Chapter Three - Methodology

1.0 INTRODUCTION

Current study is experimental in nature. Obviously considerations related to experimental designs are very important here. Each experiment done in this research is planned according to standard representative experiment in its respective area. However, there is one difference from most of the other study. This difference is that from Experiment 1 to Experiment 5 there is a progressive gradation of task difficulty.

Another feature, more relevant for our country is that perhaps this is first experiment in which computer simulation of experimental situation has been done. Besides, it also involves a very large collection of data under different experimental conditions.

2.0 AIM

The present study explores cognitive-affective processes in multiple-task performance through empirical evidence for Executive Process Interactive Control (EPIC) based Strategic Response Deferement (SRD) model of Psychological Refractory Period (PRP) procedures under varied experimental setup.

3.0 OBJECTIVES

1. To measure PRP effect when primary task is Task 1 and secondary task is Task 2.
2. To measure PRP effect when primary task is Task 2 and secondary task is Task 1.
3. To measure PRP effect under triple task scenario.
4. To compare PRP effects as obtained through objective 1, 2 & 3.
5. To match PRP effects as obtained through objectives 1, 2 & 3 with the EPIC based SRD model of PRP procedure.
6. To match discrete successive choice task effects with the EPIC based SRD model of PRP procedure.
7. To understand the differences in PRP effect among Cautious and Daring individuals and compare them with EPIC based SRD model of PRP procedure.
8. To understand the differences in PRP effect among Field Dependent and Field

Independent individuals and compare them with EPIC based SRD model of PRP procedure.

9. To understand the differences in PRP effect among Reflective and Impulsive individuals and compare them with EPIC based SRD model of PRP procedure.

10. To understand the trial-to-trial variations in individual performance under different experimental conditions in context of theoretical formulation of EPIC based SRD model of PRP procedures.

4.0 HYPOTHESES

Based on several objectives above, the following hypotheses are advanced.

1. Repetitive response time shall be more for left hand in comparison to right hand response time.

2. Repetitive response time shall be more for middle finger in comparison to index finger.

3. There will be interaction effect of hand and finger in repetition response time.

4. Second response time of Experiment 3 shall be same as the repetitive response time of the respective stimuli.

5. There will be no significant differences in correct responses for different stimulus display time for all stimuli.

6. Choice reaction times - serial shall be higher than simple reaction time in case of letter stimuli in comparison to digit stimuli.

7. Choice reaction times - repeat stimuli shall be higher than the choice reaction times - serial.

8. Choice reaction times - alternate stimuli shall be higher than the choice reaction times - repeat.

9. PRP effect in T1 priority task shall be as per the standard PRP effect curve.

10. PRP effect shall be different in T2 priority task in comparison to standard PRP

effect curve.

11. PRP effect shall be different in subject decision priority task (random) in comparison to standard PRP effect curve.

12. There will be PRP effect in T1 also in triple task trial whenever priority is not T1.

13. There will be PRP effect in T2 and T3 in triple task trial and it will be significantly different from standard PRP effect curve.

5.0 SAMPLE

As this study is a mixed design, and it involves a large collection of data 20 voluntary subjects from Postgraduate classes of Department of Psychology, Faculty of Education & Psychology, M. S. University of Baroda were considered sufficient sample. One subject dropped out due to ill-health and social commitment and so a new subject was recruited in lieu of him. All subjects had more or less similar know-how of computers, normal or corrected-to-normal vision and right-handedness.

6.0 EXPERIMENTAL DESIGN

6.1 Experimental design of present study is mixed one. This is because data has been collected in such a way that they could analysed as Between-subject, Within-subjects as well as Single-subject design. No counterbalancing has been done purposefully. This was done to maximize the systematic effect to maximal. All throughout conditions stimulus conditions were maintained constant.

6.2 Dependent measures :

- Response time
- Response accuracy

6.3 Tasks :

Task 1 : Visual - Manual two-choice task (digital stimuli)

Task 2 : Visual - Manual two-choice task (letter stimuli)

Task 3 : Visual - Manual two-choice task (digital stimuli)

6.4 Stimulus Onset Asynchrony :

- 0.00 sec
- 0.20 sec
- 0.40 sec
- 0.60 sec
- 0.80 sec

6.5 Effectors :

- Right index finger for digit '4'
- Right middle finger for digit '5'
- Left index finger for letter 'd'
- Left middle finger for letter 'f'

6.6 Sequence of experiments :

1. Experiment 1 - Stimulus Identification
2. Experiment 2 - Repetitive Response
3. Experiment 3 - Simple Reaction Time
    - Single response
    - Double response
4. Experiment 4 - Discrete Successive Choice Reaction Time
    - Serial
    - Reverse
    - Alternative

5. Experiment 5 - Discrete Concurrent Two Choice Reaction Time

   - Dual Task

   - Triple task

6. Experiment 6 - Matched Figure Test

7. Experiment 7 - Embedded Figure Test

7.0 PROCEDURE

Each experiment was simulated and conducted on computer through a Visual Basic program. The program Access files for data storage. The flow of simulation was left to the subject's control. Details of each program has been attached herewith in Appendices. Details of each experiment follow -

7.1 Experiment 1 - Stimulus Identification

Complete experiment was simulated on computer. The flow of simulation was left with the subject. The experimenter was just supposed to supervise the occurrence of experimentation. Whole experiment was completed in eleven screens. Before beginning the experiment, the experimenter could set the stimulus display time as the per the standard series.

The first screen was a welcome screen, wherein a respondent was welcome, informed and thanked for participation in the experiment. On pressing 'next' the respondent could move to screen two which asked respondent to fill relevant basic information such as name, birth date, age, gender, and class.

Next screen gave detailed instructions to the subject about the procedure and checked whether instruction was properly understood. On pressing 'yes' the subject was shown example screen, which displayed 5 rectangles, four of which contained digit '4', '5' and letters 'd', 'f' in the centre respectively, and a blank rectangle. This was followed by a 'get ready' screen with a fixation dot in the centre. When respondent pressed 'enter' a blank screen appeared and in the centre any of the five stimulus rectangle was displayed for prefixed display time. Afterwards the respondent was shown response screen wherein five rectangles were again shown and asked to click the rectangle which was displayed on the screen. This was followed by a feedback screen. Subsequently the respondent was again displayed 'get ready' screen with a fixation dot and the next trial continued upto the end of a block.

Presentation of rectangles was completely randomized. Each rectangle was displayed 50 times and in all 250 rectangles were displayed in one block. Ten such blocks were presented in the range of 90 - 10 msec display time. Between each block respondent was given a rest period as per the need of the respondent.

7.2 Experiment 2 - Repetitive Response

Complete experiment was simulated on computer. The flow of simulation was left with the subject. The experimenter was just supposed to supervise the occurrence of experimentation. Whole experiment was completed in seven screens. The first screen was a welcome screen, wherein a respondent was welcome, informed and thanked for participation in the experiment. On pressing 'next' the respondent could move to screen two which asked to fill respondent relevant basic information such as name, birth date, age, gender, and class.

Third screen consisted of the experimental instruction for respondent explaining to him / her about what was expected to be done. This screen was followed by 'get ready screen' wherein subject was asked to check the position of his finger and hand on appropriate key. The next screen instructed the subject to 'start'. With the first key press, the 'start' screen was removed and the screen started displaying the letter or digit pressed by the subject. During the experiment, the subject was supposed to press repeatedly a key as per instruction 100 times. The program recorded each key press time, accuracy of key press and other respondent related details. In all respondent pressed following four keys in the same order for 100 times.

1. Type '4' with right-hand index finger
2. Type '5' with right-hand middle finger
3. Type 'f' with left-hand index finger
4. Type 'd' with left-hand middle finger

Program kept count of 100 key press and stopped the key press on 100th count. In case of wrong key press by mistake, maximum upto 10 corrections were allowed by taking count upto 110. Subsequently, the subject was given feedback about his / her mean repetitive response time. Then the procedure continued for remaining three stimuli in same manner. Finally, the respondent was thanked again for participating in the experiment.

7.3 Experiment 3 - Simple Reaction Time - Single response & Double response

Essential simulation followed similar screens. In this experiment the respondent were shown each digit and letter along with blank screen one after the other. Stimulus presentation was as given below :

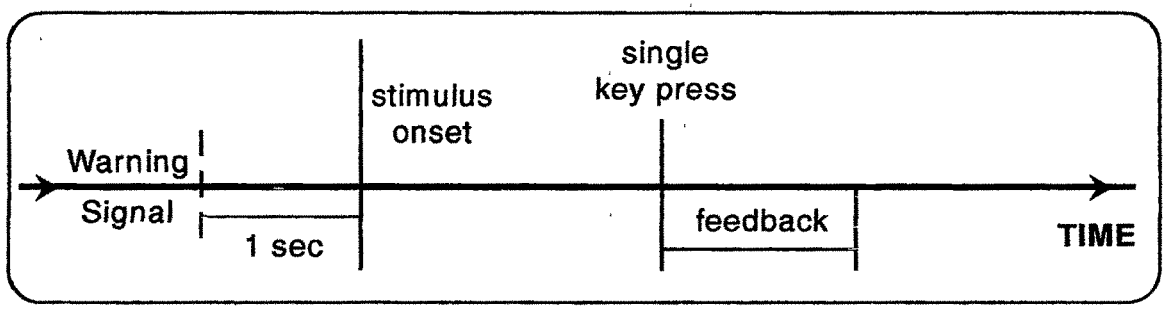
Stimulus	*No. of trials*	*Response*	*Effector*
4 + blank screen	(50+25)	4 on numeric pad	right hand index finger
5 + blank screen	(50+25)	5 on numeric pad	right hand middle finger
d + blank screen	(50+25)	d on alphabetic pad	left hand middle finger
f + blank screen	(50+25)	f on alphabetic pad	left hand index finger

The respondent was supposed to press appropriate key once with appropriate finger as quickly as possible. The program recorded response time, response accuracy and other details. This was considered as one block.

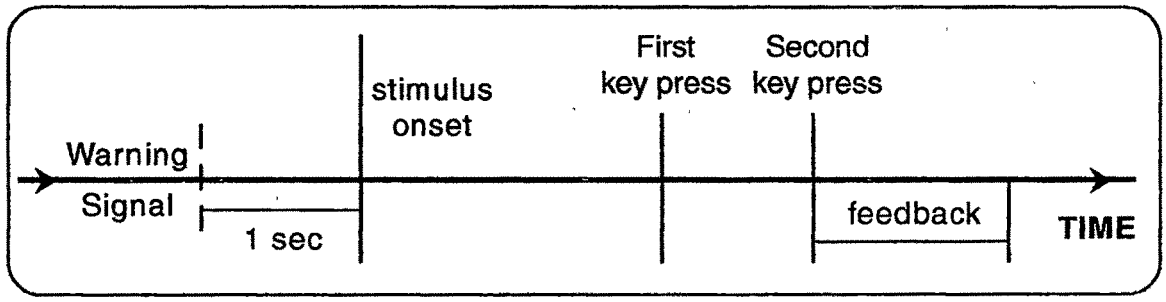
Subsequently another block with the same procedure was followed. Only difference was that the subject was to press the response key twice as quickly as possible.

Schematic representation of the experimental procedure is as given below.

Block 1



Block 2



7.4 Experiment 4 - Discrete Successive Choice Reaction Time

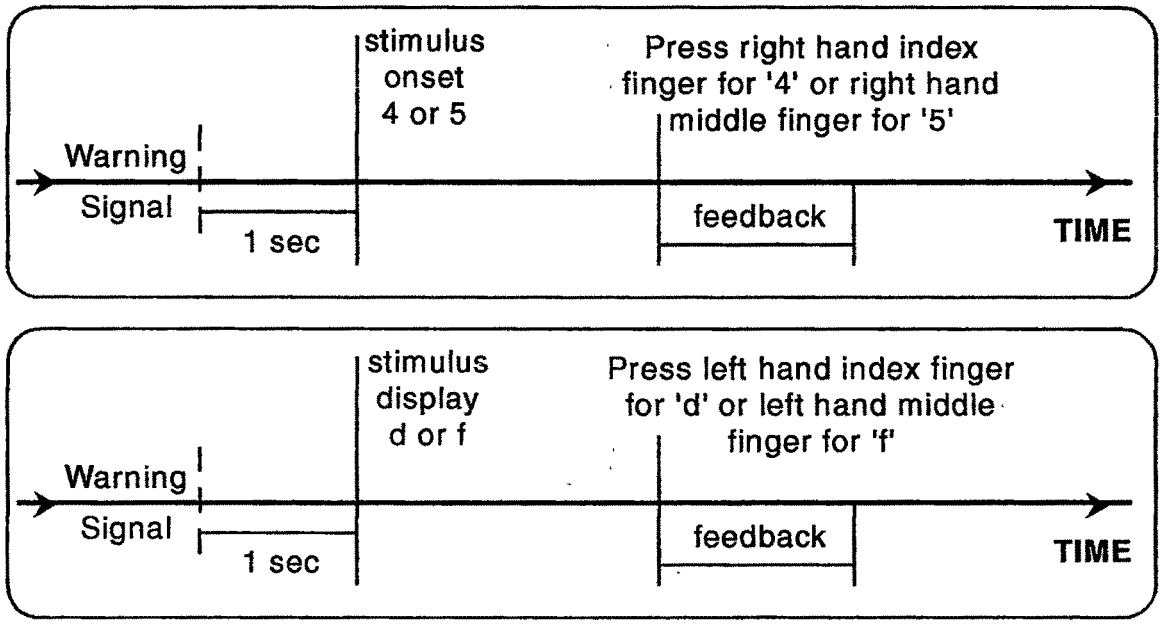
This experiment was conducted in three parts as given below -

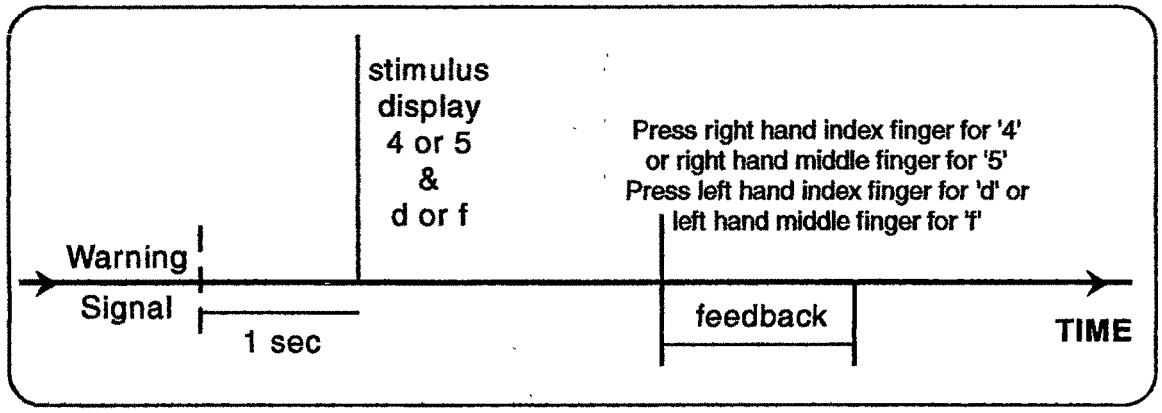
PART I : Discrete Successive Choice Reaction Time - Serial

Essential simulation followed similar screens. In this experiment the respondent were shown either digit or letter in serial order. Stimulus presentation was randomized as given below :

Stimulus	*No. of trials*	*Response*	*Effector*
4 + 5	(50+50)	4 on numeric pad	right hand index finger
		5 on numeric pad	right hand middle finger
d + f	(50+50)	d on alphabetic pad	left hand middle finger
		f on alphabetic pad	left hand index finger
4 + 5 + d + f	(50+50+50+50)	4 on numeric pad	right hand index finger
		5 on numeric pad	right hand middle finger
		d on alphabetic pad	left hand middle finger
		f on alphabetic pad	left hand index finger

The respondent was supposed to respond with appropriate hand and finger as quickly as possible. Schematic presentation of the procedure is as under -



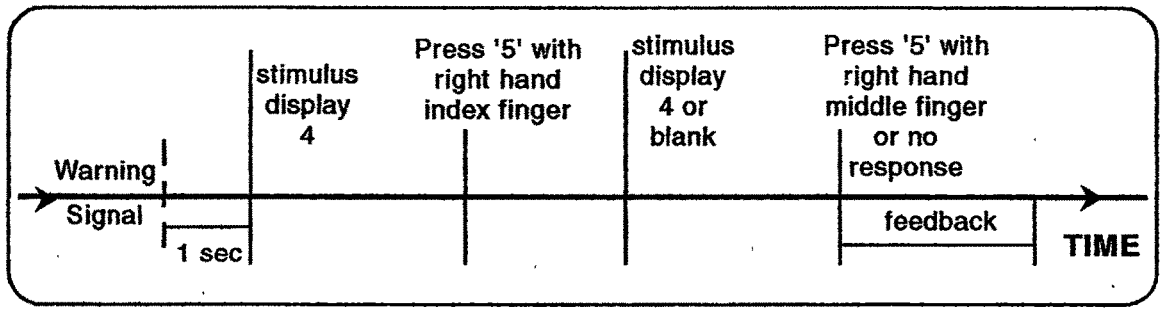


PART II : Discrete Successive Choice Reaction Time - Reverse

Essential simulation followed similar screens. In this experiment the respondent were shown either digit or letter in serial order. Stimulus presentation was randomized and as given below :

Stimulus	*Presentation*	*Response*	*Effector*
4 + 4 or blank	(50 + 25)	5 + 5 on numeric pad	right hand middle finger
5 + 5 or blank	(50 + 25)	4 + 4 on numerical pad	left hand index finger
d + d or blank	(50 + 25)	f + f on alphabetic pad	left hand index finger
f + f or blank	(50 + 25)	d + d on alphabetic pad	left hand middle finger

The respondent was supposed to respond with appropriate hand and finger as quickly as possible. Schematic presentation of the procedure is as under -



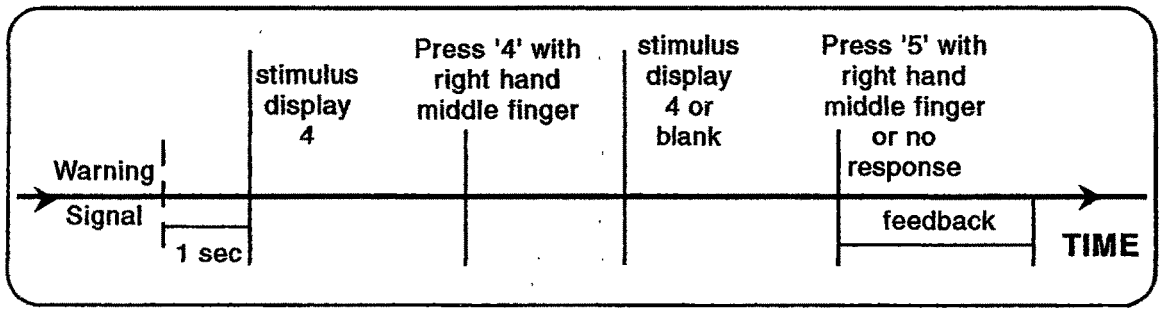
Same procedure was repeated for digit '5' and letters 'd' and 'f'. In this procedure principal difference was that the same stimulus was presented twice in succession and the subject had to respond to both with same response.

PART III : Discrete Successive Choice Reaction Time - Alternate

Essential simulation followed similar screens. In this experiment the respondents were shown either digit or letter in serial order. Stimulus presentation was randomized as given below :

Stimulus	*Presentation*	*Response*	*Effector*
4 + 4 or blank	(50 + 25)	4 + 5 on numeric pad	right hand middle finger
5 + 5 or blank	(50 + 25)	5 + 4 on numerical pad	left hand index finger
d + d or blank	(50 + 25)	d + f on alphabetic pad	left hand index finger
f + f or blank	(50 + 25)	f + d on alphabetic pad	left hand middle finger

The respondent was supposed to respond with appropriate hand and finger as quickly as possible. Schematic presentation of the procedure was as under -



Same procedure was repeated for digit '5 & 4' and letters 'd & f' and 'f & d'. In this procedure principal difference was that the alternate stimulus was presented and the subject had to respond first stimuli with the same response and second stimulus with reverse response.

7.5 Experiment 5 - Discrete Concurrent Two Choice Reaction Time

This experiment was conducted in two parts as given below -

PART I : Discrete Concurrent Choice Reaction Time - Dual Task

Essential simulation followed similar screens. In this experiment tasks were defined as -

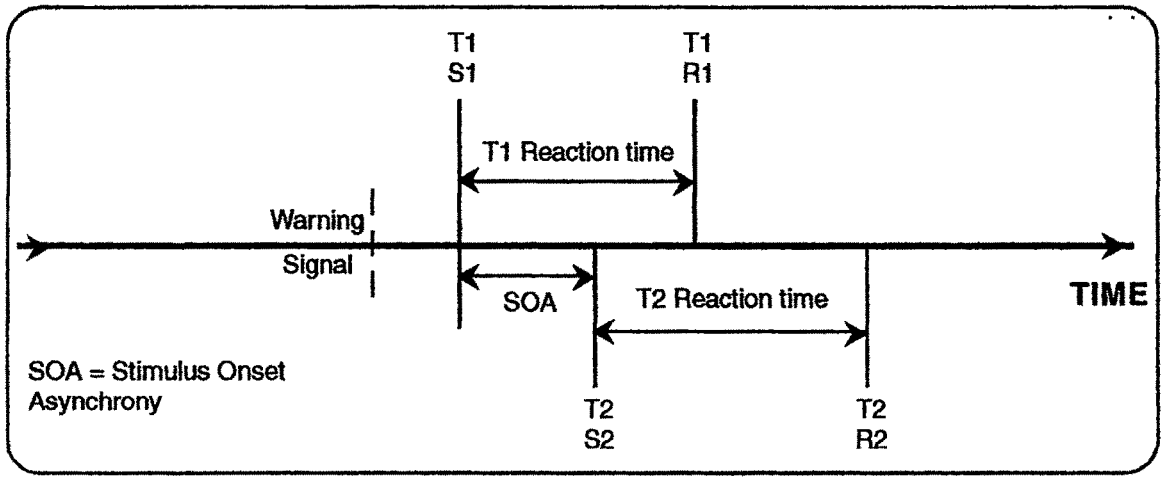
Task 1 - Stimulus 4 or 5 and response key 4 or 5 on numeric key pad

Task 2 - Stimulus d or f and response key d or f on alphanumeric key pad

The respondents were given tasks in the following order :

Task	*No. of trials*	*SOA*	*Task priority*	*Presentation*
T1 & T2	(50+50)	0/200/400/600/800 msec	T1 & T2	Serial
T1 & T2	(50+50)	0/200/400/600/800 msec	T2 & T1	Serial
T1 & T2	(50+50)	0/200/400/600/800 msec	Subject decision	Random

The respondent was supposed to respond with appropriate hand and finger as quickly as possible. Schematic presentation of the procedure was as under -



PART II : Discrete Concurrent Choice Reaction Time - Triple Task

Essential simulation followed similar screens. In this experiment tasks were defined as -

Task 1 - Stimulus 4 or 5 and response key 4 or 5 on numeric key pad

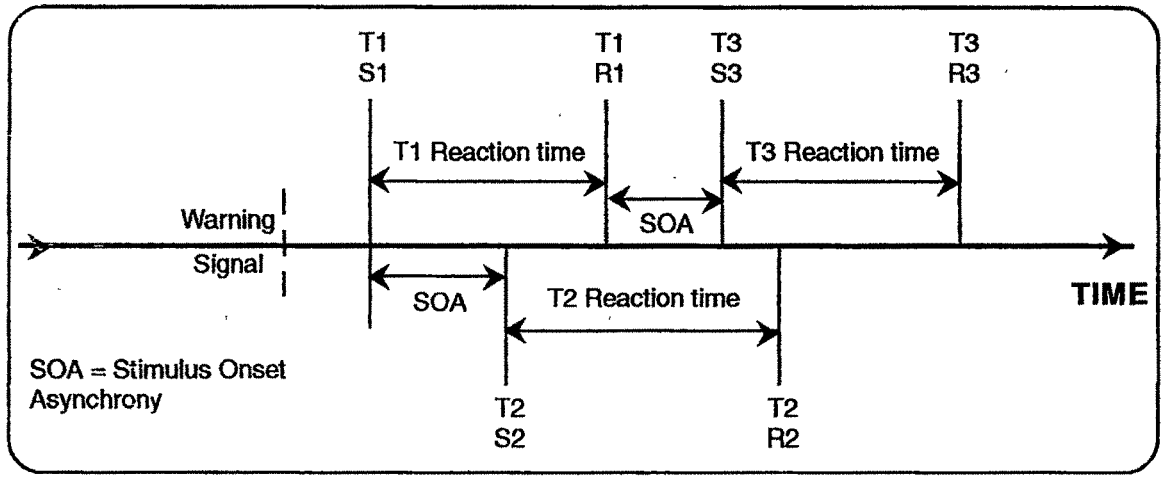
Task 2 - Stimulus d or f and response key d or f on alphanumeric key pad

Task 3 - Same as Task 1 (i.e. stimulus 4 or 5 and response key 4 or 5)

The respondents were given tasks in the following order :

Task	*No. of trials*	*SOA*	*Task priority*	*Presentation*
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T1, T2, T3	Serial
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T1, T3, T2	Serial
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T2, T1, T3	Serial
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T2, T3, T1	Serial
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T3, T1, T2	Serial
T1, T2, T3	(50+50+50)	0/200/400/600/800 msec	T3, T2, T1	Serial

The respondent was supposed to respond with appropriate hand and finger as quickly as possible. Schematic presentation of the procedure is as under -



Same procedure was repeated for different priorities responses (T1T2T3). In this procedure principal difference was of the presentation of T3 also. SOA for T3 was decided as per the mean reaction time of respondent in Part I of the experiment.

7.6 Experiment 6 - Matched Figure Test

In this experiment, simulation of Matched Figure Test was presented to the respondent. The respondent was supposed to match each stimulus figure with the response figure, given along with distracter figures. Response time and response accuracy was recorded by the program.

7.7 Experiment 7 - Embedded Figure Test

In this experiment, simulation of Embedded Figure Test was presented to the subject on computer. The subject was first shown a stimulus figure and then he/she was supposed to find out the same figure hidden into a response figures. The subject was supposed to press a key as soon as he could identify the stimulus figure. The time was recorded for the same. Subsequently the respondent was given grey coloured response figure, wherein he/she was supposed to highlight the hidden stimulus figure. No second thought was allowed while highlighting the figure. Subsequently the subject was shown next stimulus figure. The procedure continued until the end of the test.

8.0 TOOLS

8.1 A Desk Top Computer with

- Intel Pentium IV processor
- LG Studioworks 700E Color Monitor
- Standard Keyboard with 104 keys
- Logitech Optical Mouse

8.2 Computer software for simulation and data storage

- Programming language - Visual Basic 6.0
- Database - MS Access 2000

8.3 Computer software for data analysis

- SPSS 10.0

- MS Excel 2000

9.0 STATISTICAL ANALYSIS

Analysis of data was done using Univariate ANOVA, descriptive statistics and data was reported in form of frequency, percentage and charts.