOL

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| — | ⊥ | ⊐ | L | U | O | Λ | X | = |

SCORE: 38

SAMPLES

2 1 3 7 2 4 8 1 5 4 2 1 3 2 1 4 2 3 5 2 3 1 4 6 3

1 5 4 2 7 6 3 5 7 2 8 5 4 6 3 7 2 8 1 9 5 8 4 7 3

6 2 5 1 9 2 8 3 7 4 6 5 9 4 8 3 7 2 6 1 5 4 6 3 7

9 2 8 1 7 9 4 6 8 5 9 7 1 8 5 2 9 4 8 6 3 7 9 8 6

## 8. PICTURE COMPLETION

| | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Oar lock | 0 |
| 10. Pins or Lugs | 1 |
| 11. Flag | 0 |
| 12. Dog tracks | 1 |
| 13. Cornwall | 1 |
| 14. Stacks | 0 |
| 15. Leg | 1 |
| 16. Arm image | 0 |
| 17. Finger | 0 |
| 18. Shadow | 1 |
| 19. Stirrup | 1 |
| 20. Snow | 0 |
| 21. Eyebrow | 0 |
| | 14 |

## 9. BLOCK DESIGN

| | Time | SCORE |
|---|---|---|
| 1. 60" | 1: 10" 2: | 0 2 4 |
| 2. 60" | 1: 20" 2: | 0 2 4 |
| 3. 60" | 10" | 0 4 |
| 4. 60" | 10" | 0 4 |
| 5. 60" | 23" | 0 4 |
| 6. 60" | 26" | 0 4 |
| 7. 120" | 105" | 0 4 5 (31-40) 6 (1-30) |
| 8. 120" | — | 0 4 5 (46-70) 6 (1-45) |
| 9. 120" | — | 0 4 5 (61-80) 6 (1-60) |
| 10. 120" | — | 0 4 5 (61-80) 6 (1-60) |
| | | 26 |

## 10. PICTURE ARRANGEMENT

| | Order | Time | SCORE |
|---|---|---|---|
| 1. Nest 60" | 1: WXY 2: | 4" | 0 2 4 (WXY) |
| 2. House 60" | 1: PAT 2: | 6" | 0 2 4 (PAT) |
| 3. Hold up 60" | ABCD | 6" | 0 4 (ABCD) |
| 4. Louie 60" | ATOMIC | 43" | 0 4 (ATOMIC) |
| 5. Enter 60" | — | 80" | 0 4 (OPENS) |
| 6. Flirt 60" | AJNET | 60" | 0 2 (JNAET AJNET) 4 (JANET) |
| 7. Fish 120" | EFGHIJ | 60" | 0 2 (EGFHIJ) 4 5 (26-40) 6 (1-25) (EFGHIJ, EJFGHI) |
| 8. Taxi 120" | SALUEM | 47" | 0 2 (SALMUE) 4 5 (16-25) 6 (1-15) (SAMUEL, AMUELS) |

22

SCORE

## 11. OBJECT ASSEMBLY

15

| | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 17" | 0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10) |
| Profile | 120" | 120" | 0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25) |
| Hand | 180" | 180" | 0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30) |
| Elephant | 180" | 180 | 0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20) |

# WAIS RECORD FORM

**Wechsler Adult Intelligence Scale**

Name: Subject 2

Birth Date: 19th Feb 1914 (MO. DAY YR.) Age: 52 Sex: F Marital: S M D W (CIRCLE ONE)

Nat.: British Color: White Tested by: [illegible]

Place of Examination: Loughborough University Date: 19 July 66

Occupation: Housewife + subject for Exps. Education: to 14 yrs Primary

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

## SUMMARY

| TEST | Raw Score | Scaled Score | |
|---|---|---|---|
| Information | 7 | 6 | |
| Comprehension | 22 | 14 | |
| Arithmetic | 10 | 9 | |
| Similarities | 8 | 7 | |
| Digit Span | 9 | 7 | |
| Vocabulary | 43 | 10 | |
| Verbal Score | | 53 | |
| Digit Symbol | 44 | 8 | |
| Picture Completion | 11 | 8 | |
| Block Design | 28 | 9 | |
| Picture Arrangement | 18 | 8 | |
| Object Assembly | 23 | 7 | |
| Performance Score | | 40 | |
| Total Score | | | |

VERBAL SCORE 53 IQ 95

PERFORMANCE SCORE 40 IQ 99

FULL SCALE SCORE 93 IQ 96

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## I. INFORMATION

| I. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 4 | 11. Height 5'10" | 0 | 21. Members of Parliament | |
| 2. Ball | | 12. Italy Naples | 0 | 22. Genesis | |
| 3. Months | | 13. Clothes | — | 23. Temperature | |
| 4. Thermometer | | 14. Valentine's Day Feb 14 | | 24. Iliad | |
| 5. Rubber Tree | 1 | 15. Hamlet | | 25. Blood vessels | |
| 6. Prime Ministers L.G. B. Church Chamb | 1 | 16. Vatican | | 26. Koran | |
| 7. Longfellow Poet | 1 | 17. New York | | 27. Faust | |
| 8. Weeks 56 | 0 | 18. Egypt | | 28. Ethnology | |
| 9. Gibraltar — | 0 | 19. Yeast | | 29. Apocrypha | |
| 10. Brazil Spain | 0 | 20. Population | | | 7 |

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GR/7889/465/30T

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 2 |
| 2. Engine | | 2 |
| 3. Envelope | Post. | 2 |
| 4. Bad company | Bad influence. | 2 |
| 5. Cinema | Report it to manager etc. | 2 |
| 6. Taxes | Because the people work.— | 0 |
| 7. Iron | Do on the spot — a job you want to do. | 1 |
| 8. Child employment | Child at school shouldn't go to work — too young. Isn't fair to a child. | 1 |
| 9. Forest | Follow sun. | 2 |
| 10. Deaf | Can't hear - so can't talk. | 2 |
| 11. Town land | Industrial — more people at higher rates — borough. | 1 |
| 12. Marriage | to show married officially by law.— | 2 |
| 13. Still waters | quiet people take all in but don't say anything. — know/keep — listen — knowledge | 2 |
| 14. Swallow | — swallows to be expected in a big flight — discovers ... not just one | 1 |
| | | 22 |

| 3. ARITHMETIC | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | 9/- | 2" | 0 1 |
| 4. 15" | 4/- | 0" | 0 1 |
| 5. 30" | 30/- | 0" | 0 1 |
| 6. 30" | 30 | 5" | 0 1 |
| 7. 30" | 26 | 3" | 0 1 |
| 8. 30" | 7¼ | 25" | 0 1 |
| 9. 30" | 1/4 | 0" | 0 1 |
| 10. 30" | 10 sec | 30" | 0 1 |
| 11. 60" | 18/6 | 15" | 0 1 $^{1-10}$ 2 |
| 12. 60" | £3 20 | 8" | 0 1 $^{1-10}$ 2 |
| 13. 60" | — | 65" | 0 1 $^{1-15}$ 2 |
| 14. 120" | — | 125" | 0 1 $^{1-20}$ 2 |
| | | | 10 |

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | Fruit - grow on a tree | 1 |
| 2. Coat—Dress | Cover you - full length — | 1 |
| 3. Axe—Saw | both wooden handle — chop with axe saw — | 0 |
| 4. Dog—Lion | both got 4 legs & tail. | 1 |
| 5. North—West | directions. | 2 |
| 6. Eye—Ear | see with eyes - hear with ear. | 0 |
| 7. Air—Water | do with weather — air damp when it rains. | 0 |
| 8. Table—Chair | both wood got legs & usually made of — furniture | 2 |
| 9. Egg—Seed | chickens from eggs - things grow from seeds | 1 |
| 10. Poem—Statue | wording under statue — | 0 |
| 11. Wood—Alcohol | drink from wood. | 0 |
| 12. Praise—Punishment | - not alike — | 0 |
| 13. Fly—Tree | both flutter in air. | 0 |
| | | 8 |

| 5. DIGIT SPAN | SCORE |
|---|---|
| Digits Forward | Circle |
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| Digits Backward | Circle |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 5 + B 4 = 9
Highest numbers circled

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 6 | |
| 2. Ship | | |
| 3. Penny | | |
| 4. Winter | 2 | Cold snow when' ,, |
| 5. Repair | 2 | mend. |
| 6. Breakfast | 2 | first meal of day |
| 7. Fabric | 2 | material |
| 8. Slice | 1 | to cut from orange etc |
| 9. Assemble | 2 | gather together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 2 | very large |
| 12. Hasten | 2 | hurry |
| 13. Sentence | 1 | Sentence in letter - death sentence - write a sentence. |
| 14. Regulate | 2 | put right - regulate clock - cooking. |
| 15. Commence | 2 | begin |
| 16. Ponder | 1 | wonder - making up mind |
| 17. Cavern | 1 | in rocks - bldgs holes. - where - pot holes go |
| 18. Designate | 0 | — |
| 19. Domestic | 1 | to clean - be a domestic - washing up |
| 20. Consume | 0 | gather together |
| 21. Terminate | 2 | finish. |
| 22. Obstruct | 2 | get in way |
| 23. Remorse | 0 | sorry when lost someone |
| 24. Sanctuary | 2 | bird sanctuary - place where find peace |
| 25. Matchless | 1 | - can't match up - curtains. |
| 26. Reluctant | 1 | Reluctant to take - holding back. |
| 27. Calamity | 1 | when break pots |
| 28. Fortitude | 0 | — fortitude of sins. |
| 29. Tranquil | 1 | steady |
| 30. Edifice | 0 | — |
| 31. Compassion | 0 | art of bible |
| 32. Tangible | 0 | — |
| 33. Perimeter | 0 | area of something - top. - round a bldg etc |
| 34. Audacious | 1 | Cock sure — - |
| 35. Ominous | 0 | ominous clouds when very black. |
| 36. Tirade | 0 | — |
| 37. Encumber | 0 | — |
| 38. Plagiarize | 0 | — |
| 39. Impale | 1 | — an ancient can be impaled - stuck on something |
| 40. Travesty | 0 | — |
| | 43 | |

## 7. DIGIT SYMBOL

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| — | T | ⊐ | L | U | O | ∧ | X | = |

SCORE: 44

SAMPLES

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 3 | 7 | 2 | 4 | 8 | 1 | 5 | 4 | 2 | 1 | 3 | 2 | 1 | 4 | 2 | 3 | 5 | 2 | 3 | 1 | 4 | 6 | 3 |
| 1 | 5 | 4 | 2 | 7 | 6 | 3 | 5 | 7 | 2 | 8 | 5 | 4 | 6 | 3 | 7 | 2 | 8 | 1 | 9 | 5 | 8 | 4 | 7 | 3 |
| 6 | 2 | 5 | 1 | 9 | 2 | 8 | 3 | 7 | 4 | 6 | 5 | 9 | 4 | 8 | 3 | 7 | 2 | 6 | 1 | 5 | 4 | 6 | 3 | 7 |
| 9 | 2 | 8 | 1 | 7 | 9 | 4 | 6 | 8 | 5 | 9 | 7 | 1 | 8 | 5 | 2 | 9 | 4 | 8 | 6 | 3 | 7 | 9 | 8 | 6 |

## 8. PICTURE COMPLETION

| | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 0 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | 0 |
| 11. Flag | 1 |
| 12. Dog tracks | 0 |
| 13. Cornwall | 0 |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | 0 |
| 17. Finger | 0 |
| 18. Shadow | 0 |
| 19. Stirrup | 0 |
| 20. Snow | 0 |
| 21. Eyebrow | 0 |
| | 11 |

## 9. BLOCK DESIGN

| | Time | SCORE |
|---|---|---|
| 1. 60" | 1 20" / 2 | 0 2 4 |
| 2. 60" | 1 15" / 2 | 0 2 4 |
| 3. 60" | 12" | 0 4 |
| 4. 60" | 14" | 0 4 |
| 5. 60" | 18" | 0 4 |
| 6. 60" | 25" | 0 4 |
| 7. 120" | 150" | 0 4 5 (31-40) 6 (1-30) |
| 8. 120" | 130" x | 0 4 5 (46-70) 6 (1-45) |
| 9. 120" | 130 x | 0 4 5 (61-80) 6 (1-60) |
| 10. 120" | | 0 4 5 (61-80) 6 (1-60) |
| | | 28 |

## 10. PICTURE ARRANGEMENT

| | Order | Time | SCORE |
|---|---|---|---|
| 1. Nest 60" | 1 15" / 2 | WXY | 0 2 4 WXY |
| 2. House 60" | 1 PAT / 2 | 5" | 0 2 4 PAT |
| 3. Hold up 60" | ABCJ | 10" | 0 4 ABCD |
| 4. Louie 60" | IAOMTC | 60" | 0 4 ATOMIC |
| 5. Enter 60" | OPENS | 45" | 0 4 OPENS |
| 6. Flirt 60" | JNAET | 43" | 0 2 JNAET 4 JANET AJNET |
| 7. Fish 120" | IEFGHJ | 48" | 0 2 EGFHIJ 4 5 (28-40) 6 (1-28) EFGHIJ EJFGHI |
| 8. Taxi 120" | ASLMUE | 85" | 0 2 SALMUE 4 5 (16-25) 6 (1-15) SAMUEL AMUELS |
| | | | 18 |

## 11. OBJECT ASSEMBLY

SCORE: 23

| | Time | SCORE |
|---|---|---|
| Manikin 120" | 15" | 0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10) |
| Profile 120" | 50" | 0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25) |
| Hand 180" | 110" | 0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30) |
| Elephant 180" | — | 0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20) |

WAIS. Subject 2
1966

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name SUBJECT 3

Birth Date 25th Mar 1926 (MO. DAY YR.) Age 40 Sex F Marital: S (M) D W (CIRCLE ONE)

Nat. British Color White Tested by [illegible]

Place of Examination Loughborough University Date 20 July

Occupation Book binder. Housewife Education 15 yrs. Primary School Evening Class Typing + [illegible]

| TABLE OF SCALED SCORE EQUIVALENTS* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

| SUMMARY | | | |
|---|---|---|---|
| TEST | Raw Score | Scaled Score | |
| Information | 15 | 10 | |
| Comprehension | 24 | 16 | |
| Arithmetic | 12 | 11 | |
| Similarities | 13 | 10 | |
| Digit Span | 13 | 12 | |
| Vocabulary | 52 | 11 | |
| Verbal Score | | 70 | |
| Digit Symbol | 46 | 8 | |
| Picture Completion | 12 | 9 | |
| Block Design | 28 | 9 | |
| Picture Arrangement | 18 | 8 | |
| Object Assembly | 28 | 9 | |
| Performance Score | | 43 | |
| Total Score | | | |

VERBAL SCORE 70 IQ 110

PERFORMANCE SCORE 43 IQ 96

FULL SCALE SCORE 113 IQ 104

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

| I. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 4 | 11. Height 5'7" | 0 | 21. Members of Parliament 40 | 0 |
| 2. Ball | | 12. Italy Rome | 1 | 22. Genesis — | 0 |
| 3. Months | | 13. Clothes air – | 0 | 23. Temperature 100 F | 0 |
| 4. Thermometer | | 14. Valentine's Day 14th Feb | 1 | 24. Iliad — | 0 |
| 5. Rubber Trees | 1 | 15. Hamlet Sp. | 1 | 25. Blood vessels | |
| 6. Prime Ministers 4 | 1 | 16. Vatican Pope lives | 1 | 26. Koran | |
| 7. Longfellow Poet | 1 | 17. New York 3000 | 1 | 27. Faust | |
| 8. Weeks 52 | 1 | 18. Egypt [illegible] | 0 | 28. Ethnology | |
| 9. Gibraltar E. | 0 | 19. Yeast [illegible] | 1 | 29. Apocrypha | |
| 10. Brazil S. Am. | 1 | 20. Population 20 mil | 0 | | 15 |

OBSERVATIONS:

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GR/7889/465/30T

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 4 |
| 2. Engine | | |
| 3. Envelope | Post. | 2 |
| 4. Bad company | Bad influence. | 2 |
| 5. Cinema | Report to mgr. Don't Panic | 2 |
| 6. Taxes | help run country schools universities public bldgs. health & welfare | 2 |
| 7. Iron | Take chance while got it — opportunity | 2 |
| 8. Child employment | overworked & child protection education | 2 |
| 9. Forest | Compass. Breeze. ... host light. | 0 |
| 10. Deaf | can't hear ... | 2 |
| 11. Town land | facilities transport dens | 0 |
| 12. Marriage | ... Records. ... | 2 |
| 13. Still waters | Quiet persons not nec quiet ... | 2 |
| 14. Swallow | must have time to find out about things people — not judge immediately. | 2 |
| | | 24 |

| 3. ARITHMETIC | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | 9/- | 2" | 0 1 |
| 4. 15" | 4/- | 1" | 0 1 |
| 5. 30" | 20/- | 1" | 0 1 |
| 6. 30" | 36 | 3" | 0 1 |
| 7. 30" | 6 | 25" | 0 1 |
| 8. 30" | 8 | 3" | 0 1 |
| 9. 30" | 1/4 | 0" | 0 1 |
| 10. 30" | 40/4 | 1" | 0 1 |
| 11. 60" | 37/ | 10" | 0 1 1-10 2 |
| 12. 60" | ... | 4" | 0 1 1-10 2 |
| 13. 60" | /10 | 55" | 0 1 1-15 2 |
| 14. 120" | 1 | 22" | 0 1 1-20 2 |
| | | | 12 |

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | peeled | 1 |
| 2. Coat—Dress | clothing. | 2 |
| 3. Axe—Saw | tools | 2 |
| 4. Dog—Lion | animals | 2 |
| 5. North—West | directions | 2 |
| 6. Eye—Ear | part of body help make contact with people & things | 1 |
| 7. Air—Water | have oxygen — needed for life. | 1 |
| 8. Table—Chair | furniture | 2 |
| 9. Egg—Seed | plant for seed — chicken from egg. | 0 |
| 10. Poem—Statue | — | 0 |
| 11. Wood—Alcohol | made from same things | 0 |
| 12. Praise—Punishment | — | 0 |
| 13. Fly—Tree | both need air not human outdoor things | 0 |
| | | 13 |

| 5. DIGIT SPAN | SCORE |
|---|---|
| Digits Forward | Circle |
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| Digits Backward | Circle |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 8 + B 5 = 13
Highest numbers circled

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | | |
| 2. Ship | 6 | |
| 3. Penny | | |
| 4. Winter | 2 | Cold season |
| 5. Repair | 2 | mend |
| 6. Breakfast | 2 | 1st meal of day |
| 7. Fabric | 2 | material |
| 8. Slice | 1 | to cut piece of |
| 9. Assemble | 2 | put together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 2 | huge big |
| 12. Hasten | 2 | hurry |
| 13. Sentence | 0 | part of talking. part of paragraph. |
| 14. Regulate | 2 | keeping even - not taking or too [illegible] part or the [illegible] |
| 15. Commence | 2 | begin |
| 16. Ponder | 2 | think - [illegible] |
| 17. Cavern | 2 | cave |
| 18. Designate | 0 | — |
| 19. Domestic | 2 | house(work) included - kitchens — |
| 20. Consume | 2 | eat |
| 21. Terminate | 2 | to end |
| 22. Obstruct | 2 | put in way of block |
| 23. Remorse | 2 | feel - sorry for something you've hurt someone [illegible] |
| 24. Sanctuary | 2 | place of peace & quiet |
| 25. Matchless | 2 | nothing to compare with - different - quality |
| 26. Reluctant | 2 | don't want to - rather not |
| 27. Calamity | 0 | like weekly [illegible] not [illegible] up for [illegible] |
| 28. Fortitude | 0 | safety |
| 29. Tranquil | 2 | peaceful |
| 30. Edifice | 0 | food - |
| 31. Compassion | 1 | feeling for people in trouble or accident |
| 32. Tangible | 1 | ~~something you can feel~~ |
| 33. Perimeter | 0 | — |
| 34. Audacious | 1 | Someone with lot of courage - [illegible] not timid |
| 35. Ominous | 0 | — |
| 36. Tirade | 0 | — |
| 37. Encumber | 0 | — |
| 38. Plagiarize | 0 | — |
| 39. Impale | 0 | — |
| 40. Travesty | | - |
| | 52 | |

7. DIGIT SYMBOL

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|

SCORE 46

SAMPLES

| 8. PICTURE COMPLETION | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 0 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 0 |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | 0 |
| 11. Flag | 0 |
| 12. Dog tracks | 0 |
| 13. Cornwall | 0 |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | 1 |
| 17. Finger | 1 |
| 18. Shadow | 0 |
| 19. Stirrup | 1 |
| 20. Snow | 0 |
| 21. Eyebrow | 0 |
| | 12 |

| 9. BLOCK DESIGN | Time | SCORE |
|---|---|---|
| 1. 60" | 1 5" / 2 | 0 2 4 |
| 2. 60" | 1 45" / 2 | 0 2 4 |
| 3. 60" | 8" | 0 4 |
| 4. 60" | 10" | 0 4 |
| 5. 60" | 8" | 0 4 |
| 6. 60" | 10" | 0 4 |
| 7. 120" | 50" | 0 4 5 (31-40) 6 (1-30) |
| 8. 120" | 125" | 0 4 5 (46-70) 6 (1-45) |
| 9. 120" | — | 0 4 5 (61-80) 6 (1-60) |
| 10. 120" | — | 0 4 5 (61-80) 6 (1-60) |
| | | 26 |

| 10. PICTURE ARRANGEMENT | | Order | Time | SCORE |
|---|---|---|---|---|
| 1. Nest | 60" | 1 WXY / 2 | 5" | 0 2 4 (WXY) |
| 2. House | 60" | 1 PAT / 2 | 8" | 0 2 4 (PAT) |
| 3. Hold up | 60" | ABCD | 12" | 0 4 (ABCD) |
| 4. Louie | 60" | ATOMIC | 20" | 0 4 (ATOMIC) |
| 5. Enter | 60" | DPESN | 60" | 0 4 (OPEKS) |
| 6. Flirt | 60" | ANEJT | 45" | 0 2 (JNAET AJNET) 4 (JANET) |
| 7. Fish | 120" | EGFHIJ | 75" | 0 2 (EGFHIJ) 4 5 6 (EFGHIJ EJFGHI) |
| 8. Taxi | 120" | ALMEUS | 75" | 0 2 (SALMUE) 4 5 6 (SAMUEL AMUELS) (16-25) (1-15) |
| | | | | 18 |

SCORE 26

| 11. OBJECT ASSEMBLY | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 18" | 0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10) |
| Profile | 120" | 120" | 0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25) |
| Hand | 180" | 105" | 0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30) |
| Elephant | 180" | 125" | 0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20) |

WAIS. Subject 3
1966

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name: SUBJECT 4
Birth Date: 20th Nov 1944 (MO. DAY YR.) Age: 22 Sex: F Marital: S M D W (CIRCLE ONE)
Nat.: BRITISH Color: WHITE Tested by: DMH
Place of Examination: Loughborough University Date: July 1966
Occupation: STUDENT Education: UNIVERSITY

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## SUMMARY

| TEST | Raw Score | Scaled Score |
|---|---|---|
| Information | 23 | 14 |
| Comprehension | 25 | 17 |
| Arithmetic | 11 | 10 |
| Similarities | 20 | 13 |
| Digit Span | 15 | 15 |
| Vocabulary | 72 | 16 |
| Verbal Score | | 85 |
| Digit Symbol | 72 | 15 |
| Picture Completion | 18 | 13 |
| Block Design | 42 | 13 |
| Picture Arrangement | 18 | 8 |
| Object Assembly | 38 | 13 |
| Performance Score | | 62 |
| Total Score | | 147 |

VERBAL SCORE 85 IQ 125
PERFORMANCE SCORE 62 IQ 115
FULL SCALE SCORE 147 IQ 122

## I. INFORMATION

| I. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 4 | 11. Height | 1 | 21. Members of Parliament | 1 |
| 2. Ball | | 12. Italy | 1 | 22. Genesis | 1 |
| 3. Months | | 13. Clothes | 1 | 23. Temperature | 1 |
| 4. Thermometer | | 14. Valentine's Day | 1 | 24. Iliad | 1 |
| 5. Rubber | 1 | 15. Hamlet | 1 | 25. Blood vessels | 0 |
| 6. Prime Ministers | 1 | 16. Vatican | 1 | 26. Koran | 1 |
| 7. Longfellow | 1 | 17. New York | 0 | 27. Faust | 1 |
| 8. Weeks | 1 | 18. Egypt | 0 | 28. Ethnology | 1 |
| 9. Gibraltar | 1 | 19. Yeast | 0 | 29. Apocrypha | 0 |
| 10. Brazil | 1 | 20. Population | 0 | | 23 |

OBSERVATIONS:

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GR/7889/465/30T

## 2. COMPREHENSION

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | Clean | 2 |
| 2. Engine | pull | 2 |
| 3. Envelope | Post | 2 |
| 4. Bad company | Bad influence on self | 2 |
| 5. Cinema | Rush to stage & give warning adding 'dont Panic" | 0 |
| 6. Taxes | Public Benefit - Schools Health | 2 |
| 7. Iron | Dont miss opportunity | 2 |
| 8. Child employment | Health + Good of Children | 2 |
| 9. Forest | Direction from Sun - Climb tree | 2 |
| 10. Deaf | Need to hear sounds to imitate them | 2 |
| 11. Town land | Shortage of land. Better Services | 2 |
| 12. Marriage | For children not illegitimate. Taxes recognized legal Procedure | 2 |
| 13. Still waters | Opposite appearance - e.g. seemingly quiet people may have great depts. + sharp people be shallow | 2 |
| 14. Swallow | cf. 'dont count chickens' etc" one sign of happiness doesn't mean happy for ever | 1 |
| | | 25 |

## 3. ARITHMETIC

| | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | 9/- | 2" | 0 1 |
| 4. 15" | 4/- | 0 | 0 1 |
| 5. 30" | 30 | 0 | 0 1 |
| 6. 30" | 30 | 5" | 0 1 |
| 7. 30" | 6 | 0 | 0 1 |
| 8. 30" | 8 | 14" | 0 1 |
| 9. 30" | 1/4 | 0 | 0 1 |
| 10. 30" | £102 | 30" | 0 1 |
| 11. 60" | 18/6 | 5" | 0 1 1-10 2 |
| 12. 60" | £350 | 35" | 0 1 1-10 2 |
| 13. 60" | £45 | 25" | 0 1 1-15 2 |
| 14. 120" | - | - | 0 1 1-20 2 |
| | | | 11 |

## 4. SIMILARITIES

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | Both have skins. Fruits | 2 |
| 2. Coat—Dress | Clothes - Material - Man made | 2 |
| 3. Axe—Saw | Man made Tools - Both of metal | 2 |
| 4. Dog—Lion | Animals - 4 legs & tails | 2 |
| 5. North—West | Points of Compass | 2 |
| 6. Eye—Ear | Parts of Body - to do with senses | 2 |
| 7. Air—Water | Parts of Earth - chemical | 0 |
| 8. Table—Chair | Made of wood - man made | 0 |
| 9. Egg—Seed | Fruits - Both grow up & develop | 1 |
| 10. Poem—Statue | Man made - both produced by Artists - Both can be to memory of a Person | 2 |
| 11. Wood—Alcohol | Same chemical Properties - Both Burn | 2 |
| 12. Praise—Punishment | Both inflicted by man on man ~~influence people to do things~~ | 2 |
| 13. Fly—Tree | Both grow. Both on earth. Both feed on products of Earth. | 1 |
| | | 20 |

## 5. DIGIT SPAN

| Digits Forward | Circle |
|---|---|
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| **Digits Backward** | **Circle** |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 7 + B 8 = 15
Highest numbers circled

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 6 | |
| 2. Ship | | |
| 3. Penny | | |
| 4. Winter | 2 | Season :- nso-7a |
| 5. Repair | 2 | mend - fix |
| 6. Breakfast | 2 | morning meal |
| 7. Fabric | 2 | material - man made |
| 8. Slice | 2 | Cut thin wedge |
| 9. Assemble | 2 | gather together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 2 | very large - great |
| 12. Hasten | 2 | Hurry |
| 13. Sentence | 2 | Grammatical Structure - varying subject matter |
| 14. Regulate | 2 | measure out - temper - en small[illegible] |
| 15. Commence | 2 | Start |
| 16. Ponder | 2 | Think meditate |
| 17. Cavern | 2 | Cave |
| 18. Designate | 1 | Give a person a special job. Allot something to someone |
| 19. Domestic | 2 | of the home |
| 20. Consume | 2 | Eat - Devour - |
| 21. Terminate | 2 | End - Cause to end. |
| 22. Obstruct | 2 | Place obstacle in way - impede |
| 23. Remorse | 2 | Regret grief, sorrow for something done or said |
| 24. Sanctuary | 2 | Place in churches where criminals went for protection |
| 25. Matchless | 1 | Unlike any other thing or object |
| 26. Reluctant | 2 | Unwilling |
| 27. Calamity | 2 | Disaster |
| 28. Fortitude | 2 | Strength of mind + will in face of severe cares |
| 29. Tranquil | 2 | Calm, peaceful, restful |
| 30. Edifice | 0 | Esth. for respect - holy |
| 31. Compassion | 2 | main emotion of sympathy |
| 32. Tangible | 2 | within reach - able to be touched |
| 33. Perimeter | 2 | Encircles something |
| 34. Audacious | 2 | Bold Daring |
| 35. Ominous | 2 | Threatening - Something to be feared |
| 36. Tirade | 2 | Express feelings of extreme anger against someone or something |
| 37. Encumber | 2 | Impede with too much luggage. - Burden |
| 38. Plagiarize | 0 | Torment - Tease |
| 39. Impale | 2 | Pierce - Stick someone |
| 40. Travesty | 0 | Pardon - Forgive |
| | 72 | |

7. DIGIT SYMBOL

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| — | T | ⊏ | L | ∩ | O | V | X | = |

SCORE 72

SAMPLES

## 8. PICTURE COMPLETION

| | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | 1 |
| 11. Flag | 1 |
| 12. Dog tracks | 1 |
| 13. Cornwall | 0 |
| 14. Stacks | 0 |
| 15. Leg | 1 |
| 16. Arm image | 0 |
| 17. Finger | 1 |
| 18. Shadow | 1 |
| 19. Stirrup | 1 |
| 20. Snow | 1 |
| 21. Eyebrow | 1 |
| | 18 |

## 9. BLOCK DESIGN

| | Time | SCORE |
|---|---|---|
| 1. 60" | 1: 5" 2: | 0 2 4 |
| 2. 60" | 1: 4" 2: | 0 2 4 |
| 3. 60" | 10" | 0 4 |
| 4. 60" | 5" | 0 4 |
| 5. 60" | 5" | 0 4 |
| 6. 60" | 10" | 0 4 |
| 7. 120" | 20" | 0 4 5 (31-40) 6 (1-30) |
| 8. 120" | 40" | 0 4 5 (46-70) 6 (1-45) |
| 9. 120" | 51" | 0 4 5 (61-90) 6 (1-60) |
| 10. 120" | | 0 4 5 (61-90) 6 (1-60) |
| | | 42 |

## 10. PICTURE ARRANGEMENT

| | Order | Time | SCORE |
|---|---|---|---|
| 1. Nest 60" | 1: WXY 2: | 3" | 0 2 4 WXY |
| 2. House 60" | 1: PAT 2: | 4" | 0 2 4 PAT |
| 3. Hold up 60" | ABCD | 4" | 0 4 ABCD |
| 4. Louie 60" | CATIOM | 32" | 0 4 ATOMIC |
| 5. Enter 60" | OPENS | 60" | 0 4 OPENS |
| 6. Flirt 60" | AJNET | 20" | 0 2 (JNAET AJNET) 4 JANET |
| 7. Fish 120" | GEFHIJ | 30" | 0 2 (EGFHIJ) 4 5 (26-40) 6 (1-25) EFGHIJ EJFGHI |
| 8. Taxi 120" | ALMEKS | 39" | 0 2 (SALMUE) 4 5 (16-25) 6 (1-15) SAMUEL AMUELS |
| | | | 18 |

SCORE

## 11. OBJECT ASSEMBLY

38

| | Time | SCORE |
|---|---|---|
| Manikin 120" | 10" | 0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10) |
| Profile 120" | 52" | 0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25) |
| Hand 180" | 20" | 0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30) |
| Elephant 180" | 17" | 0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20) |

WAIS. Subject 4
1966

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME.. SUBJECT 1 ..... AGE....54......

OCCUPATION...HOUSEWIFE........... SEX...FEMALE

N= 13 E= 12 L= 1

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E 12 N 13 L 1

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | ✓ | |
| 2. | Have you often got a restless feeling that you want something but do not know what? | ✓ | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | | ✓ |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | ✓ | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | ✓ | |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | ✓ |
| 7. | Do you sometimes sulk? | | ✓ |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | ✓ | |
| 9. | Are you moody? | | ✓ |
| 10. | Do you like mixing with people? | | ✓ |
| 11. | Have you often lost sleep over your worries? | ✓ | |
| 12. | Do you sometimes get cross? | ✓ | |
| 13. | Would you call yourself happy-go-lucky? | ✓ | |
| 14. | Do you often make up your mind too late? | ✓ | |
| 15. | Do you like working alone? | | ✓ |
| 16. | Have you often felt listless and tired for no good reason? | | ✓ |
| 17. | Are you rather lively? | ✓ | |
| 18. | Do you sometimes laugh at a dirty joke? | ✓ | |
| 19. | Do you often feel "fed-up"? | | ✓ |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | ✓ |
| 21. | Does your mind often wander when you are trying to attend closely to something? | ✓ | |
| 22. | Can you put your thoughts into words quickly? | | ✓ |
| 23. | Are you often "lost in thought"? | ✓ | |
| 24. | Are you completely free from prejudices of any kind? | | ✓ |
| 25. | Do you like practical jokes? | | ✓ |
| 26. | Do you often think of your past? | ✓ | |
| 27. | Do you very much like good food? | ✓ | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | ✓ | |
| 29. | Do you mind selling things or asking people for money for some good cause? | ✓ | |
| 30. | Do you sometimes boast a little? | | ✓ |
| 31. | Are you touchy about some things? | ✓ | |
| 32. | Would you rather be at home on your own than go to a boring party? | ✓ | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | ✓ | |
| 34. | Do you like planning things carefully, well ahead of time? | ✓ | |
| 35. | Do you have dizzy turns? | | ✓ |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | ✓ |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | ✓ | |
| 38. | Do you ever get short of breath without having done heavy work? | | ✓ |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | ✓ | |
| 40. | Do you suffer from "nerves"? | | ✓ |
| 41. | Would you rather plan things than do things? | | ✓ |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | ✓ | |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | ✓ |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | ✓ |
| 45. | Do you get very bad headaches? | | ✓ |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | ✓ | |
| 47. | Do you find it hard to fall asleep at bedtime? | | ✓ |
| 48. | Have you sometimes told lies in your life? | ✓ | |
| 49. | Do you sometimes say the first thing that comes into your head? | ✓ | |
| 50. | Do you worry too long after an embarrassing experience? | | ✓ |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | ✓ | |
| 52. | Do you often get into a jam because you do things without thinking? | ✓ | |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | | ✓ |
| 54. | Would you rather win than lose a game? | ✓ | |
| 55. | Do you often feel self-conscious when you are with superiors? | ✓ | |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | ✓ | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | ✓ | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME...... SUBJECT 2 .......... AGE.....52.....

OCCUPATION.....Housewife..................... SEX.....f.........

N= 11 E= 17 L= 0

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E 17 N 11 L 0

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | | ✓ |
| 2. | Have you often got a restless feeling that you want something but do not know what? | ✓ | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | ✓ | |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | ✓ | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | | ✓ |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | ✓ |
| 7. | Do you sometimes sulk? | | ✓ |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | ✓ | |
| 9. | Are you moody? | | ✓ |
| 10. | Do you like mixing with people? | ✓ | |
| 11. | Have you often lost sleep over your worries? | ✓ | |
| 12. | Do you sometimes get cross? | ✓ | |
| 13. | Would you call yourself happy-go-lucky? | ✓ | |
| 14. | Do you often make up your mind too late? | ✓ | |
| 15. | Do you like working alone? | ✓ | |
| 16. | Have you often felt listless and tired for no good reason? | ✓ | |
| 17. | Are you rather lively? | ✓ | |
| 18. | Do you sometimes laugh at a dirty joke? | ✓ | |
| 19. | Do you often feel "fed-up"? | | ✓ |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | ✓ |
| 21. | Does your mind often wander when you are trying to attend closely to something? | | ✓ |
| 22. | Can you put your thoughts into words quickly? | ✓ | |
| 23. | Are you often "lost in thought"? | ✓ | |
| 24. | Are you completely free from prejudices of any kind? | | ✓ |
| 25. | Do you like practical jokes? | ✓ | |
| 26. | Do you often think of your past? | ✓ | |
| 27. | Do you very much like good food? | ✓ | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | ✓ | |
| 29. | Do you mind selling things or asking people for money for some good cause? | | ✓ |
| 30. | Do you sometimes boast a little? | ✓ | |
| 31. | Are you touchy about some things? | ✓ | |
| 32. | Would you rather be at home on your own than go to a boring party? | ✓ | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | | ✓ |
| 34. | Do you like planning things carefully, well ahead of time? | ✓ | |
| 35. | Do you have dizzy turns? | ✓ | |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | ✓ |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | ✓ | |
| 38. | Do you ever get short of breath without having done heavy work? | | ✓ |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | ✓ | |
| 40. | Do you suffer from "nerves"? | | ✓ |
| 41. | Would you rather plan things than do things? | | ✓ |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | ✓ | |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | ✓ |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | ✓ |
| 45. | Do you get very bad headaches? | | ✓ |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | ✓ | |
| 47. | Do you find it hard to fall asleep at bedtime? | | ✓ |
| 48. | Have you sometimes told lies in your life? | ✓ | |
| 49. | Do you sometimes say the first thing that comes into your head? | ✓ | |
| 50. | Do you worry too long after an embarrassing experience? | | ✓ |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | ✓ | |
| 52. | Do you often get into a jam because you do things without thinking? | | ✓ |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | ✓ | |
| 54. | Would you rather win than lose a game? | ✓ | |
| 55. | Do you often feel self-conscious when you are with superiors? | | ✓ |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | ✓ | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | ✓ | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME.. SUBJECT 3 .7.. AGE...4.0......

OCCUPATION..BOOKBINDER | HOUSEWIFE SEX..FEMALE.

N= 14 E= 12 L= 2

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E 12 N 14 L 2

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | | X |
| 2. | Have you often got a restless feeling that you want something but do not know what? | X | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | X | |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | X | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | | X |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | X |
| 7. | Do you sometimes sulk? | | X |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | | X |
| 9. | Are you moody? | | X |
| 10. | Do you like mixing with people? | | X |
| 11. | Have you often lost sleep over your worries? | X | |
| 12. | Do you sometimes get cross? | X | |
| 13. | Would you call yourself happy-go-lucky? | | X |
| 14. | Do you often make up your mind too late? | X | |
| 15. | Do you like working alone? | X | |
| 16. | Have you often felt listless and tired for no good reason? | X | |
| 17. | Are you rather lively? | X | |
| 18. | Do you sometimes laugh at a dirty joke? | X | |
| 19. | Do you often feel "fed-up"? | | X |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | X |
| 21. | Does your mind often wander when you are trying to attend closely to something? | | X |
| 22. | Can you put your thoughts into words quickly? | X | |
| 23. | Are you often "lost in thought"? | X | |
| 24. | Are you completely free from prejudices of any kind? | | X |
| 25. | Do you like practical jokes? | | X |
| 26. | Do you often think of your past? | X | |
| 27. | Do you very much like good food? | X | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | X | |
| 29. | Do you mind selling things or asking people for money for some good cause? | X | |
| 30. | Do you sometimes boast a little? | X | |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | X | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | | X |
| 34. | Do you like planning things carefully, well ahead of time? | X | |
| 35. | Do you have dizzy turns? | | X |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | | X |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | X | |
| 40. | Do you suffer from "nerves"? | X | |
| 41. | Would you rather plan things than do things? | | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | | X |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | X |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | X |
| 45. | Do you get very bad headaches? | X | |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | X | |
| 47. | Do you find it hard to fall asleep at bedtime? | | X |
| 48. | Have you sometimes told lies in your life? | X | |
| 49. | Do you sometimes say the first thing that comes into your head? | X | |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | X | |
| 52. | Do you often get into a jam because you do things without thinking? | X | |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | | X |
| 54. | Would you rather win than lose a game? | | X |
| 55. | Do you often feel self-conscious when you are with superiors? | | X |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME........SUBJECT 4............ AGE...21........

OCCUPATION....Student.................. SEX....FEMALE

N= 17 E= 20 L= 0

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

UNIVERSITY OF LONDON PRESS LTD
Warwick Lane, London E.C.4

E 20 N 17 L 0

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | X | |
| 2. | Have you often got a restless feeling that you want something but do not know what? | X | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | | X |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | X | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | | X |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | X |
| 7. | Do you sometimes sulk? | X | |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | X | |
| 9. | Are you moody? | X | |
| 10. | Do you like mixing with people? | X | |
| 11. | Have you often lost sleep over your worries? | X | |
| 12. | Do you sometimes get cross? | X | |
| 13. | Would you call yourself happy-go-lucky? | X | |
| 14. | Do you often make up your mind too late? | X | |
| 15. | Do you like working alone? | | X |
| 16. | Have you often felt listless and tired for no good reason? | | X |
| 17. | Are you rather lively? | X | |
| 18. | Do you sometimes laugh at a dirty joke? | X | |
| 19. | Do you often feel "fed-up"? | | X |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | X |
| 21. | Does your mind often wander when you are trying to attend closely to something? | X | |
| 22. | Can you put your thoughts into words quickly? | X | |
| 23. | Are you often "lost in thought"? | X | |
| 24. | Are you completely free from prejudices of any kind? | | X |
| 25. | Do you like practical jokes? | | X |
| 26. | Do you often think of your past? | X | |
| 27. | Do you very much like good food? | X | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | X | |
| 29. | Do you mind selling things or asking people for money for some good cause? | | X |
| 30. | Do you sometimes boast a little? | X | |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | | X |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | X | |
| 34. | Do you like planning things carefully, well ahead of time? | X | |
| 35. | Do you have dizzy turns? | | X |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | X | |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | X | |
| 40. | Do you suffer from "nerves"? | | X |
| 41. | Would you rather plan things than do things? | | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | X | |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | X | |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | X | |
| 45. | Do you get very bad headaches? | | X |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | X | |
| 47. | Do you find it hard to fall asleep at bedtime? | | X |
| 48. | Have you sometimes told lies in your life? | X | |
| 49. | Do you sometimes say the first thing that comes into your head? | X | |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | | X |
| 52. | Do you often get into a jam because you do things without thinking? | X | |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | X | |
| 54. | Would you rather win than lose a game? | X | |
| 55. | Do you often feel self-conscious when you are with superiors? | X | |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

## APPENDIX IV

Notes on Tests given the Subjects in Main Experiment and Copies of Score Sheets

# CONTENTS

# NOTES ON TESTS

## "The 16 P.F. Test"

This test sets out to measure sixteen personality factors or "source traits" as follows:-

A. Cyclothymia versus Schizothymia

B. General Intelligence versus Mental Defect

C. Emotional Stability versus Dissatisfied Emotionality

E. Dominance versus Submission

F. Surgency versus Desurgency

G. Super-ego Strength versus Lack of rigid internal standards

H. Parmia, Adventurous versus Threctia, Shy

I. Premsia, Sensitive versus Harria, Tough

L. Protension (Paranoid Tendency) versus Relaxed Security

M. Autia, Bohemian Introverted versus Praxernia, Practical

N. Shrewdness versus Naivete

O. Guilt Proneness versus Confident Adequacy

Q1. Radicalism versus Conservatism

Q2. Self Sufficiency versus Group Dependency

Q3. High Self Sentiment (Controlled) versus Poor Self Sentiment (Lax)

Q4. High Ergic Tension versus Low Ergic Tension

The test has been standardized on a variety of groups and the question responses are treated as behaviour and not as valid self ratings.

Stromberg Dexterity Test

This test was developed as an aid in choosing workers for jobs which require speed and accuracy of arm and hand movement.

The SDT requires that a subject pick up a certain block, note its colour, move it to a specified position and so on through fifty four blocks. The Test has been used with laundry workers, punch press applicants, welders, general factory workers and others. The more rapidly a subject completes the test, the better is his performance.

The reliability coefficients of the test were found to be 0.84, 0.87 and 0.90 for different groups.

It is necessary for the user of the test to develop job or plant norms. When this was done data was collected which showed a tendency for workers with better SDT scores to earn higher wages. Data is still being collected with the aim of establishing stable general norms. The present norms for several industrial groups are based on numbers ranging from thirty one to eighty subjects per group.

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name: Subject 1

Birth Date: Jun 7th 1908 (MO. DAY YR.) Age: 59 Sex: F Marital: S (M) D W (CIRCLE ONE)

Nat.: British Color: White Tested by: Zmh

Place of Examination: Loughborough University Date: Nov 1967

Occupation: HOUSEWIFE Education: Primary to 14 yrs + Some night school.

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## SUMMARY

| TEST | Raw Score | Scaled Score |
|---|---|---|
| Information | 17 | 11 |
| Comprehension | 21 | 13 |
| Arithmetic | 11 | 10 |
| Similarities | 17 | 12 |
| Digit Span | 11 | 10 |
| Vocabulary | 63 | 14 |
| Verbal Score | | 70 |
| Digit Symbol | 29 | 6 |
| Picture Completion | 13 | 9 |
| Block Design | 34 | 10 |
| Picture Arrangement | 20 | 9 |
| Object Assembly | 29 | 9 |
| Performance Score | | 43 |
| Total Score | | |

VERBAL SCORE 70 IQ 114

PERFORMANCE SCORE 43 IQ 108

FULL SCALE SCORE 113 IQ 112

## 1. INFORMATION

| 1. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 1 | 11. Height | 1 | 21. Members of Parliament | – |
| 2. Ball | 1 | 12. Italy | 1 | 22. Genesis | 1 |
| 3. Months | 1 | 13. Clothes | – | 23. Temperature | – |
| 4. Thermometer | 1 | 14. Valentine's Day | – | 24. Iliad | – |
| 5. Rubber | 1 | 15. Hamlet | – | 25. Blood vessels | 1 |
| 6. Prime Ministers | 1 | 16. Vatican | 1 | 26. Koran | – |
| 7. Longfellow | 1 | 17. New York | – | 27. Faust | 1 |
| 8. Weeks | 1 | 18. Egypt | – | 28. Ethnology | – |
| 9. Gibraltar | 1 | 19. Yeast | 1 | 29. Apocrypha | – |
| 10. Brazil | 1 | 20. Population | – | | 17 |

OBSERVATIONS:

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GR/7889/465/30T

## 2. COMPREHENSION

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 2 |
| 2. Engine | | 2 |
| 3. Envelope | Post box - Police | 2 |
| 4. Bad company | Sound tempted y'self | 2 |
| 5. Cinema | Don't cause panic. Go quietly to attendant | 2 |
| 6. Taxes | Road funds Bldg. - Things gov organize Keep country going | 2 |
| 7. Iron | Do it immediately - Don't lose time. | 1 |
| 8. Child employment | Stop people employing children under age Keep them at school - Not taken advantage of. | 2 |
| 9. Forest | Rays of sun - give direction | 2 |
| 10. Deaf | Never heard sound ∴ don't know | 2 |
| 11. Town land | Has been drained - In country no sewage etc public services | 1 |
| 12. Marriage | To make it a legal - - | – |
| 13. Still waters | People think more deeply than they talk. Secretive reserved | – |
| 14. Swallow | More than one particular thing to make a whole | 1 |
| | | 21 |

## 3. ARITHMETIC

| | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | ✓ | 2" | 0 1 |
| 4. 15" | ✓ | 9" | 0 1 |
| 5. 30" | ✓ | 2" | 0 1 |
| 6. 30" | ✓ | 4" | 0 1 |
| 7. 30" | ✓ | 2" | 0 1 |
| 8. 30" | ✓ | 2" | 0 1 |
| 9. 30" | ✗ | 10" | 0 1 |
| 10. 30" | ✓ | 6" | 0 1 |
| 11. 60" | ✓ | 20" | 0 1 (1-10) 2 |
| 12. 60" | ✓ | 35" | 0 1 (1-10) 2 |
| 13. 60" | ✗ | over 60" | 0 1 (1-15) 2 |
| 14. 120" | ✗ | – | 0 1 (1-20) 2 |
| | | | 11 |

## 4. SIMILARITIES

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | Peel - | 1 |
| 2. Coat—Dress | Outer Clothing | 2 |
| 3. Axe—Saw | Both used for cutting. | 2 |
| 4. Dog—Lion | 4 legs - Tail head - [illegible]. | 1 |
| 5. North—West | Hemispheres - South to do with | 0 |
| 6. Eye—Ear | Senses | 2 |
| 7. Air—Water | Needed for living | 2 |
| 8. Table—Chair | Part of home - Usually made of same material | 1 |
| 9. Egg—Seed | Both propagate the species | 2 |
| 10. Poem—Statue | Culture. | 1 |
| 11. Wood—Alcohol | Both have to make | 1 |
| 12. Praise—Punishment | Way of show approv. or disapprov | – |
| 13. Fly—Tree | Both living things Both grow | 2 |
| | | 17 |

## 5. DIGIT SPAN

| Digits Forward | SCORE Circle |
|---|---|
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| **Digits Backward** | **Circle** |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 7 + B 4 = 11

Highest numbers circled

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 2 | |
| 2. Ship | 2 | |
| 3. Penny | 2 | |
| 4. Winter | 2 | Cold Period – |
| 5. Repair | 2 | Put a new piece in a part to things that are worn out |
| 6. Breakfast | 2 | 1st meal |
| 7. Fabric | 2 | material – knitted or woven |
| 8. Slice | 1 | piece of the whole – slice of bread |
| 9. Assemble | 1 | People assemble for church – school – for conference – Parliament |
| 10. Conceal | 2 | Hide |
| 11. Enormous | 2 | Tremendous. |
| 12. Hasten | 2 | Hurry – go quickly. |
| 13. Sentence | 2 | Several words together to make a meaning |
| 14. Regulate | 2 | adjust something – like clock – when to go out of gives speed |
| 15. Commence | 2 | Starting. |
| 16. Ponder | 2 | Wonder – think |
| 17. Cavern | 2 | Hole in hillside – Cave. |
| 18. Designate | 2 | Told to go somewhere & do something – designate a person to a assignment |
| 19. Domestic | 2 | belonging to home. |
| 20. Consume | 1 | What you take up |
| 21. Terminate | 2 | End! |
| 22. Obstruct | 2 | In the way |
| 23. Remorse | 1 | To be sorry |
| 24. Sanctuary | 2 | In a church – place of worship. |
| 25. Matchless | 2 | no equal |
| 26. Reluctant | 2 | Don't wish to – won't to do something |
| 27. Calamity | 1 | upheaval – what shouldn't have happened – accidental death |
| 28. Fortitude | 2 | Strength. |
| 29. Tranquil | 2 | Quiet not exactly sound. – quieten down. |
| 30. Edifice | 0 | — |
| 31. Compassion | 2 | What you feel for other people – when in trouble. sorrow for them |
| 32. Tangible | 2 | Something you can feel |
| 33. Perimeter | 2 | Outside – measurement |
| 34. Audacious | 2 | Cheeky – |
| 35. Ominous | 0 | Inevitable – |
| 36. Tirade | 1 | When someone cross – let steam. |
| 37. Encumber | 0 | Vicars and churches. |
| 38. Plagiarize | 0 | — |
| 39. Impale | 1 | To put on fence or railings – fasten on spike or nail |
| 40. Travesty | 0 | Person done something one way & should have done it another could have done it differently & this would have been correct way |
| | 63 | |

## 7. DIGIT SYMBOL

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| – | ⊥ | ⊐ | ⅃ | U | O | Λ | X | = |

SCORE 29

SAMPLES

## 8. PICTURE COMPLETION

| | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | — |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | 1 |
| 11. Flag | — |
| 12. Dog tracks | — |
| 13. Cornwall | — |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | — |
| 17. Finger | 1 |
| 18. Shadow | 1 |
| 19. Stirrup | — |
| 20. Snow | — |
| 21. Eyebrow | — |
| | 13 |

## 9. BLOCK DESIGN

| | | Time | SCORE |
|---|---|---|---|
| 1. | 60" | 1 18" 2 — | 0 2 4 |
| 2. | 60" | 1 15" 2 | 0 2 4 |
| 3. | 60" | 8" | 0 4 |
| 4. | 60" | 8" | 0 4 |
| 5. | 60" | 10" | 0 4 |
| 6. | 60" | 50" | 0 4 |
| 7. | 120" | 40" | 0 4 31-40 5 1-30 6 |
| 8. | 120" | — | 0 4 48-70 5 1-42 6 |
| 9. | 120" | 80" | 0 4 61-80 5 1-60 6 |
| 10. | 120" | — | 0 4 61-80 5 1-60 6 |
| | | | 34 |

## 10. PICTURE ARRANGEMENT

| | | Order | Time | SCORE |
|---|---|---|---|---|
| 1. Nest | 60" | 1 WXY 2 | 15" | 0 2 4 WXY |
| 2. House | 60" | 1 PAT 2 | 7" | 0 2 4 PAT |
| 3. Hold up | 60" | ABCD | 4" | 0 4 ABCD |
| 4. Louie | 60" | ATOMIC | 59" | 0 4 ATOMIC |
| 5. Enter | 60" | OPENS | 2 mins | 0 4 OPENS |
| 6. Flirt | 60" | JANET | 2 m | 0 2 JNAET AJNET 4 JANET |
| 7. Fish | 120" | EFGHIJ | 90" | 0 2 EGFHIJ 4 26-40 5 1-25 6 EFGHIJ EJFGHI |
| 8. Taxi | 120" | SAMUEL | 90" | 0 2 SALMUE 4 16-25 5 1-15 6 SAMUEL AMUELS |
| | | | | 20 |

## 11. OBJECT ASSEMBLY

| | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 25" | 0 1 2 3 4 5 16-20 6 11-15 7 1-10 8 |
| Profile | 120" | 102" | 0 1 2 3 4 5 6 7 8 9 36-45 11 26-35 12 1-25 13 |
| Hand | 180" | 89" | 0 1 2 3 4 5 6 7 41-50 9 31-40 10 1-30 11 |
| Elephant | 180" | 130 | 0 1 2 3 4 5 6 7 8 31-50 10 21-30 11 1-20 12 |

SCORE 29

WAIS. Subject 1
1967

# WAIS RECORD FORM
Wechsler Adult Intelligence Scale

Name: Subject 2
Birth Date: Jan 21st 1912 (MO. DAY YR.) Age: 57 Sex: F Marital: S (M) D W (CIRCLE ONE)
Nat.: British Color: White Tested by: DMH
Place of Examination: Loughborough University Date: Nov. 1967
Occupation: HOUSEWIFE Education: 15 yrs Primary

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## SUMMARY

| TEST | Raw Score | Scaled Score |
|---|---|---|
| Information | 15 | 10 |
| Comprehension | 26 | 18 |
| Arithmetic | 14 | 13 |
| Similarities | 8 | 7 |
| Digit Span | 10 | 9 |
| Vocabulary | 56 | 12 |
| Verbal Score | | 69 |
| Digit Symbol | 44 | 8 |
| Picture Completion | 16 | 11 |
| Block Design | 34 | 10 |
| Picture Arrangement | 16 | 7 |
| Object Assembly | 31 | 10 |
| Performance Score | | 46 |
| Total Score | | |

VERBAL SCORE 69 IQ 113
PERFORMANCE SCORE 46 IQ 112
FULL SCALE SCORE 115 IQ 113

## 1. INFORMATION

| | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 1 | 11. Height | 1 | 21. Members of Parliament | — |
| 2. Ball | 1 | 12. Italy | 1 | 22. Genesis | — |
| 3. Months | 1 | 13. Clothes | 1 | 23. Temperature | — |
| 4. Thermometer | 1 | 14. Valentine's Day | — | 24. Iliad | — |
| 5. Rubber Tree | 1 | 15. Hamlet | — | 25. Blood vessels | |
| 6. Prime Ministers | 1 | 16. Vatican | 1 | 26. Koran | |
| 7. Longfellow | 1 | 17. New York | — | 27. Faust | |
| 8. Weeks | 1 | 18. Egypt | — | 28. Ethnology | |
| 9. Gibraltar | 1 | 19. Yeast | — | 29. Apocrypha | |
| 10. Brazil | 1 | 20. Population | — | | 15 |

OBSERVATIONS:

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GR/7889/465/30T

## 2. COMPREHENSION

| | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 2 |
| 2. Engine | | 2 |
| 3. Envelope | Post. | 2 |
| 4. Bad company | Bad influence | 2 |
| 5. Cinema | [illegible] — no stampede — they take precaution | 2 |
| 6. Taxes | Roads - health - pay for Royal Police - Nation | 2 |
| 7. Iron | Do job while going is good | 2 |
| 8. Child employment | [illegible] school - not fit for children | 1 |
| 9. Forest | Sun — | 2 |
| 10. Deaf | Can't hear right sound for pronunciation | 2 |
| 11. Town land | More demand in town | 2 |
| 12. Marriage | legality - to show they have been married - keep account | 2 |
| 13. Still waters | Quiet people may think deeply | 2 |
| 14. Swallow | like one fine day doesn't make a summer - one has to have more than one | 1 |
| | | 26 |

## 3. ARITHMETIC

| | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 (1) |
| 2. 15" | | | 0 (1) |
| 3. 15" | 4/- | 10" | 0 (1) |
| 4. 15" | 4/- | 2" | 0 (1) |
| 5. 30" | 30/- | 0 | 0 (1) |
| 6. 30" | 35 | 2" | 0 (1) |
| 7. 30" | 6 | 4" | 0 (1) |
| 8. 30" | [illegible] | 5" | 0 (1) |
| 9. 30" | [illegible] | 5" | 0 (1) |
| 10. 30" | [illegible] | 15" | 0 (1) |
| 11. 60" | [illegible] | 15" | 0 (1) 1-10 2 |
| 12. 60" | £1.00 | 8" | 0 1 1-10 (2) |
| 13. 60" | — | — | 0 1 1-15 2 |
| 14. 120" | 92 | 45" | 0 (1) 1-20 2 |
| | | | 14 |

## 4. SIMILARITIES

| | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | Both need peeling. | 1 |
| 2. Coat—Dress | Both worn | 1 |
| 3. Axe—Saw | Both chop wood | 1 |
| 4. Dog—Lion | They ~~gnaw~~ chew at things. | 1 |
| 5. North—West | | — |
| 6. Eye—Ear | Belong to the head | 1 |
| 7. Air—Water | Both elements | 1 |
| 8. Table—Chair | Household articles | 1 |
| 9. Egg—Seed | Both eaten | — |
| 10. Poem—Statue | — | — |
| 11. Wood—Alcohol | Clothes from wood | — |
| 12. Praise—Punishment | Both from [illegible] | — |
| 13. Fly—Tree | Both belong to nature | 1 |
| | | 8 |

## 5. DIGIT SPAN

| Digits Forward | SCORE Circle |
|---|---|
| 5-8-2 / 6-9-4 | (3) 3 |
| 6-4-3-9 / 7-2-8-6 | (4) 4 |
| 4-2-7-3-1 / 7-5-8-3-6 | (5) 5 |
| 6-1-9-4-7-3 / 3-9-2-4-8-7 | 6 6 |
| 5-9-1-7-4-2-8 / 4-1-7-9-3-8-6 | 7 7 |
| 5-8-1-9-2-6-4-7 / 3-8-2-9-5-1-7-4 | 8 8 |
| 2-7-5-8-6-2-5-8-4 / 7-1-3-9-4-2-5-6-8 | 9 9 |
| **Digits Backward** | **Circle** |
| 2-4 / 5-8 | (2) 2 |
| 6-2-9 / 4-1-5 | (3) 3 |
| 3-2-7-9 / 4-9-6-8 | (4) 4 |
| 1-5-2-8-6 / 6-1-8-4-3 | (5) 5 |
| 5-3-9-4-1-8 / 7-2-4-8-5-6 | 6 6 |
| 8-1-2-9-3-6-5 / 4-7-3-9-1-2-8 | 7 7 |
| 9-4-3-7-6-2-5-8 / 7-2-8-1-9-6-5-3 | 8 8 |

F 5 + B 5 = 10
Highest numbers circled

## 6. VOCABULARY

| | SCORE 2, 1 or 0 | |
|---|---|---|
| 1. Bed | 2 | |
| 2. Ship | 2 | |
| 3. Penny | 2 | |
| 4. Winter | 2 | End season of year |
| 5. Repair | 2 | mend |
| 6. Breakfast | 2 | 1st meal of day |
| 7. Fabric | 2 | material |
| 8. Slice | 1 | piece |
| 9. Assemble | 1 | no of people together |
| 10. Conceal | 2 | not to show |
| 11. Enormous | 2 | very big |
| 12. Hasten | 2 | be quick |
| 13. Sentence | 1 | lot of words — or time in prison |
| 14. Regulate | 2 | adjust so they 'll work |
| 15. Commence | 2 | start |
| 16. Ponder | 2 | think about |
| 17. Cavern | 2 | cave |
| 18. Designate | 2 | give a job to someone to do — a certain person |
| 19. Domestic | 2 | home things — to do with the home |
| 20. Consume | 2 | use up in different ways |
| 21. Terminate | 2 | end |
| 22. Obstruct | 2 | put something in front of |
| 23. Remorse | 1 | to be sorry |
| 24. Sanctuary | 1 | place — a religious word in church |
| 25. Matchless | 2 | can't compare with anything else — better than all others |
| 26. Reluctant | 2 | to do something against one's will |
| 27. Calamity | 1 | something not very good comes out of it |
| 28. Fortitude | 2 | put up with the something — to bear — even things look worse |
| 29. Tranquil | 2 | peaceful |
| 30. Edifice | — | [illegible] of work |
| 31. Compassion | 1 | show kindness |
| 32. Tangible | — | all mixed up |
| 33. Perimeter | — | instrument |
| 34. Audacious | — | — |
| 35. Ominous | 1 | feeling about something that is not very good |
| 36. Tirade | — | bad temper — loose temper |
| 37. Encumber | 2 | down under a lot of things — |
| 38. Plagiarize | — | — |
| 39. Impale | — | — |
| 40. Travesty | — | to [illegible] |
| | 56 | |

## 7. DIGIT SYMBOL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | SCORE 44 |

SAMPLES

## 8. PICTURE COMPLETION

| | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Car lock | 1 |
| 10. Pins or Lugs | 1 |
| 11. Flag | — |
| 12. Dog tracks | 1 |
| 13. Cornwall | 1 |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | — |
| 17. Finger | 1 |
| 18. Shadow | 1 |
| 19. Stirrup | — |
| 20. Snow | — |
| 21. Eyebrow | — |
| | 16 |

## 9. BLOCK DESIGN

| | Time | SCORE |
|---|---|---|
| 1. 60" | 1: 14" 2: | 0 2 4 (4) |
| 2. 60" | 1: 7" 2: | 0 2 4 (4) |
| 3. 60" | 9" | 0 4 (4) |
| 4. 60" | 9" | 0 4 (4) |
| 5. 60" | 4" | 0 4 (4) |
| 6. 60" | 27" | 0 4 (4) |
| 7. 120" | 25" | 0 4 5 (31-40) 6 (1-30) (6) |
| 8. 120" | — | 0 4 5 (46-70) 6 (1-45) (0) |
| 9. 120" | — | 0 4 5 (61-80) 6 (1-60) (0) |
| 10. 120" | 115" | 0 4 5 (61-80) 6 (1-60) (4) |
| | | 34 |

## 10. PICTURE ARRANGEMENT

| | | Order | Time | SCORE |
|---|---|---|---|---|
| 1. Nest | 60" | 1: WXY 2: | 4" | 0 2 4 WXY (4) |
| 2. House | 60" | 1: PAT 2: | 4" | 0 2 4 PAT (4) |
| 3. Hold up | 60" | PAT | 5" | 0 4 ABCD (4) |
| 4. Louie | 60" | ATMIOC | 21" | 0 4 ATOMIC (0) |
| 5. Enter | 60" | OPENS | 45" | 0 4 OPENS (4) |
| 6. Flirt | 60" | AJNJE | over 60" | 0 2 JNAET AJNET 4 JANET (0) |
| 7. Fish | 120" | IEGFHJ | 68" | 0 2 EGFHIJ 4 5 (26-40) 6 (1-25) EFGHIJ EJFGHI (0) |
| 8. Taxi | 120" | SALMEN | 60" | 0 2 SALMUE 4 5 (16-25) 6 (1-15) SAMUEL AMUELS (0) |
| | | | | 16 |

## 11. OBJECT ASSEMBLY

| | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 14" | 0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10) — (7) |
| Profile | 120" | 49" | 0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25) — (9) |
| Hand | 180" | 87" | 0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30) — (7) |
| Elephant | 180" | 54" | 0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20) — (8) |
| | | | SCORE 31 |

WAIS. Subject 2
1967

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name: Subject 3

Birth Date: Sept 28th '38 (MO. DAY YR.) Age: 29 Sex: F Marital: S (M) D W (CIRCLE ONE)

Nat.: British Color: White Tested by: [illegible]

Place of Examination: Loughborough University Date: Nov. 1967

Occupation: Housewife Education: "O" levels. 17 yrs.

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## SUMMARY

| TEST | Raw Score | Scaled Score | |
|---|---|---|---|
| Information | 22 | 13 | |
| Comprehension | 26 | 18 | |
| Arithmetic | 8 | 7 | |
| Similarities | 19 | 13 | |
| Digit Span | 9 | 7 | |
| Vocabulary | 72 | 16 | |
| Verbal Score | | 74 | |
| Digit Symbol | 62 | 12 | |
| Picture Completion | 19 | 14 | |
| Block Design | 32 | 10 | |
| Picture Arrangement | 22 | 9 | |
| Object Assembly | 21 | 10 | |
| Performance Score | | 55 | |
| Total Score | | | |

VERBAL SCORE 74 IQ 113

PERFORMANCE SCORE 55 IQ 107

FULL SCALE SCORE 129 IQ 111

## 1. INFORMATION

| 1. INFORMATION | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 1 | 11. Height -5'4" | 1 | 21. Members of Parliament | 1 |
| 2. Ball | 1 | 12. Italy Rome | 1 | 22. Genesis | 1 |
| 3. Months | 1 | 13. Clothes Reflection | 1 | 23. Temperature | — |
| 4. Thermometer | 1 | 14. Valentine's Day Feb 14th | 1 | 24. Iliad | 1 |
| 5. Rubber Tree | 1 | 15. Hamlet Sp | 1 | 25. Blood vessels | 1 |
| 6. Prime Ministers [illegible] | 1 | 16. Vatican Pope [illegible] | 1 | 26. Koran | — |
| 7. Longfellow Poet | 1 | 17. New York 1,000 | — | 27. Faust | — |
| 8. Weeks 52 | 1 | 18. Egypt Africa | 1 | 28. Ethnology | — |
| 9. Gibraltar S. | 1 | 19. Yeast [illegible] | 1 | 29. Apocrypha (Not John Ru[illegible]) | |
| 10. Brazil S.A. | 1 | 20. Population — | — | | 22 |

**OBSERVATIONS:**

## 2. COMPREHENSION

| 2. COMPREHENSION | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 2 |
| 2. Engine | | 2 |
| 3. Envelope | Post Office. — | 2 |
| 4. Bad company | Rubs off & make up bad too. | 2 |
| 5. Cinema | Manager – | 2 |
| 6. Taxes | finances of country. | 2 |
| 7. Iron | Do something before it is too late | 2 |
| 8. Child employment | Age protection of chimney sweeps | 1 |
| 9. Forest | Sun – | 2 |
| 10. Deaf | Can hear sound : don't hear words to learn. | 2 |
| 11. Town land | Crowded – more people want to buy it. | 2 |
| 12. Marriage | A Record – registry office. | 2 |
| 13. Still waters | more to some people than appears on surface. | 2 |
| 14. Swallow | more than one little bit of a thing to make a whole | 1 |
| | | 26 |

## 3. ARITHMETIC

| | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 (1) |
| 2. 15" | | | 0 (1) |
| 3. 15" | 9/- | 9" | 0 (1) |
| 4. 15" | 4/- | 1" | 0 (1) |
| 5. 30" | 30/- | 5" | 0 (1) |
| 6. 30" | 30 | 4" | 0 (1) |
| 7. 30" | 6 | 6" | 0 (1) |
| 8. 30" | — | — | 0 1 |
| 9. 30" | 1/4 | 40" | 0 (1) |
| 10. 30" | — | — | 0 1 |
| 11. 60" | — | — | 0 1 2 (1-10) |
| 12. 60" | | | 0 1 2 (1-10) |
| 13. 60" | | | 0 1 2 (1-15) |
| 14. 120" | | | 0 1 2 (1-20) |
| | | | 8 |

## 4. SIMILARITIES

| 4. SIMILARITIES | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | fruit. | 2 |
| 2. Coat—Dress | clothes. | 2 |
| 3. Axe—Saw | Splitting wood – Tools. | 2 |
| 4. Dog—Lion | Animals – 4 legs. | 2 |
| 5. North—West | Points of compass | 2 |
| 6. Eye—Ear | Sense organs on head. | 2 |
| 7. Air—Water | Both contain $O_2$ | 1 |
| 8. Table—Chair | furniture. | 2 |
| 9. Egg—Seed | Beginnings – embryo. | 2 |
| 10. Poem—Statue | Form of Art. | 2 |
| 11. Wood—Alcohol | Containers for alcohol and wood | 0 |
| 12. Praise—Punishment | — | 0 |
| 13. Fly—Tree | Fly nests in tree | 0 |
| | | 19 |

## 5. DIGIT SPAN

| Digits Forward | Circle |
|---|---|
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| **Digits Backward** | **Circle** |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 5 + B 4 = 9
Highest numbers circled

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| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 2 | |
| 2. Ship | 2 | |
| 3. Penny | 2 | |
| 4. Winter | 2 | Coldest season |
| 5. Repair | 2 | mend. |
| 6. Breakfast | 2 | 1st meal of day |
| 7. Fabric | 2 | material. |
| 8. Slice | 1 | piece - cut. |
| 9. Assemble | 2 | put together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 1 | large - |
| 12. Hasten | 2 | to go quickly |
| 13. Sentence | 2 | group of words joined together to say something |
| 14. Regulate | 2 | to set something to go at set speed. |
| 15. Commence | 2 | Start |
| 16. Ponder | 2 | think about - |
| 17. Cavern | 2 | Cave. |
| 18. Designate | 2 | appoint |
| 19. Domestic | 2 | pertaining to the home. |
| 20. Consume | 2 | Eat. |
| 21. Terminate | 2 | End. |
| 22. Obstruct | 2 | Put something in the way of. |
| 23. Remorse | 2 | sadness - sorry (over own actions) |
| 24. Sanctuary | 2 | haven. |
| 25. Matchless | 2 | Perfect - cant match up to it |
| 26. Reluctant | 2 | hesitant |
| 27. Calamity | 2 | Something terrible happening |
| 28. Fortitude | 2 | strength |
| 29. Tranquil | 2 | peaceful |
| 30. Edifice | — | |
| 31. Compassion | 2 | feel sorry for someone - do something about it |
| 32. Tangible | 2 | concrete - definite. |
| 33. Perimeter | 2 | outside edge - |
| 34. Audacious | 2 | cheeky |
| 35. Ominous | 2 | threatening |
| 36. Tirade | 2 | Start [illegible] temper - throw things about |
| 37. Encumber | 2 | loaded |
| 38. Plagiarize | — | - plagu |
| 39. Impale | 2 | Spear - |
| 40. Travesty | — | |
| | 72 | |

7. DIGIT SYMBOL

SAMPLES

SCORE 62

| 8. PICTURE COMPLETION | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | — |
| 11. Flag | 1 |
| 12. Dog tracks | 1 |
| 13. Cornwall | 1 |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | 1 |
| 17. Finger | 1 |
| 18. Shadow | 1 |
| 19. Stirrup | 1 |
| 20. Snow | 1 |
| 21. Eyebrow | — |
| | 19 |

| 9. BLOCK DESIGN | Time | SCORE |
|---|---|---|
| 1. 60" | 1 15" / 2 | 0 2 4 |
| 2. 60" | 1 40" / 2 | 0 2 4 |
| 3. 60" | 9" | 0 4 |
| 4. 60" | 14" | 0 4 |
| 5. 60" | 30" | 0 4 |
| 6. 60" | 50" | 0 4 |
| 7. 120" | 54" | 0 4 31-40 5 1-30 6 |
| 8. 120" | 180" | 0 4 46-70 5 1-45 6 |
| 9. 120" | — | 0 4 61-80 5 1-60 6 |
| 10. 120" | 90" | 0 4 61-80 5 1-60 6 |
| | | 32 |

| 10. PICTURE ARRANGEMENT | | Order | Time | SCORE |
|---|---|---|---|---|
| 1. Nest | 60" | 1 WXY 2 | 30" | 0 2 4 WXY |
| 2. House | 60" | 1 PAT 2 | 30" | 0 2 4 PAT |
| 3. Hold up | 60" | ABCD | 12" | 0 4 ABCD |
| 4. Louie | 60" | ATOMIC | 37" | 0 4 ATOMIC |
| 5. Enter | 60" | OESPN | 35" | 0 4 OPENS |
| 6. Flirt | 60" | AJNET | 50" | 0 2 4 JNAET AJNET JANET |
| 7. Fish | 120" | EFGHIJ | 74" | [redacted] 4 EGFHIJ 26-40 5 EFGHIJ EJFGHI 1-25 6 |
| 8. Taxi | 120" | ALMENS | 115" | 0 2 4 SALMUE 16-25 5 SAMUEL AMUELS 1-15 6 |
| | | | | 22 |

SCORE

| 11. OBJECT ASSEMBLY | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 14" | 0 1 2 3 4 5 16-20 6 11-15 7 1-10 8 |
| Profile | 120" | 63" | 0 1 2 3 4 5 6 7 8 9 36-45 11 26-35 12 1-25 13 |
| Hand | 180" | 150" | 0 1 2 3 4 5 6 7 41-50 9 31-40 10 1-30 11 |
| Elephant | 180" | 100" | 0 1 2 3 4 5 6 7 8 31-50 10 21-30 11 1-20 12 |
| | | | 31 |

WAIS. Subject 3
1967

# WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name Subject 4

Birth Date March 25th '42 (MO. DAY YR.) Age 25 Sex F Marital: S M D W (CIRCLE ONE)

Nat. BRITISH Color White Tested by CMH

Place of Examination Loughborough University Date Nov 1967

Occupation HOUSEWIFE (LIBRARY ASSISTANT) Education 17 age 'O' level 1 year Secretarial

## TABLE OF SCALED SCORE EQUIVALENTS*

| Scaled Score | Information | Comprehension | Arithmetic | Similarities | Digit Span | Vocabulary | Digit Symbol | Picture Completion | Block Design | Picture Arrangement | Object Assembly | Scaled Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RAW SCORE | | | | | | | | | | | |
| 19 | 29 | 27-28 | | 26 | 17 | 78-80 | 87-90 | | | | | 19 |
| 18 | 28 | 26 | | 25 | | 76-77 | 83-86 | 21 | | 36 | 44 | 18 |
| 17 | 27 | 25 | 18 | 24 | | 74-75 | 79-82 | | 48 | 35 | 43 | 17 |
| 16 | 26 | 24 | 17 | 23 | 16 | 71-73 | 76-78 | 20 | 47 | 34 | 42 | 16 |
| 15 | 25 | 23 | 16 | 22 | 15 | 67-70 | 72-75 | | 46 | 33 | 41 | 15 |
| 14 | 23-24 | 22 | 15 | 21 | 14 | 63-66 | 69-71 | 19 | 44-45 | 32 | 40 | 14 |
| 13 | 21-22 | 21 | 14 | 19-20 | | 59-62 | 66-68 | 18 | 42-43 | 30-31 | 38-39 | 13 |
| 12 | 19-20 | 20 | 13 | 17-18 | 13 | 54-58 | 62-65 | 17 | 39-41 | 28-29 | 36-37 | 12 |
| 11 | 17-18 | 19 | 12 | 15-16 | 12 | 47-53 | 58-61 | 15-16 | 35-38 | 26-27 | 34-35 | 11 |
| 10 | 15-16 | 17-18 | 11 | 13-14 | 11 | 40-46 | 52-57 | 14 | 31-34 | 23-25 | 31-33 | 10 |
| 9 | 13-14 | 15-16 | 10 | 11-12 | 10 | 32-39 | 47-51 | 12-13 | 28-30 | 20-22 | 28-30 | 9 |
| 8 | 11-12 | 14 | 9 | 9-10 | | 26-31 | 41-46 | 10-11 | 25-27 | 18-19 | 25-27 | 8 |
| 7 | 9-10 | 12-13 | 7-8 | 7-8 | 9 | 22-25 | 35-40 | 8-9 | 21-24 | 15-17 | 22-24 | 7 |
| 6 | 7-8 | 10-11 | 6 | 5-6 | 8 | 18-21 | 29-34 | 6-7 | 17-20 | 12-14 | 19-21 | 6 |
| 5 | 5-6 | 8-9 | 5 | 4 | | 14-17 | 23-28 | 5 | 13-16 | 9-11 | 15-18 | 5 |
| 4 | 4 | 6-7 | 4 | 3 | 7 | 11-13 | 18-22 | 4 | 10-12 | 8 | 11-14 | 4 |
| 3 | 3 | 5 | 3 | 2 | | 10 | 15-17 | 3 | 6-9 | 7 | 8-10 | 3 |
| 2 | 2 | 4 | 2 | 1 | 6 | 9 | 13-14 | 2 | 3-5 | 6 | 5-7 | 2 |
| 1 | 1 | 3 | 1 | | 4-5 | 8 | 12 | 1 | 2 | 5 | 3-4 | 1 |
| 0 | 0 | 0-2 | 0 | 0 | 0-3 | 0-7 | 0-11 | 0 | 0-1 | 0-4 | 0-2 | 0 |

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

## SUMMARY

| TEST | Raw Score | Scaled Score |
|---|---|---|
| Information | 26 | 16 |
| Comprehension | 25 | 17 |
| Arithmetic | 11 | 10 |
| Similarities | 17 | 12 |
| Digit Span | 13 | 12 |
| Vocabulary | 64 | 14 |
| Verbal Score | | 81 |
| Digit Symbol | 65 | 12 |
| Picture Completion | 17 | 12 |
| Block Design | 40 | 12 |
| Picture Arrangement | 26 | 11 |
| Object Assembly | 33 | 10 |
| Performance Score | | 57 |
| Total Score | | |

VERBAL SCORE 81 IQ 120

PERFORMANCE SCORE 57 IQ 110

FULL SCALE SCORE 138 IQ 116

## 1. INFORMATION

| | SCORE 1 or 0 | | SCORE 1 or 0 | | SCORE 1 or 0 |
|---|---|---|---|---|---|
| 1. Flag | 1 | 11. Height | 1 | 21. Members of Parliament | 0 |
| 2. Ball | 1 | 12. Italy | 1 | 22. Genesis | 1 |
| 3. Months | 1 | 13. Clothes | 1 | 23. Temperature | 1 |
| 4. Thermometer | 1 | 14. Valentine's Day | 1 | 24. Iliad | 1 |
| 5. Rubber | 1 | 15. Hamlet | 1 | 25. Blood vessels | 1 |
| 6. Prime Ministers | 1 | 16. Vatican | 1 | 26. Koran | 1 |
| 7. Longfellow | 1 | 17. New York | 1 | 27. Faust | 1 |
| 8. Weeks | 1 | 18. Egypt | 1 | 28. Ethnology | 0 |
| 9. Gibraltar | 1 | 19. Yeast | 1 | 29. Apocrypha | 0 |
| 10. Brazil | 1 | 20. Population | 1 | | 26 |

OBSERVATIONS:

## 2. COMPREHENSION

| | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Clothes | | 2 |
| 2. Engine | | 2 |
| 3. Envelope | Post it | 2 |
| 4. Bad company | Bad influence | 2 |
| 5. Cinema | [illegible] | 2 |
| 6. Taxes | National Health ... country [illegible] | 2 |
| 7. Iron | First opportunity | 2 |
| 8. Child employment | not down mines [illegible] ... at school - growth [illegible] | 2 |
| 9. Forest | Sun — | 2 |
| 10. Deaf | They couldn't hear - so [illegible] | 2 |
| 11. Town land | Short, Towns cramped - land needed for houses etc. & [illegible] | 2 |
| 12. Marriage | To make it legal - so people can know. | 1 |
| 13. Still waters | People on outside quite calm can be [illegible] inside | 0 |
| 14. Swallow | Generalization [illegible] so from one thing to whole lot | 2 |
| | | 25 |

## 3. ARITHMETIC

| | R or W | Time | SCORE |
|---|---|---|---|
| 1. 15" | | | 0 1 |
| 2. 15" | | | 0 1 |
| 3. 15" | 9/- | 2" | 0 1 |
| 4. 15" | 4/- | 0 | 0 1 |
| 5. 30" | 36/- | 0 | 0 1 |
| 6. 30" | 30 | 4" | 0 1 |
| 7. 30" | 6 | 1" | 0 1 |
| 8. 30" | 72 | 5" | 0 1 |
| 9. 30" | 1/4 | 6" | 0 1 |
| 10. 30" | 12/10 | 7" | 0 1 |
| 11. 60" | 12/6 | 19" | 0 1 2 (1-10) |
| 12. 60" | £600 | 0 | 0 1 2 (1-10) |
| 13. 60" | £55 | 14" | 0 1 2 (1-15) |
| 14. 120" | 48 | 19" | 0 1 2 (1-20) |
| | | | 11 |

## 4. SIMILARITIES

| | | SCORE 2, 1 or 0 |
|---|---|---|
| 1. Orange—Banana | Fruit. | 2 |
| 2. Coat—Dress | Garments. | 2 |
| 3. Axe—Saw | Tools. | 2 |
| 4. Dog—Lion | 4 footed mammals | 2 |
| 5. North—West | Points of Compass | 2 |
| 6. Eye—Ear | Parts of head | 1 |
| 7. Air—Water | Both elements | 1 |
| 8. Table—Chair | Furniture | 2 |
| 9. Egg—Seed | Fruit | 0 |
| 10. Poem—Statue | Art - | 2 |
| 11. Wood—Alcohol | Both from trees or plants | 0 |
| 12. Praise—Punishment | Both be administered by one person | 0 |
| 13. Fly—Tree | Both move. | 1 |
| | | 17 |

## 5. DIGIT SPAN

| Digits Forward | SCORE Circle |
|---|---|
| 5-8-2<br>6-9-4 | 3<br>3 |
| 6-4-3-9<br>7-2-8-6 | 4<br>4 |
| 4-2-7-3-1<br>7-5-8-3-6 | 5<br>5 |
| 6-1-9-4-7-3<br>3-9-2-4-8-7 | 6<br>6 |
| 5-9-1-7-4-2-8<br>4-1-7-9-3-8-6 | 7<br>7 |
| 5-8-1-9-2-6-4-7<br>3-8-2-9-5-1-7-4 | 8<br>– 8 |
| 2-7-5-8-6-2-5-8-4<br>7-1-3-9-4-2-5-6-8 | 9<br>9 |
| **Digits Backward** | **Circle** |
| 2-4<br>5-8 | 2<br>2 |
| 6-2-9<br>4-1-5 | 3<br>3 |
| 3-2-7-9<br>4-9-6-8 | 4<br>4 |
| 1-5-2-8-6<br>6-1-8-4-3 | 5<br>5 |
| 5-3-9-4-1-8<br>7-2-4-8-5-6 | 6<br>6 |
| 8-1-2-9-3-6-5<br>4-7-3-9-1-2-8 | 7<br>7 |
| 9-4-3-7-6-2-5-8<br>7-2-8-1-9-6-5-3 | 8<br>8 |

F 7 + B 6 = 13

Highest numbers circled

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GR/7889/465/30T

| | SCORE 2, 1 or 0 | 6. VOCABULARY |
|---|---|---|
| 1. Bed | 2 | |
| 2. Ship | 2 | |
| 3. Penny | 2 | |
| 4. Winter | 2 | part season of year |
| 5. Repair | 2 | mend something |
| 6. Breakfast | 2 | 1st meal |
| 7. Fabric | 2 | material |
| 8. Slice | 1 | cut with knife |
| 9. Assemble | 2 | fit together |
| 10. Conceal | 2 | hide |
| 11. Enormous | 2 | Gigantic |
| 12. Hasten | 2 | hurry |
| 13. Sentence | 1 | term of imprisonment — part of speech |
| 14. Regulate | 1 | adjust |
| 15. Commence | 2 | begin |
| 16. Ponder | 2 | think at great length |
| 17. Cavern | 2 | cave |
| 18. Designate | 2 | allot |
| 19. Domestic | 2 | home or everyday, to do with home |
| 20. Consume | 2 | use |
| 21. Terminate | 2 | end |
| 22. Obstruct | 1 | prevent |
| 23. Remorse | 1 | sorry - sadness |
| 24. Sanctuary | 2 | haven |
| 25. Matchless | 2 | unique |
| 26. Reluctant | 1 | not anxious to give up |
| 27. Calamity | 2 | disaster |
| 28. Fortitude | 2 | bravery |
| 29. Tranquil | 2 | quiet |
| 30. Edifice | — | (forest) |
| 31. Compassion | 2 | sympathy |
| 32. Tangible | 2 | touchable |
| 33. Perimeter | 2 | outside edge |
| 34. Audacious | 2 | daring |
| 35. Ominous | 2 | looming overhead |
| 36. Tirade | — | ([illegible]) |
| 37. Encumber | — | ([illegible]) |
| 38. Plagiarize | — | — |
| 39. Impale | 2 | speared |
| 40. Travesty | — | — |
| | 64 | |

7. DIGIT SYMBOL

SCORE 65

| 8. PICTURE COMPLETION | SCORE 1 or 0 |
|---|---|
| 1. Knob | 1 |
| 2. Tail | 1 |
| 3. Nose | 1 |
| 4. Handles | 1 |
| 5. Diamond | 1 |
| 6. Water | 1 |
| 7. Nose piece | 1 |
| 8. Peg | 1 |
| 9. Oar lock | 1 |
| 10. Pins or Lugs | — |
| 11. Flag | 1 |
| 12. Dog tracks | 1 |
| 13. Cornwall | 1 |
| 14. Stacks | 1 |
| 15. Leg | 1 |
| 16. Arm image | — |
| 17. Finger | 1 |
| 18. Shadow | 1 |
| 19. Stirrup | — |
| 20. Snow | 1 |
| 21. Eyebrow | — |
| | 17 |

| 9. BLOCK DESIGN | Time | SCORE |
|---|---|---|
| 1. 60" | 1 [illegible] 2 | 0 2 4 |
| 2. 60" | 1 10" 2 | 0 2 4 |
| 3. 60" | 10" | 0 4 |
| 4. 60" | 9" | 0 4 |
| 5. 60" | 6" | 0 4 |
| 6. 60" | 50" | 0 4 |
| 7. 120" | 55" | 0 4 31-40 5 1-30 6 |
| 8. 120" | 95" | 0 4 46-70 5 1-45 6 |
| 9. 120" | 91" | 0 4 61-80 5 1-60 6 |
| 10. 120" | 100" | 0 4 61-80 5 1-60 6 |
| | | 40 |

| 10. PICTURE ARRANGEMENT | | Order | Time | SCORE |
|---|---|---|---|---|
| 1. Nest | 60" | 1 WXY 2 | 5" | 0 2 4 WXY |
| 2. House | 60" | 1 PAT 2 | 9" | 0 2 4 PAT |
| 3. Hold up | 60" | ABCD | 8" | 0 4 ABCD |
| 4. Louie | 60" | ATOMIC | 17" | 0 4 ATOMIC |
| 5. Enter | 60" | OPENS | 33" | 0 4 OPENS |
| 6. Flirt | 60" | AJNET | 18" | 0 2 4 JNAET JANET AJNET |
| 7. Fish | 120" | EGHJFI | 32" | 0 2 4 26-40 5 1-25 6 EGFHIJ EFGHIJ EJFGHI |
| 8. Taxi | 120" | SAMUEL | 60" | 0 2 4 16-25 5 1-15 6 SALMUE SAMUEL AMUELS |
| | | | | 26 |

| 11. OBJECT ASSEMBLY | | Time | SCORE |
|---|---|---|---|
| Manikin | 120" | 19" | 0 1 2 3 4 5 16-20 6 11-15 7 1-10 8 |
| Profile | 120" | 65" | 0 1 2 3 4 5 6 7 8 9 36-45 11 26-35 12 1-25 13 |
| Hand | 180" | 160" | 0 1 2 3 4 5 6 7 41-50 9 31-40 10 1-30 11 |
| Elephant | 180" | 27" | 0 1 2 3 4 5 6 7 8 31-50 10 21-30 11 1-20 12 |

SCORE 33

WAIS. Subject 4
1967

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME............. SUBJECT 1 ............. AGE.....59......

OCCUPATION.... Housewife .................. SEX.....f.........

N= 11 E= 23 L= 4

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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Warwick Lane, London E.C.4

E 23 N 11 L 4

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | X | |
| 2. | Have you often got a restless feeling that you want something but do not know what? | X | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | X | |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | X | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | | X |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | X | |
| 7. | Do you sometimes sulk? | | X |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | X | |
| 9. | Are you moody? | | X |
| 10. | Do you like mixing with people? | X | |
| 11. | Have you often lost sleep over your worries? | X | |
| 12. | Do you sometimes get cross? | X | |
| 13. | Would you call yourself happy-go-lucky? | X | |
| 14. | Do you often make up your mind too late? | | X |
| 15. | Do you like working alone? | | X |
| 16. | Have you often felt listless and tired for no good reason? | | X |
| 17. | Are you rather lively? | X | |
| 18. | Do you sometimes laugh at a dirty joke? | | X |
| 19. | Do you often feel "fed-up"? | | X |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | X |
| 21. | Does your mind often wander when you are trying to attend closely to something? | | X |
| 22. | Can you put your thoughts into words quickly? | X | |
| 23. | Are you often "lost in thought"? | X | |
| 24. | Are you completely free from prejudices of any kind? | | X |
| 25. | Do you like practical jokes? | X | |
| 26. | Do you often think of your past? | X | |
| 27. | Do you very much like good food? | X | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | X | |
| 29. | Do you mind selling things or asking people for money for some good cause? | | X |
| 30. | Do you sometimes boast a little? | X | |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | X | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | X | |
| 34. | Do you like planning things carefully, well ahead of time? | | X |
| 35. | Do you have dizzy turns? | | X |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | | X |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | X | |
| 40. | Do you suffer from "nerves"? | | X |
| 41. | Would you rather plan things than do things? | | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | | X |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | X |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | X | |
| 45. | Do you get very bad headaches? | | X |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | X | |
| 47. | Do you find it hard to fall asleep at bedtime? | | X |
| 48. | Have you sometimes told lies in your life? | X | |
| 49. | Do you sometimes say the first thing that comes into your head? | X | |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | | X |
| 52. | Do you often get into a jam because you do things without thinking? | X | |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | X | |
| 54. | Would you rather win than lose a game? | | X |
| 55. | Do you often feel self-conscious when you are with superiors? | | X |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME........Subject 2........ AGE....57......

OCCUPATION....Housewife.................. SEX....f.........

N= 12 E= 11 L= 5

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E 11 N 12 L 5

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | X | |
| 2. | Have you often got a restless feeling that you want something but do not know what? | X | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | | X |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | | X |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | | X |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | X |
| 7. | Do you sometimes sulk? | | X |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | | X |
| 9. | Are you moody? | | X |
| 10. | Do you like mixing with people? | X | |
| 11. | Have you often lost sleep over your worries? | X | |
| 12. | Do you sometimes get cross? | X | |
| 13. | Would you call yourself happy-go-lucky? | | X |
| 14. | Do you often make up your mind too late? | | X |
| 15. | Do you like working alone? | X | |
| 16. | Have you often felt listless and tired for no good reason? | | X |
| 17. | Are you rather lively? | X | |
| 18. | Do you sometimes laugh at a dirty joke? | | X |
| 19. | Do you often feel "fed-up"? | X | |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | X |
| 21. | Does your mind often wander when you are trying to attend closely to something? | | X |
| 22. | Can you put your thoughts into words quickly? | X | |
| 23. | Are you often "lost in thought"? | X | |
| 24. | Are you completely free from prejudices of any kind? | X | |
| 25. | Do you like practical jokes? | X | |
| 26. | Do you often think of your past? | X | |
| 27. | Do you very much like good food? | X | |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | | X |
| 29. | Do you mind selling things or asking people for money for some good cause? | | X |
| 30. | Do you sometimes boast a little? | | X |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | X | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | X | |
| 34. | Do you like planning things carefully, well ahead of time? | X | |
| 35. | Do you have dizzy turns? | X | |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | X | |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | | X |
| 40. | Do you suffer from "nerves"? | | X |
| 41. | Would you rather plan things than do things? | | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | | X |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | X |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | X |
| 45. | Do you get very bad headaches? | | X |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | | X |
| 47. | Do you find it hard to fall asleep at bedtime? | X | |
| 48. | Have you sometimes told lies in your life? | | X |
| 49. | Do you sometimes say the first thing that comes into your head? | | X |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | X | |
| 52. | Do you often get into a jam because you do things without thinking? | | X |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | | X |
| 54. | Would you rather win than lose a game? | X | |
| 55. | Do you often feel self-conscious when you are with superiors? | X | |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME.................... Subject 3 ...... AGE......29......

OCCUPATION.....Housewife................. SEX...f..........

N= 9 E= 11 L= 2

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E (11) N (9) L (2)

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | | ⊗ |
| 2. | Have you often got a restless feeling that you want something but do not know what? | | ⊗ |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | | ⊗ |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | | ⊗ |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | ⊗ | |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | ⊗ |
| 7. | Do you sometimes sulk? | ⊗ | |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | ⊗ | |
| 9. | Are you moody? | ⊗ | |
| 10. | Do you like mixing with people? | | ⊗ |
| 11. | Have you often lost sleep over your worries? | | ⊗ |
| 12. | Do you sometimes get cross? | ⊗ | |
| 13. | Would you call yourself happy-go-lucky? | | ⊗ |
| 14. | Do you often make up your mind too late? | | ⊗ |
| 15. | Do you like working alone? | | ⊗ |
| 16. | Have you often felt listless and tired for no good reason? | | ⊗ |
| 17. | Are you rather lively? | | ⊗ |
| 18. | Do you sometimes laugh at a dirty joke? | ● | ⊗ |
| 19. | Do you often feel "fed-up"? | | ⊗ |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | ⊗ |
| 21. | Does your mind often wander when you are trying to attend closely to something? | | ⊗ |
| 22. | Can you put your thoughts into words quickly? | | ⊗ |
| 23. | Are you often "lost in thought"? | | ⊗ |
| 24. | Are you completely free from prejudices of any kind? | | ⊗ |
| 25. | Do you like practical jokes? | | ⊗ |
| 26. | Do you often think of your past? | | ⊗ |
| 27. | Do you very much like good food? | | ⊗ |

| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | X | |
| 29. | Do you mind selling things or asking people for money for some good cause? | | X |
| 30. | Do you sometimes boast a little? | X | |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | | X |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | X | |
| 34. | Do you like planning things carefully, well ahead of time? | X | |
| 35. | Do you have dizzy turns? | X | |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | | X |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | X | |
| 40. | Do you suffer from "nerves"? | | X |
| 41. | Would you rather plan things than do things? | | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | X | |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | | X |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | X |
| 45. | Do you get very bad headaches? | | X |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | | X |
| 47. | Do you find it hard to fall asleep at bedtime? | | X |
| 48. | Have you sometimes told lies in your life? | X | |
| 49. | Do you sometimes say the first thing that comes into your head? | X | |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | | X |
| 52. | Do you often get into a jam because you do things without thinking? | | X |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | | X |
| 54. | Would you rather win than lose a game? | | X |
| 55. | Do you often feel self-conscious when you are with superiors? | X | |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# EYSENCK PERSONALITY INVENTORY

by H. J. Eysenck and Sybil B. G. Eysenck

## PERSONALITY QUESTIONNAIRE

### FORM B

NAME............SUBJECT 4.......... AGE....25.......

OCCUPATION....Housewife............... SEX...f.........

N= 15 E= 6 L= 3

*Instructions*

Here are some questions regarding the way you behave, feel and act. After each question is a space for answering "YES" or "NO".

Try to decide whether "YES" or "NO" represents your usual way of acting or feeling. Then put a cross in the circle under the column headed "YES" or "NO". Work quickly, and don't spend too much time over any question; we want your first reaction, not a long-drawn out thought process. The whole questionnaire shouldn't take more than a few minutes. Be sure not to omit any questions.

Now turn the page over and go ahead. Work quickly, and remember to answer every question. There are no right or wrong answers, and this isn't a test of intelligence or ability, but simply a measure of the way you behave.

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E 6 N 15 L 3

## FORM B

| | | YES | NO |
|---|---|---|---|
| 1. | Do you like plenty of excitement and bustle around you? | | X |
| 2. | Have you often got a restless feeling that you want something but do not know what? | X | |
| 3. | Do you nearly always have a "ready answer" when people talk to you? | | X |
| 4. | Do you sometimes feel happy, sometimes sad, without any real reason? | X | |
| 5. | Do you usually stay in the background at parties and "get-togethers"? | X | |
| 6. | As a child, did you always do as you were told immediately and without grumbling? | | X |
| 7. | Do you sometimes sulk? | X | |
| 8. | When you are drawn into a quarrel, do you prefer to "have it out" to being silent, hoping things will blow over? | X | |
| 9. | Are you moody? | X | |
| 10. | Do you like mixing with people? | | X |
| 11. | Have you often lost sleep over your worries? | | X |
| 12. | Do you sometimes get cross? | X | |
| 13. | Would you call yourself happy-go-lucky? | | X |
| 14. | Do you often make up your mind too late? | | X |
| 15. | Do you like working alone? | X | |
| 16. | Have you often felt listless and tired for no good reason? | X | |
| 17. | Are you rather lively? | | X |
| 18. | Do you sometimes laugh at a dirty joke? | | X |
| 19. | Do you often feel "fed-up"? | X | |
| 20. | Do you feel uncomfortable in anything but everyday clothes? | | X |
| 21. | Does your mind often wander when you are trying to attend closely to something? | X | |
| 22. | Can you put your thoughts into words quickly? | | X |
| 23. | Are you often "lost in thought"? | X | |
| 24. | Are you completely free from prejudices of any kind? | | X |
| 25. | Do you like practical jokes? | | X |
| 26. | Do you often think of your past? | X | |
| 27. | Do you very much like good food? | X | |

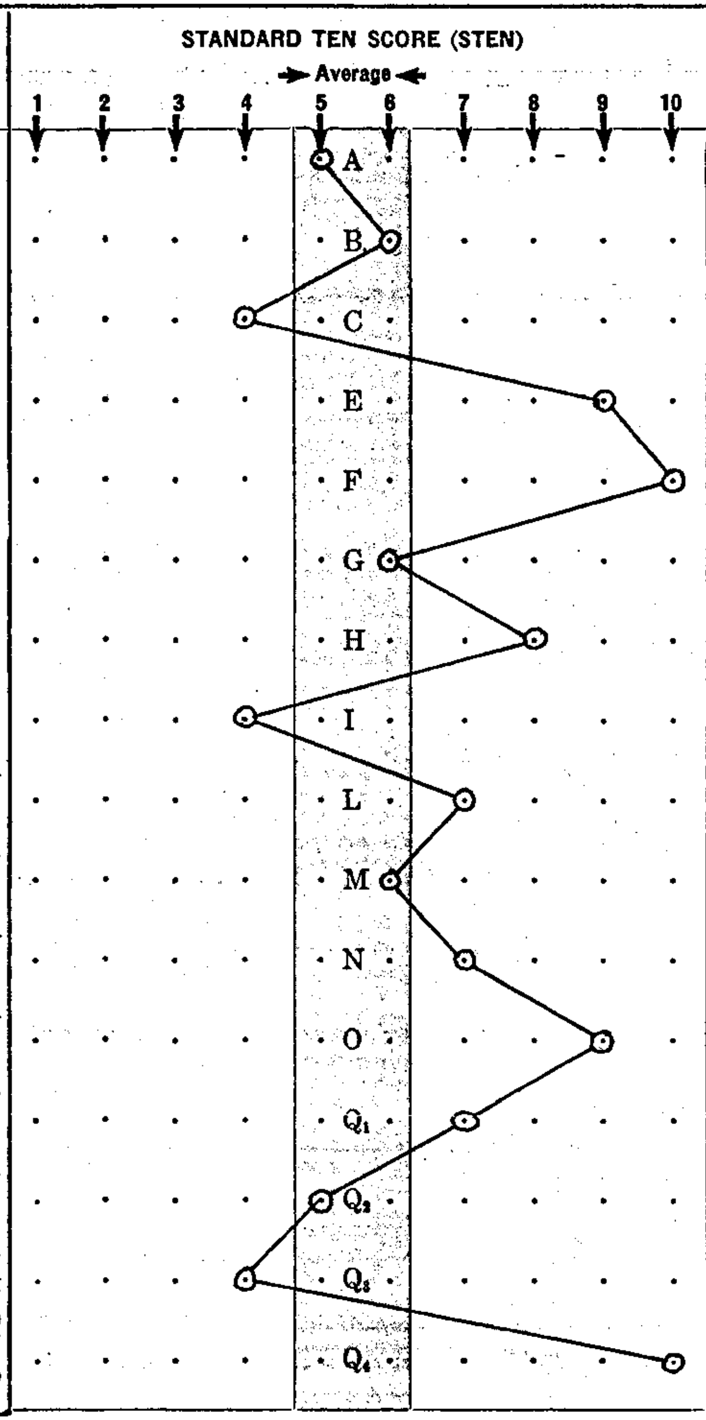
| | | YES | NO |
|---|---|---|---|
| 28. | When you get annoyed, do you need someone friendly to talk to about it? | | X |
| 29. | Do you mind selling things or asking people for money for some good cause? | X | |
| 30. | Do you sometimes boast a little? | | X |
| 31. | Are you touchy about some things? | X | |
| 32. | Would you rather be at home on your own than go to a boring party? | X | |
| 33. | Do you sometimes get so restless that you cannot sit long in a chair? | X | |
| 34. | Do you like planning things carefully, well ahead of time? | X | |
| 35. | Do you have dizzy turns? | | X |
| 36. | Do you *always* answer a personal letter as soon as you can after you have read it? | | X |
| 37. | Can you usually do things better by figuring them out alone than by talking to others about it? | X | |
| 38. | Do you ever get short of breath without having done heavy work? | | X |
| 39. | Are you an easy-going person, not generally bothered about having everything "just-so"? | | X |
| 40. | Do you suffer from "nerves"? | | X |
| 41. | Would you rather plan things than do things? | X | X |
| 42. | Do you sometimes put off until tomorrow what you ought to do today? | X | |
| 43. | Do you get nervous in places like lifts, trains or tunnels? | X | |
| 44. | When you make new friends, is it usually *you* who makes the first move, or does the inviting? | | X |
| 45. | Do you get very bad headaches? | X | |
| 46. | Do you generally feel that things will sort themselves out and come right in the end somehow? | X | |
| 47. | Do you find it hard to fall asleep at bedtime? | | X |
| 48. | Have you sometimes told lies in your life? | X | |
| 49. | Do you sometimes say the first thing that comes into your head? | X | |
| 50. | Do you worry too long after an embarrassing experience? | X | |
| 51. | Do you usually keep "yourself to yourself" except with very close friends? | X | |
| 52. | Do you often get into a jam because you do things without thinking? | X | |
| 53. | Do you like cracking jokes and telling funny stories to your friends? | | X |
| 54. | Would you rather win than lose a game? | | X |
| 55. | Do you often feel self-conscious when you are with superiors? | | X |
| 56. | When the odds are against you, do you still usually think it worth taking a chance? | X | |
| 57. | Do you often get "butterflies in your tummy" before an important occasion? | X | |

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED *ALL* THE QUESTIONS

# 16 P.F. TEST PROFILE

IPAT

| FACTOR | Raw Score Form A | Raw Score Form B | Raw Score Total | Standard Score | LOW SCORE DESCRIPTION | HIGH SCORE DESCRIPTION |
|---|---|---|---|---|---|---|
| A | 11 | | | 5 | **RESERVED,** DETACHED, CRITICAL, COOL (Sizothymia) | **OUTGOING,** WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia) |
| B | 6 | | | 6 | **LESS INTELLIGENT,** CONCRETE-THINKING (Lower scholastic mental capacity) | **MORE INTELLIGENT,** ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity) |
| C | 12 | | | 4 | **AFFECTED BY FEELINGS,** EMOTIONALLY LESS STABLE, EASILY UPSET (Lower ego strength) | **EMOTIONALLY STABLE,** FACES REALITY, CALM, MATURE (Higher ego strength) |
| E | 17 | | | 9 | **HUMBLE,** MILD, ACCOMMODATING, CONFORMING (Submissiveness) | **ASSERTIVE,** INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance) |
| F | 23 | | | 10 | **SOBER,** PRUDENT, SERIOUS, TACITURN (Desurgency) | **HAPPY-GO-LUCKY,** IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC (Surgency) |
| G | 13 | | | 5 | **EXPEDIENT,** EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength) | **CONSCIENTIOUS,** PERSEVERING, STAID, RULE-BOUND (Stronger superego strength) |
| H | 20 | | | 8 | **SHY,** RESTRAINED, DIFFIDENT, TIMID (Threctia) | **VENTURESOME,** SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia) |
| I | 10 | | | 4 | **TOUGH-MINDED,** SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria) | **TENDER-MINDED,** DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia) |
| L | 10 | | | 7 | **TRUSTING,** ADAPTABLE, FREE OF JEALOUSY, EASY TO GET ON WITH (Alaxia) | **SUSPICIOUS,** SELF-OPINIONATED, HARD TO FOOL (Protension) |
| M | 13 | | | 6 | **PRACTICAL,** CAREFUL, CONVENTIONAL, REGULATED BY EXTERNAL REALITIES, PROPER (Praxernia) | **IMAGINATIVE,** WRAPPED UP IN INNER URGENCIES, CARELESS OF PRACTICAL MATTERS, BOHEMIAN (Autia) |
| N | 12 | | | 7 | **FORTHRIGHT,** NATURAL, ARTLESS, SENTIMENTAL (Artlessness) | **SHREWD,** CALCULATING, WORLDLY, PENETRATING (Shrewdness) |
| O | 17 | | | 9 | **PLACID,** SELF-ASSURED, CONFIDENT, SERENE (Untroubled adequacy) | **APPREHENSIVE,** WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness) |
| $Q_1$ | 10 | | | 7 | **CONSERVATIVE,** RESPECTING ESTABLISHED IDEAS, TOLERANT OF TRADITIONAL DIFFICULTIES (Conservatism) | **EXPERIMENTING,** CRITICAL, LIBERAL, ANALYTICAL, FREE-THINKING (Radicalism) |
| $Q_2$ | 9 | | | 5 | **GROUP-DEPENDENT,** A "JOINER" AND SOUND FOLLOWER (Group adherence) | **SELF-SUFFICIENT,** PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency) |
| $Q_3$ | 9 | | | 4 | **UNDISCIPLINED SELF-CONFLICT,** FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration) | **CONTROLLED,** SOCIALLY-PRECISE, FOLLOWING SELF-IMAGE (High self-concept control) |
| $Q_4$ | 25 | | | 10 | **RELAXED,** TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension) | **TENSE,** FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension) |




| A sten of | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | is obtained |
|---|---|---|---|---|---|---|---|---|---|---|---|
| by about | 2.3% | 4.4% | 9.2% | 15.0% | 19.1% | 19.1% | 15.0% | 9.2% | 4.4% | 2.3% | of adults |

Name: SUBJECT 1

Comments:

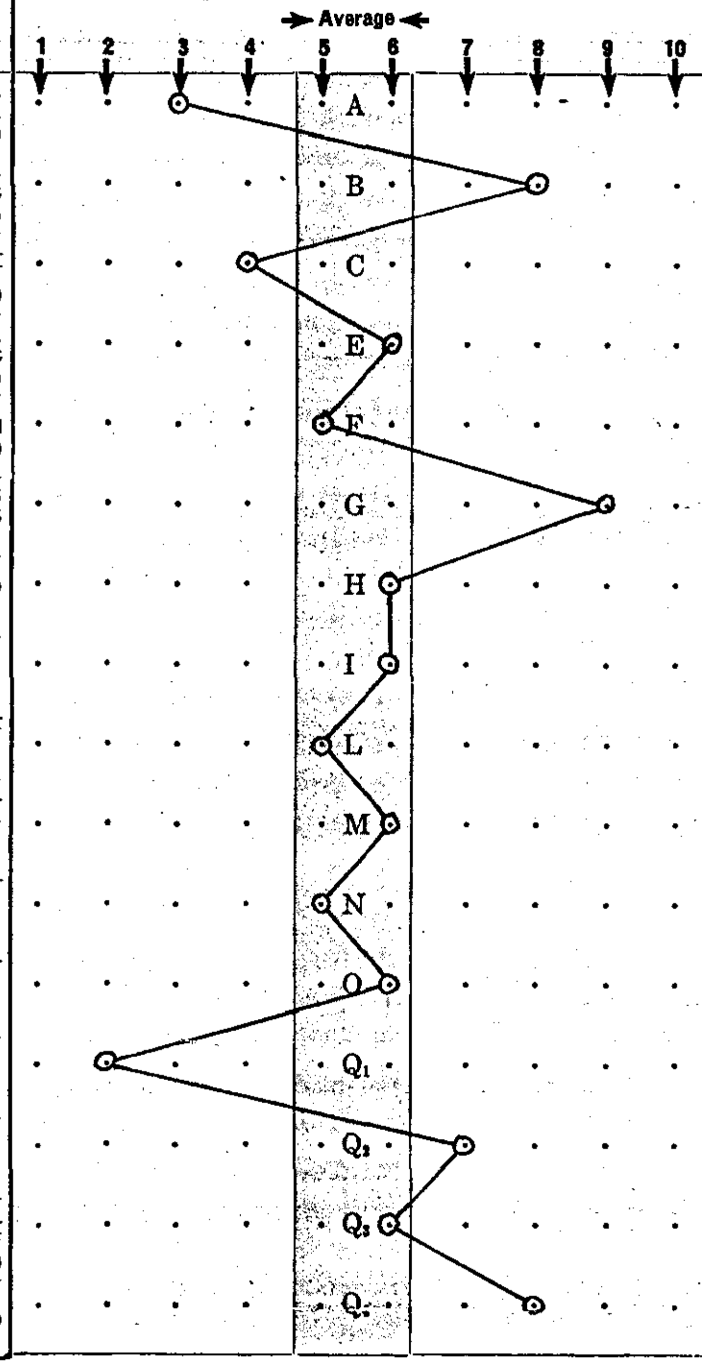
# 16 P.F. TEST PROFILE

Name: SUBJECT 2

Comments:

| FACTOR | Raw Score Form A | Raw Score Form B | Raw Score Total | Standard Score | LOW SCORE DESCRIPTION | HIGH SCORE DESCRIPTION |
|---|---|---|---|---|---|---|
| A | 8 | | | 3 | **RESERVED,** DETACHED, CRITICAL, COOL (Sizothymia) | **OUTGOING,** WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia) |
| B | 8 | | | 8 | **LESS INTELLIGENT,** CONCRETE-THINKING (Lower scholastic mental capacity) | **MORE INTELLIGENT,** ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity) |
| C | 13 | | | 4 | **AFFECTED BY FEELINGS,** EMOTIONALLY LESS STABLE, EASILY UPSET (Lower ego strength) | **EMOTIONALLY STABLE,** FACES REALITY, CALM, MATURE (Higher ego strength) |
| E | 11 | | | 6 | **HUMBLE,** MILD, ACCOMMODATING, CONFORMING (Submissiveness) | **ASSERTIVE,** INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance) |
| F | 13 | | | 5 | **SOBER,** PRUDENT, SERIOUS, TACITURN (Desurgency) | **HAPPY-GO-LUCKY,** IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC (Surgency) |
| G | 18 | | | 9 | **EXPEDIENT,** EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength) | **CONSCIENTIOUS,** PERSEVERING, STAID, RULE-BOUND (Stronger superego strength) |
| H | 13 | | | 6 | **SHY,** RESTRAINED, DIFFIDENT, TIMID (Threctia) | **VENTURESOME,** SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia) |
| I | 12 | | | 6 | **TOUGH-MINDED,** SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria) | **TENDER-MINDED,** DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia) |
| L | 6 | | | 5 | **TRUSTING,** ADAPTABLE, FREE OF JEALOUSY, EASY TO GET ON WITH (Alaxia) | **SUSPICIOUS,** SELF-OPINIONATED, HARD TO FOOL (Protension) |
| M | 14 | | | 6 | **PRACTICAL,** CAREFUL, CONVENTIONAL, REGULATED BY EXTERNAL REALITIES, PROPER (Praxernia) | **IMAGINATIVE,** WRAPPED UP IN INNER URGENCIES, CARELESS OF PRACTICAL MATTERS, BOHEMIAN (Autia) |
| N | 10 | | | 5 | **FORTHRIGHT,** NATURAL, ARTLESS, SENTIMENTAL (Artlessness) | **SHREWD,** CALCULATING, WORLDLY, PENETRATING (Shrewdness) |
| O | 12 | | | 6 | **PLACID,** SELF-ASSURED, CONFIDENT, SERENE (Untroubled adequacy) | **APPREHENSIVE,** WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness) |
| $Q_1$ | 4 | | | 2 | **CONSERVATIVE,** RESPECTING ESTABLISHED IDEAS, TOLERANT OF TRADITIONAL DIFFICULTIES (Conservatism) | **EXPERIMENTING,** CRITICAL, LIBERAL, ANALYTICAL, FREE-THINKING (Radicalism) |
| $Q_2$ | 13 | | | 7 | **GROUP-DEPENDENT,** A "JOINER" AND SOUND FOLLOWER (Group adherence) | **SELF-SUFFICIENT,** PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency) |
| $Q_3$ | 13 | | | 6 | **UNDISCIPLINED SELF-CONFLICT,** FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration) | **CONTROLLED,** SOCIALLY-PRECISE, FOLLOWING SELF-IMAGE (High self-concept control) |
| $Q_4$ | 18 | | | 8 | **RELAXED,** TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension) | **TENSE,** FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension) |

STANDARD TEN SCORE (STEN)




| A sten of | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | is obtained |
|---|---|---|---|---|---|---|---|---|---|---|---|
| by about | 2.3% | 4.4% | 9.2% | 15.0% | 19.1% | 19.1% | 15.0% | 9.2% | 4.4% | 2.3% | of adults |

# 16 P.F. TEST PROFILE

Name: SUBJECT 3

Comments:

| FACTOR | Raw Score Form A | Raw Score Form B | Raw Score Total | Standard Score | LOW SCORE DESCRIPTION | HIGH SCORE DESCRIPTION |
|---|---|---|---|---|---|---|
| A | 6 | | | 2 | **RESERVED,** DETACHED, CRITICAL, COOL (Sizothymia) | **OUTGOING,** WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia) |
| B | 8 | | | 8 | **LESS INTELLIGENT,** CONCRETE-THINKING (Lower scholastic mental capacity) | **MORE INTELLIGENT,** ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity) |
| C | 17 | | | 6 | **AFFECTED BY FEELINGS,** EMOTIONALLY LESS STABLE, EASILY UPSET (Lower ego strength) | **EMOTIONALLY STABLE,** FACES REALITY, CALM, MATURE (Higher ego strength) |
| E | 17 | | | 4 | **HUMBLE,** MILD, ACCOMMODATING, CONFORMING (Submissiveness) | **ASSERTIVE,** INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance) |
| F | 10 | | | 4 | **SOBER,** PRUDENT, SERIOUS, TACITURN (Desurgency) | **HAPPY-GO-LUCKY,** IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC (Surgency) |
| G | 8 | | | 3 | **EXPEDIENT,** EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength) | **CONSCIENTIOUS,** PERSEVERING, STAID, RULE-BOUND (Stronger superego strength) |
| H | 7 | | | 3 | **SHY,** RESTRAINED, DIFFIDENT, TIMID (Threctia) | **VENTURESOME,** SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia) |
| I | 13 | | | 6 | **TOUGH-MINDED,** SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria) | **TENDER-MINDED,** DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia) |
| L | 10 | | | 7 | **TRUSTING,** ADAPTABLE, FREE OF JEALOUSY, EASY TO GET ON WITH (Alaxia) | **SUSPICIOUS,** SELF-OPINIONATED, HARD TO FOOL (Protension) |
| M | 12 | | | 5 | **PRACTICAL,** CAREFUL, CONVENTIONAL, REGULATED BY EXTERNAL REALITIES, PROPER (Praxernia) | **IMAGINATIVE,** WRAPPED UP IN INNER URGENCIES, CARELESS OF PRACTICAL MATTERS, BOHEMIAN (Autia) |
| N | 12 | | | 7 | **FORTHRIGHT,** NATURAL, ARTLESS, SENTIMENTAL (Artlessness) | **SHREWD,** CALCULATING, WORLDLY, PENETRATING (Shrewdness) |
| O | 13 | | | 7 | **PLACID,** SELF-ASSURED, CONFIDENT, SERENE (Untroubled adequacy) | **APPREHENSIVE,** WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness) |
| $Q_1$ | 7 | | | 4 | **CONSERVATIVE,** RESPECTING ESTABLISHED IDEAS, TOLERANT OF TRADITIONAL DIFFICULTIES (Conservatism) | **EXPERIMENTING,** CRITICAL, LIBERAL, ANALYTICAL, FREE-THINKING (Radicalism) |
| $Q_2$ | 14 | | | 8 | **GROUP-DEPENDENT,** A "JOINER" AND SOUND FOLLOWER (Group adherence) | **SELF-SUFFICIENT,** PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency) |
| $Q_3$ | 14 | | | 7 | **UNDISCIPLINED SELF-CONFLICT,** FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration) | **CONTROLLED,** SOCIALLY-PRECISE, FOLLOWING SELF-IMAGE (High self-concept control) |
| $Q_4$ | 16 | | | 7 | **RELAXED,** TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension) | **TENSE,** FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension) |

STANDARD TEN SCORE (STEN): 1 2 3 4 5 6 7 8 9 10 (Average: 5–6)

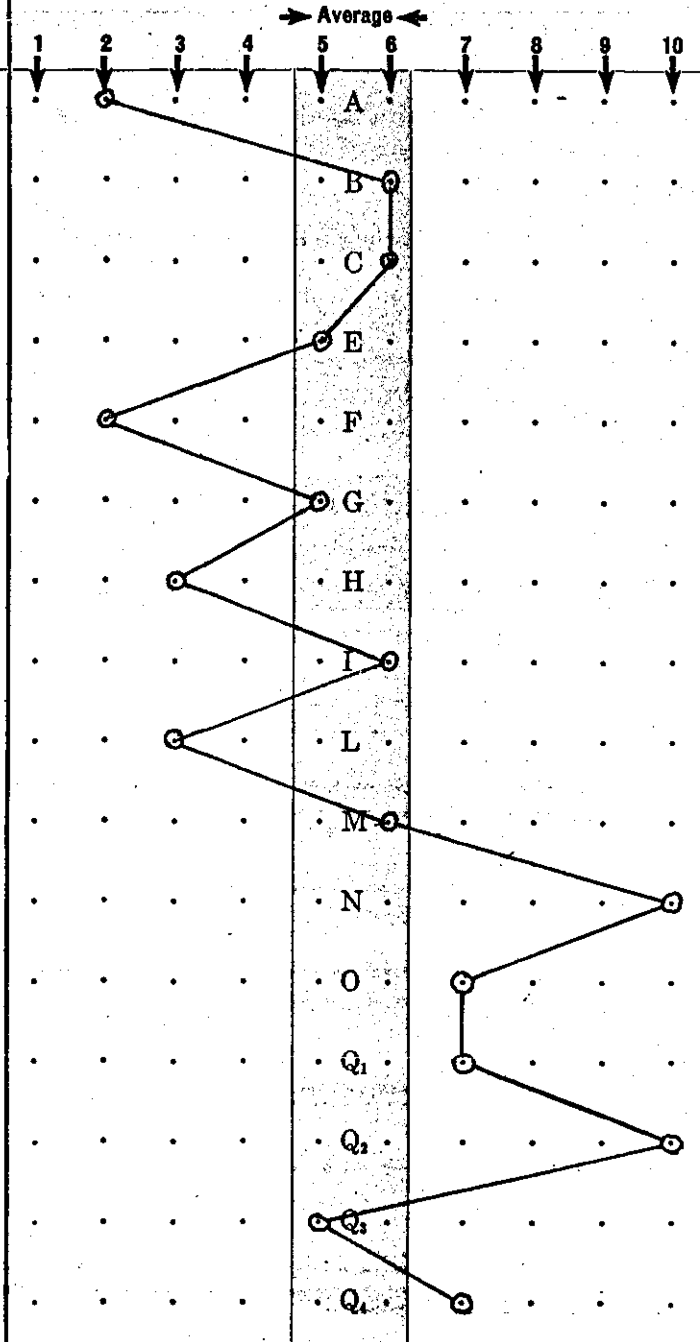
| A sten of | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| by about | 2.3% | 4.4% | 9.2% | 15.0% | 19.1% | 19.1% | 15.0% | 9.2% | 4.4% | 2.3% | of adults |

*A sten of … is obtained by about … of adults*

# 16 P.F. TEST PROFILE

| FACTOR | Raw Score Form A | Raw Score Form B | Raw Score Total | Standard Score | LOW SCORE DESCRIPTION | HIGH SCORE DESCRIPTION |
|---|---|---|---|---|---|---|
| A | 6 | | | 2 | **RESERVED,** DETACHED, CRITICAL, COOL (Sizothymia) | **OUTGOING,** WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia) |
| B | 6 | | | 6 | **LESS INTELLIGENT,** CONCRETE-THINKING (Lower scholastic mental capacity) | **MORE INTELLIGENT,** ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity) |
| C | 16 | | | 6 | **AFFECTED BY FEELINGS,** EMOTIONALLY LESS STABLE, EASILY UPSET (Lower ego strength) | **EMOTIONALLY STABLE,** FACES REALITY, CALM, MATURE (Higher ego strength) |
| E | 9 | | | 5 | **HUMBLE,** MILD, ACCOMMODATING, CONFORMING (Submissiveness) | **ASSERTIVE,** INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance) |
| F | 5 | | | 2 | **SOBER,** PRUDENT, SERIOUS, TACITURN (Desurgency) | **HAPPY-GO-LUCKY,** IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC (Surgency) |
| G | 12 | | | 5 | **EXPEDIENT,** EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength) | **CONSCIENTIOUS,** PERSEVERING, STAID, RULE-BOUND (Stronger superego strength) |
| H | 5 | | | 3 | **SHY,** RESTRAINED, DIFFIDENT, TIMID (Threctia) | **VENTURESOME,** SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia) |
| I | 12 | | | 6 | **TOUGH-MINDED,** SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria) | **TENDER-MINDED,** DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia) |
| L | 4 | | | 3 | **TRUSTING,** ADAPTABLE, FREE OF JEALOUSY, EASY TO GET ON WITH (Alaxia) | **SUSPICIOUS,** SELF-OPINIONATED, HARD TO FOOL (Protension) |
| M | 13 | | | 6 | **PRACTICAL,** CAREFUL, CONVENTIONAL, REGULATED BY EXTERNAL REALITIES, PROPER (Praxernia) | **IMAGINATIVE,** WRAPPED UP IN INNER URGENCIES, CARELESS OF PRACTICAL MATTERS, BOHEMIAN (Autia) |
| N | 16 | | | 10 | **FORTHRIGHT,** NATURAL, ARTLESS, SENTIMENTAL (Artlessness) | **SHREWD,** CALCULATING, WORLDLY, PENETRATING (Shrewdness) |
| O | 13 | | | 7 | **PLACID,** SELF-ASSURED, CONFIDENT, SERENE (Untroubled adequacy) | **APPREHENSIVE,** WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness) |
| $Q_1$ | 10 | | | 7 | **CONSERVATIVE,** RESPECTING ESTABLISHED IDEAS, TOLERANT OF TRADITIONAL DIFFICULTIES (Conservatism) | **EXPERIMENTING,** CRITICAL, LIBERAL, ANALYTICAL, FREE-THINKING (Radicalism) |
| $Q_2$ | 18 | | | 10 | **GROUP-DEPENDENT,** A "JOINER" AND SOUND FOLLOWER (Group adherence) | **SELF-SUFFICIENT,** PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency) |
| $Q_3$ | 11 | | | 5 | **UNDISCIPLINED SELF-CONFLICT,** FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration) | **CONTROLLED,** SOCIALLY-PRECISE, FOLLOWING SELF-IMAGE (High self-concept control) |
| $Q_4$ | 16 | | | 7 | **RELAXED,** TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension) | **TENSE,** FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension) |

STANDARD TEN SCORE (STEN)




| A sten of | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | is obtained |
|---|---|---|---|---|---|---|---|---|---|---|---|
| by about | 2.3% | 4.4% | 9.2% | 15.0% | 19.1% | 19.1% | 15.0% | 9.2% | 4.4% | 2.3% | of adults |



Name: SUBJECT 4

Comments:

# APPENDIX V

Copy of paper: "Studies of a Repetitive Task Simulating Industrial Press Operation"

THE INSTITUTION OF PRODUCTION ENGINEERS

# STUDIES OF A REPETITIVE TASK SIMULATING INDUSTRIAL PRESS OPERATION

by

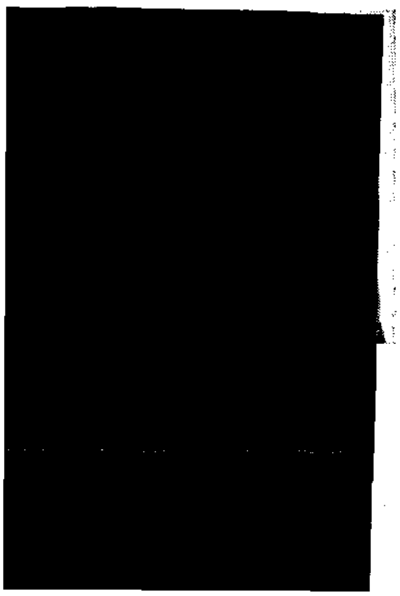
**Miss O. HARTNETT,** BA, MSc

As appearing in the June 1967 issue of "The Production Engineer" [redacted]

Miss O. **HARTNETT**, BA, MSc

# Studies of a Repetitive Task Simulating Industrial Press Operation

Miss Oonagh Hartnett was educated at various schools, in England, Ireland and the United States. She took her first degree at Trinity College, Dublin and did the research for this Paper while working for an MSc in the Department of Ergonomics and Cybernetics at Loughborough University of Technology. She is at present working in this Department doing further research under the supervision of Dr. Elwyn Edwards. Her work is supported financially by the Medical Research Council. During the seven years, 1957 - 1964, Miss Hartnett gained considerable experience of industry when she was one of Her Majesty's Inspectors of Factories.



DURING 1964 there were 268,648 reported accidents in premises subject to the Factories Act. Of these, 37,216 were caused by machinery in motion under power and 3,466 by non-powered machinery. The Ministry of Labour has considered it worthwhile issuing two booklets dealing specifically with safety on one type of machine, the press. One of these booklets is concerned with safety devices for hand and foot operated presses and the second with safety in the use of mechanical power presses. This indicates that it must be the experience of the Ministry's Safety, Health and Welfare Department that presses have considerable potential as accident producers.

Experience obtained while a member of HM Factory Inspectorate inclines the author to the opinion that accidents happen on hand-fed, foot-operated presses, whether of the power or non-power variety, when the repetitive rhythm of the work cycle is interrupted at one point but not totally suspended. For instance, one of the operative's hands may be physically delayed under the tool of a press because a particular work piece is proving awkward to position but there is no such delay imposed on movements by the other hand or on the operative's foot movements and because he is so accustomed to the rhythm of the work cycle he is unable to break that cycle quickly enough and he brings the tool of the press down on his own hand.

In this experiment an attempt was made to simulate some of the conditions of this type of industrial accident. During a run of repetitive work on such presses subjects were presented unexpectedly with a task (switching off stimulus lights) which involved an interruption of the rhythm and cycle of their repetitive work and which entailed response by both hand and foot. The project was concerned to try to distinguish between a number of possibilities:

(i) whether subjects with fast reaction times would be more capable than subjects with slower times of interrupting work cycles when external stimuli occurred;

(ii) whether or not subjects would find it more difficult to halt in the middle of a cycle as their performance of a simple repetitive operation became faster more skilled and automatic;

(iii) whether or not the subjects' capacity to interrupt their work cycles correlated positively or negatively with the length of time worked without a rest break.

## the subjects

Four married women were employed as subjects to operate the presses. None had any industrial experience. Three were normally employed as cleaners in the University and the fourth worked usually at a tea bar, again in the University.

The subjects were well motivated. Not only were they paid slightly more than they would have been paid at their usual employment but also they were employed during the summer vacation at a time when


**Fig. 1. The experimental press equipment**

normally they would have been receiving no pay at all as their usual services are not required in the University during vacations.

All of the subjects said that they liked the work, that it was easier than their usual work. They all inquired about further employment and two put on weight!

The Wechsler Adult Intelligence Scale was given to each subject, the results being as follows:

Subject 1: Married, aged 55 years, IQ 119. Usual work — tea-bar assistant. Right handed.

Subject 2: Married, aged 38 years, IQ 79. Usual work — cleaner. Right handed.

Subject 3: Married, aged 52 years, IQ 73. Usual work — cleaner. Right handed.

Subject 4: Married, aged 56 years, IQ 80. Usual work — cleaner. Right handed.

### the equipment

#### *four foot-operated, hand-fed presses*

These were mounted each on an equal segment of a 4 ft. × 4 ft. table, as shown in Fig. 1.

Tool and die: Circular $\frac{1}{4}$ in. diameter case hardened mild steel.

Tool stroke: $1\frac{3}{8}$ in.

Back stop and guide: Mounted behind and to the left or take off side of the die. Adjustable from $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. from the centre of the die.

Foot pedal: 11 in. × $3\frac{1}{2}$ in.

Guards: Each tool and each die was surrounded by a fixed perspex guard with $\frac{1}{8}$ in. clearance between its base and the table. Thus it could also be used as a stripper plate.

All the electric wiring was of low voltage.

#### *work piece*

White cardboard squares, 3 in. × 3 in. × $\frac{1}{48}$ in.

#### *stimulus lights*

These were $\frac{3}{8}$ in. diameter, red and green, mounted beside and 2 in. to the rear of the die. They were wired via two switches in series, the first was controlled by the Experimenter, the second operated when the workpiece came in contact with the back stop. Thus the stimulus lights appeared at the instant in any cycle (selected by the Experimenter) at the point when operation of the foot-pedal was due.

#### *stop clocks*

Two Venner electronic millisecond stop clocks automatically timed the intervals between the illumination of the two lights and their being extinguished by the depression of micro switches placed adjacent to the tool and foot pedal respectively.

#### *mechanism for counting the number of strokes*

A fourth micro switch was mounted on the punch arm support so that it was depressed at each descent of the tool. Each time the switch was depressed an

English Numbering Machines counter registered a count of one. The numbering machine was connected with a Labgear timing unit. The number of counts was stored and a running total was printed out every 20 seconds separately for each machine.

### the chairs

Four Tan-Sad True Posture chairs were used. The seats and back rests were adjustable. The seats were not padded and subject No. 3 brought a cushion.

### the experimental procedure

Each of the four subjects operated a hand-fed, foot-operated press. They punched holes in squares of cardboard. Two lights were positioned beside the tool of each press. At times unexpected by the subject these lights were switched on. One switch controlled both lights so that they were turned on simultaneously. The subjects had to respond by turning the lights off. Two switches were used for this purpose, one operated by the hand and the other by the foot. In each case the preferred hand was used both to feed the work and operate the hand switch and the preferred foot to press the pedal and operate the foot switch.

Thus, during a run of repetitive work on a press, subjects were presented unexpectedly with a task which involved an interruption in the rhythm and cycle of their repetitive work and which entailed response by the use of both hand and foot.

The experiment continued from 9 a.m. to 12.30 p.m., five days a week for four weeks.

### the subjects' tasks

1. Using the presses to punch holes in pieces of cardboard. This involved the subject in picking up a workpiece from her right, feeding it under the tool until it was aligned with both back stop and guide, bringing down the tool to punch the hole by depressing the foot pedal, releasing the tool by taking the pressure off the pedal, removing the workpiece from under the tool and placing it on the left.
2. Turning out stimulus lights. The subject depressed two micro switches to turn these lights out.

### the independent variables

*1. Periods in the Day*

Each daily session was divided into seven half-hour periods (though only in weeks 1 and 3 were these periods physically separate — see 2 below). Period 1 was from 9 a.m. to 9.30 a.m. and so on to Period 7 which was from 12 noon until 12.30 p.m.

*2. Rest Breaks*

(a) During Weeks 1 and 3 a five minute break was allowed half-hourly and a 15 minute break for coffee at 10.30 a.m. ("with breaks").

(b) During Weeks 2 and 4 only the break for coffee was allowed at 10.30 a.m. The five minute half-hourly breaks were discontinued ("without breaks").

*3. Stimuli from Lights*

The lights were turned on and each subject required to respond to these stimuli by turning the lights off once only in each period. The stimuli were given at one of the following times: five, ten, 15, 20 or 25 minutes after the beginning of a period (called Stimuli 1, 2, 3, 4 or 5 respectively).

Each subject had, as nearly as possible, an equal number of the same type of stimuli.

### the dependent variables

*1. Production*

Records were made of the number of strokes made or holes punched every 20 seconds by each subject.

*2. Reaction Time*

Measurements were made of the length of time it took each subject to respond to the stimuli lights. Hand and foot reaction times were recorded separately.

### instructions to and remarks of subjects

During the first half hour of the first day no recording was done. The time was used to instruct the subjects and to allow them to practice. They were shown the apparatus and were told: "This is a machine for punching holes in cards. In a few minutes you will be shown how it works. Your job is to punch holes in as many cards as you possibly can. During this week you will have a five minute rest break every half hour and a 15 minute break for coffee at 10.30 a.m. You may talk if you want to or not if you don't want to. You may smoke if you wish and listen to the radio".

The subjects were then shown how the presses worked. They were also shown how the stimulus lights worked and were told: "These lights will come on now and again. When they do come on, turn them off immediately and when you have turned them off continue with the punching".

The subjects were shown the switches for turning off the lights, and were allowed to practice at this to ensure that they understood.

During the remainder of the half hour the subjects practiced punching holes in the cards. They were then told to start and once more were told: "Punch holes in as many cards as you can".

At the beginning of the second week the subjects were told that there would be one break only, lasting 15 minutes, at 10.30 a.m. The third week they were told that a return was to be made to the half hourly breaks and during the fourth that the one 15 minute break only would be allowed. All of the subjects spoke out strongly in favour of the single break. They said that a break every half hour disturbed their work just when they "had got nicely into it".

At the beginning of the second week the subjects were further instructed about the switching off of the stimulus lights. They were told "be sure to switch off the lights as soon as they come on even if it means stopping in the middle of punching a hole". All the subjects replied that this was exactly what they did.

**TABLE I**
**Hand Reaction Times (secs.) for different Subjects**

| *Subjects* | *N* | $\bar{X}$ | *S.D.* |
|---|---|---|---|
| 1 | 135 | 1·13970 | ·42044 |
| 2 | 135 | 1·16725 | ·23368 |
| 3 | 135 | 1·53096 | ·49302 |
| 4 | 134 | 1·22888 | ·25122 |

**TABLE II**
**Foot Reaction Times (secs.) for different Subjects**

| *Subjects* | *N* | $\bar{X}$ | *S.D.* |
|---|---|---|---|
| 1 | 133 | ·91293 | ·49799 |
| 2 | 133 | 1·32218 | ·56538 |
| 3 | 133 | 2·04511 | ·77014 |
| 4 | 134 | 1·96634 | ·32080 |

Another demonstration was then given to them and particular emphasis was placed on the fact that the foot should depress the switch for the lights before the foot pedal of the press. The subjects once more were told to " start " and to punch holes in as many cards as they could

At the end of each session each subject was told how many strokes she had made that day. The subjects all tried hard to improve on the previous day's total.

## the results and discussion

Means and standard deviations of both production data and reaction times were computed on an IBM 1620.

### *reaction times*

*1. Subjects' reaction to Stimuli versus Work Cycle Rhythm*

There was no correlation between the speed of reaction times to the stimulus and the subjects' ability to interrupt their work cycle.

The subjects' increased skill and speed at the repetitive operation had no effect on their ability to respond to the stimuli in preference to the cycle rhythm.

Rest breaks produced no improvement in the subjects' capacities to respond first to the external stimuli. On 385 occasions out of 395 the rhythm of the work cycle was not broken until the foot movement had been completed even though the subjects were trying to give precedence to the stimuli external to and in conflict with the work cycle.

On every occasion Subjects 3 and 4 completed the work cycle movement before responding to the external stimuli. Subject 1 responded first to the work cycle movement on 99 occasions out of 100 and Subject 2, 89 times out of 98. This was in spite of special efforts and reminders to respond to the external stimuli first. Undoubtedly in this preliminary experiment accident conditions were simulated successfully in practically every instance. The conclusion must be drawn that when such conditions arise during similar repetitive work in industry an accident will almost inevitably result.

It has already been suggested in the introduction to this Paper that such conditions do arise. Work at presses was mentioned, work at wire switching machines and platen printing machines might also be suggested as indeed might repetitive work at any hand-fed machine where a similar trap is involved.

*2. The means and standard deviations of Hand and Foot Reaction Times*

Both hand and foot mean reaction times were between one and two seconds (Tables I and II). Subject 1, the most intelligent and Subject 2 the youngest had significantly the fastest hand and foot reaction times. There was no significant difference between the mean hand reaction times of these two subjects but Subject 1's foot responses were highly significant, the faster of the two. Haider and Popper (1965) did experiments to find out the reaction times of persons doing repetitive work in industry to unprepared for and infrequently given light signals. They found reaction times to be on average between one and two seconds. However, the two sets of results are not directly comparable because the responses in Haider and Popper's experiment involved the foot only whereas the repetitive work in which these subjects were engaged involved the hands only so that a break in the work cycle was not necessarily involved.

*3. Learning*

Both hand and foot reaction times improved highly significantly each week (Fig. 2, Tables III and IV). Week 1 was significantly more variable than Week 2 in the case of hand reaction times; otherwise there was no significant decrease in variability in either hand or foot reaction times. Observations suggest that the learning effect may have been due to shortened movement time rather than to improved response initiation time. The subjects located the switches

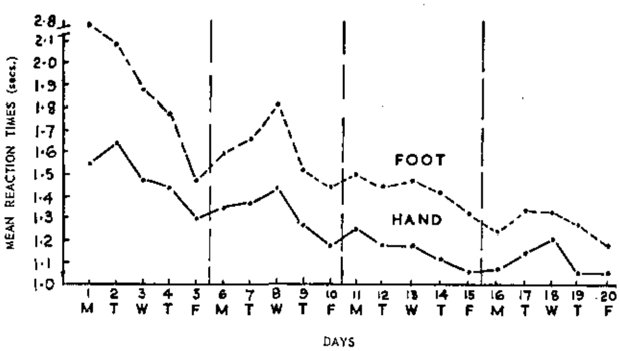



**Fig. 2. All subjects — Mean reaction times for each day**

**TABLE III**
**Hand Reaction Times (secs.) for different Weeks**

| Weeks | N | $\bar{X}$ | S.D. |
|---|---|---|---|
| 1 | 130 | 1·48061 | ·47087 |
| 2 | 135 | 1·32081 | ·34422 |
| 3 | 139 | 1·16287 | ·32333 |
| 4 | 135 | 1·11377 | ·33674 |

**TABLE IV**
**Foot Reaction Times (secs.) for different Weeks**

| Weeks | N | $\bar{X}$ | S.D. |
|---|---|---|---|
| 1 | 127 | 1·97118 | ·86828 |
| 2 | 131 | 1·60167 | ·71602 |
| 3 | 137 | 1·43167 | ·58926 |
| 4 | 138 | 1·27869 | ·53898 |

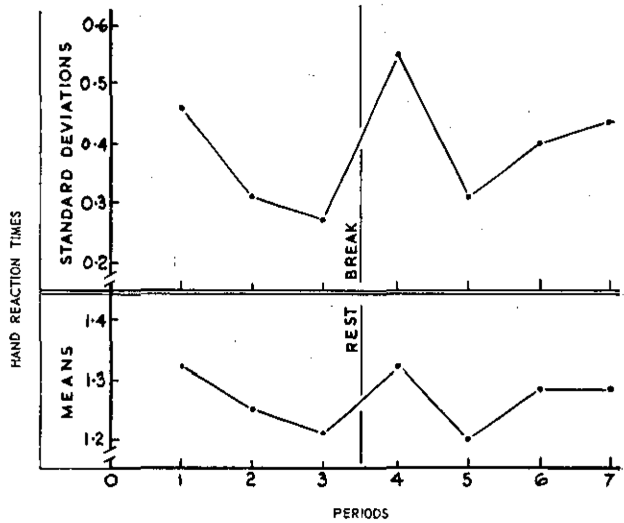



**Fig. 3. All subjects — Means and standard deviations of hand reaction times for different periods**

automatically and without looking as the experiment progressed whereas at the beginning they usually looked to see if their hand or foot was touching the switch.

### 4. *The Seven Periods of the working session*

The combined results from the four subjects for foot reaction times did not differ significantly over the seven periods. The results from the hand reaction times were interesting (Fig. 3, Table V). Reaction times in Period 1 at the start of the session were highly significantly more variable than those in Periods 2, 3 and 5. Those during Period 4, immediately after the break, were highly significantly more variable than reaction times during Periods 2, 3, 5 and 6 and significantly more variable than those during Period 7. Period 7, the last of the working sessions, had the slowest and most variable reaction times after Periods 1 and 4. Periods 1 and 4 as well as being the periods during which variability was greatest also had the slowest mean reaction times though the only statistically significant result (5% level) was that Period 1 was slower than Periods 3 and 5. The pattern at the start of the day was similar to that after the coffee break, reaction times being slower and more variable to start with and then showing improvement during the next two periods. It might have been expected that, at the start of the day and after a break, the subjects would be less fatigued and that therefore the reaction times would be faster and less variable at those times but this was not so. It is possible that during these periods the subjects may have been concentrating on trying to "get into their stride" on production and therefore found it more difficult to respond to the stimulus outside the work cycle. During the last period, i.e. Period 7, the subjects may have been trying to reach their concept of a "satisfactory day's work" (Smith, 1953) and again may have been concentrating particularly on production. This may be one of the reasons why Period 7 had the slowest and most variable reaction times after Periods 1 and 4.

The results from each subject individually followed the overall trends.

**TABLE V**
**Hand Reaction Times (secs.) for different Periods**

| Periods | N | $\bar{X}$ | S.D. |
|---|---|---|---|
| 1 | 68 | 1·32058 | ·45907 |
| 2 | 79 | 1·25202 | ·31163 |
| 3 | 78 | 1·21051 | ·26524 |
| 4 | 76 | 1·32250 | ·54509 |
| 5 | 79 | 1·20493 | ·30560 |
| 6 | 79 | 1·28253 | ·39534 |
| 7 | 80 | 1·28300 | ·43848 |

**TABLE VI**
**Mean Number of Strokes (per 20 secs.) for different Subjects**

| Subjects | N | $\bar{X}$ | S.D. |
|---|---|---|---|
| 1 | 9856 | 10·2914 | 3·2442 |
| 2 | 9808 | 6·5517 | 2·2951 |
| 3 | 9881 | 5·9648 | 2·3375 |
| 4 | 9999 | 7·6796 | 2·7036 |

### 5. *"With Breaks" and "Without Breaks" conditions*

With one exception the results from the two conditions show the same trends as the four weeks overall. During the "with breaks" condition Period 2 had slower reaction times than Period 1. The difference between the two periods was not significant and Period 1 remained more variable than Period 2 as the overall results showed. It would seem that short breaks of five minutes every half hour had little or no effect on reaction times but that the longer breaks of 15 minutes had, as previously discussed.

### 6. *The Day of the Week Effect*

The results from comparing the days of the week were not conclusive enough though the tendency was for Thursdays and Fridays to have both the fastest reaction times and the least variability.

### 7. *The Five Stimuli*

The results from the reaction times to the different stimuli (e.g. 5, 10, 15, 20 and 25 minutes after a five minute break) run counter to what might have been expected. Hand reaction times were significantly slower 15 minutes after the break than they were 20 or 25 minutes afterwards.

### 8. *Hand and Foot Reaction Times Compared*

The hand reaction times of Subjects 2, 3 and 4 were faster than their foot reaction times but Subject 1 had a slower hand reaction time. Perhaps the most notable difference between the two sets of times was the lack of effect which the variables had on the foot reaction times. Apart from the learning effect foot reaction times were remarkably steady.

## production

### 1. *Cycle Speeds*

The cycle speeds of the subjects compare realistically with the speeds of persons operating some foot presses in industry. Previous to the experiment the speeds of five different press operators, in three different factories were observed and their cycle times varied from between one and five seconds. Table VI shows the mean number of cycles completed by each subject every 20 seconds. Subject 1 the most intelligent, was the fastest followed by Subjects 4, 2 and 3.

### 2. *Learning*

Fig. 4 shows the results from all subjects combined over the four weeks. Each week there was a highly

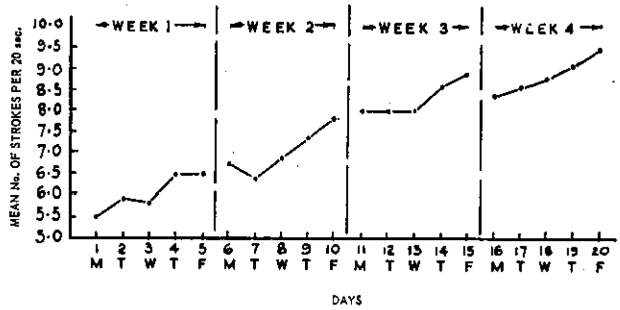



**Fig. 4. All subjects — Mean number of strokes per 20 seconds, for each day**

significant increase in production. The results from three of the subjects individually follow the same trend but in the case of Subject 1, Week 4 showed less production than Week 3. It is perhaps remarkable that learning should continue for so long when so simple an operation was involved.

The combined results give the impression that as production increased variability decreased, but the individual results from each subject do not support this idea so well. In the case of Subjects 1, 2 and 3 variability did decrease as production increased but for the first three weeks and not for the fourth. Subject 4's variability decreased for the first two weeks only.

### 3. *The Seven Periods (Tables VII and VIII)*

Wyalt and Frazer (1925) concluded that the introduction of a ten minute rest pause caused an increase in the nett rate of working and that this increase occurred in periods both preceding and following the rest. Murrell and Forsaith (1963) showed that the introduction of two pauses into a working period would reduce variability. In this experiment in the "without breaks" condition (e.g. with one 15 minute break only) there were no significant differences between the means of any of the periods. There was a steady though not significant drop in production through Periods 1 and 3 before the break. The drop continued in Period 4 immediately after the break and then there was another steady though insignificant rise in production through Periods 5, 6, and 7 to the end of the working session. In the "with breaks"

**TABLE VII**
**Mean Number of Strokes (per 20 secs.) for different Periods Weeks 2 and 4 (without breaks)**

| *Periods* | *N* | $\bar{X}$ | *S.D.* |
|---|---|---|---|
| 1 | 2478 | 8·0593 | 3·0320 |
| 2 | 3374 | 7·9853 | 3·0934 |
| 3 | 3420 | 7·9788 | 3·1343 |
| 4 | 1750 | 7·9457 | 3·0430 |
| 5 | 3479 | 7·9813 | 3·1519 |
| 6 | 3407 | 7·9960 | 3·2860 |
| 7 | 3321 | 8·0027 | 3·2089 |

**TABLE VIII**
**Mean Number of Strokes (per 20 secs.) for different Periods Weeks 1 and 3 (with breaks)**

| *Periods* | *N* | $\bar{X}$ | *S.D.* |
|---|---|---|---|
| 1 | 2229 | 7·3214 | 2·9093 |
| 2 | 2967 | 7·0257 | 2·9891 |
| 3 | 2974 | 6·9517 | 3·1393 |
| 4 | 1671 | 7·2058 | 3·0476 |
| 5 | 2824 | 7·2340 | 3·1191 |
| 6 | 2905 | 7·2836 | 3·1126 |
| 7 | 2902 | 7·3966 | 3·1824 |

condition (e.g. five minutes break every half hour and the usual break of 15 minutes) again there was a drop in production Periods 1 through 3 but under this condition the mean of Period 1 was highly significantly greater than that of Periods 2 and 3. The mean production during Period 3 before the 15 minute break was highly significantly less than that in Period 4 immediately after the same break. As in the "without breaks" condition there was an increase in production through Periods 4, 5, 6 and 7, but production in Period 7 was significantly greater than that in Periods 4 and 5. The same trends can be seen in each condition, e.g. a low in the middle of session — but in the "without breaks" condition when it might have been expected that the solitary tea break would show the more significant beneficial effect, it did not do so.

Both conditions show the same highly significant increase in variability Periods 1 through 3. Both show a highly significant decrease in variability in Period 4 immediately after the tea break and a highly significant increase in variability in Period 5 over Period 4. Then the two conditions diverge. In the "without breaks" condition there are highly significant differences in variability between Periods 5, 6 and 7. Period 5 is highly significantly less variable than Period 6 which is highly significantly more variable than Period 7. In the "with breaks" condition there are no significant differences in variability between these periods. The conclusion must be drawn from this experiment that as far as variability is concerned no differences showed themselves between the "with" and "without breaks" conditions until the subjects had been working for two hours but that after that lapse of time the more frequent breaks were linked with a steadier working rhythm over a longer time.

Under both conditions the means of Periods 4, 5 and 6 were less than the mean of Period 7. Smith (1953) concluded that the end of the day had a noticeable effect on production and that the effect depended on the concept of a day's work held by the worker. Period 7 was the last of the working sessions and it is possible that the subjects put on a spurt as there was some rivalry amongst them and they wished to improve on their previous day's performance.

It is worth remarking that the subjects did not like a five minute break every half hour. They complained that they were interrupted in their work just as they were getting into their stride.

### 4. *The Days of the Week*

Friday was the day with the greatest production in each week and the day with least variability in Weeks 2, 3 and 4.

During Weeks 1, 2 and 4 Wednesday was the most variable day. Mondays, Tuesdays and Wednesdays alternated as the days with least production therefore it is fair to say that Friday's high production is not likely to be solely due to the learning effect. If it was, the same effect could have been expected on the other days of the week so that Monday would have been the day with least production.

## future experimental work

Considerably more information could have been gained from the experiment had it been carried on for a longer time and had the work cycles been timed individually. This is now being done and it is hoped to gain more detailed information about the subjects' variability. Further measures will be made of reaction time and ability to interrupt a repetitive work cycle. These will differentiate between stimuli given during response initiation time and stimuli given during movement time.

## acknowledgments

This Paper is based upon a dissertation submitted in part fulfilment of the requirement for the degree of MSc in Ergonomics and Cybernetics at Loughborough University of Technology. The project was supervised by Dr. Elwyn Edwards. Special purpose computer programmes were written by Mr. H. David. During the period of postgraduate study, the author was supported by a Medical Research Council studentship.

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