

## DIVISION OF ATTENTION

### **Introduction:**

Divided attention could be defined as our brain's ability to **attend to two different stimuli at the same time**, and respond to the multiple demands of your surroundings. Divided attention is a type of simultaneous attention that allows us to process different information sources and successfully carry out multiple tasks at a time. This skill is also known as multitasking, which people often carry out without realizing it. This cognitive skills is very important, as it allows us to be more efficient in our day-to-day lives.

A great example of this would be singing along to a song while driving a car, doing homework while listening to music, etc

Our ability to attend to multiple stimuli and do various tasks at a time does have its limits. When you divide your attention, the efficiency with which you do these actions is decreased, and you will almost certainly perform poorly. **Interference is the term used to describe when a person has a hard time attending to two stimuli at a time.** We see interference when the brain is only able to process a certain amount of information. However, **cognitive training can help improve divided attention**, and as a consequence, the ability to do more than one activity at a time.

One of the central problems studied under attention is the possibility of dividing attention between two tasks. In the earlier days some ministers were dictating 4 to 5 letters simultaneously. What actually happens in such cases is rapid shifting of attention between two tasks. When both the tasks are done simultaneously one of them becomes automatic. To some extent division of attention is possible when one task is a simple physical one and the other task is mental. When we try to divide our attention, the performance goes down. Thus, real division of attention is not possible. When children do not divide their attention, they have better chance of learning. Index of divisibility shows the extent of division of attention between two tasks.

### **How can you improve divided attention?**

Divided attention, as with other cognitive skills, can be learned, trained, and improved. Cogni-Fit's training programs may help improve how quickly the user can change their attention between tasks, how much of their brain resources they use when attending to multiple stimuli at a time, and improve the ability to process complex information.

The divided attention rehabilitation program is based on the science of [neuroplasticity](#). Cogni-Fit has an entire battery of exercises designed to help in the rehabilitation of divided attention and other cognitive skills, which is made possible by brain plasticity. The brain and its neural connections can be strengthened and improved through practice. By training divided attention, the frequent actions will become automated, which allows the user to be more efficient.

### **Problem:**

To find out the possibility of division of attention between - two muscular tasks.

### **Materials:**

- 1) Division of attention board having circular and triangular grooves with a set of error counters with two stylus.
- 2) Stop clock
- 3) Wooden screen
- 4) Writing materials

### **Procedure:**

Before the start of the experiment all the necessary electrical connections are made.

### **Two Muscular Tasks**

**I Series:** Muscular task 1: Instruct the subject that at the signal 'Start' he has to trace the triangle pattern of the instrument with the stylus provided adjacent to it as fast as he can with his right hand. With these instructions say start" simultaneously start the stop clock and allow the subject to trace the grove for 30 seconds. At the end ask him to stop and note down the number of triangles he has traced (S1).

**II Series:** Muscular task 2: In this series the subject with the same instructions has to trace the circle with his left hand for same amour of time and at the end note down the traces (S2).

**III Series:** Two muscular tasks: The subject with the same instructions has to trace both the circle and the triangle in his left and right hand simultaneously for fifty seconds. Note down the number of triangles (D1) and the circles (D2) traced separately.

### **Precautions:**

1. The effort should be made to see that the subject performs the task properly.
2. The subject should not know the purpose of the experiment.

### **Analysis of Results:**

|          | No.of Errors<br>Trial 1 | No.of Errors<br>Trail 2 | No.of Errors<br>Trail 3 | Difference<br>between Trail 1-<br>Trail 3 |
|----------|-------------------------|-------------------------|-------------------------|---|
| Triangle | 3                       | 8                       | 5                       | 2   |
| Circle   | 4                       | 7                       | 5                       | 1   |
| Both     | 2                       | 5                       | 3                       | 1   |

### **Discussion:**

Discuss the Index of divisibility for mental tasks with that of muscular. Normally the Index will be less than 1.00. Discuss the individual tasks differences.

### **Conclusion:**

The closer the score on C.D. comes to 1, the higher the division of attention, which implies that, the subject's attention decreases when two tasks are done simultaneously. The closer the score on C.D. comes to 0, the subject's attention is not affected when two tasks are done simultaneously. The subject may be good at doing two different tasks when done simultaneously with each hand.

- 1) See whether division attention was possible in case of the subject.
- 2) See whether efficiency has gone down when subjects divided their attention.

## **BILATERAL TRANSFER OF LEARNING (MIRROR DRAWING TEST)**

### **Introduction:**

Transfer of learning is one of the most universally applied principles in practicing or learning a motor or sport skill. A man's activities (every day's experiences) show that each activity is in succession to the other. When an organism undergoes new task and new problems, its behaviour may be seriously affected by the results of past learning and conditioning. Its only through such cumulative effects of learning that steady intellectual development and growth, progressive refinement of skills and creative thinking are made possible. Thus, whenever one activity affects another following it (either by facilitating it or interfering with it, there is set to be transfer). As Sandiford pointed out, all education is based on the existence of phenomena of transfer. The educators object it to teach a child or an adult principles or methods for dealing with specific task in different situations.

### **Concept of Mirror Learning**

The mirror learning task has historically been used to study learning and the effects of distributive practice. The task has also been used as a classic experimental activity designed to illustrate the effects of learning in many undergraduate laboratories for decades. More recently Psychologists like Goldstein, Hopkins and Strube (1994) used the task to demonstrate the observer. Although this activity is designed to provide students with an experience that will allow for comparison of the task done by left and right hand, and this activity may also be used to illustrate the effects of distributive practice and effects upon the observer.

Bi-lateral transfer is started by Walkman in 1858, Swift found in 1909 by the study of ball tossing that when we throw up a ball in right hand then it transfer into left hand, Mann in 1933 had repeated the experiment in much controlled condition, but found in 1910 the same result. Stuart has found in 1910 by the use of Mirror Drawing Apparatus that positive transfer from one hand in other hand. Stuart has found in 1926 by the help of control group method that good result of bilateral transfer.

When we learn an activity with right hand, it becomes easier on that account to learn that activity with left hand. The right hand reduces the number of trials necessary for left hand to acquire that skill, such a transfer of learning is called Bi-lateral transfer.

The Experiment of throwing a ball at a moving target and mirror drawing has been studied from particular angle. This experiment shows that there is positive transfer as much as 50%.

### **Operational Meanings**

Transfer: To carry from one place to another or shifting from one place to another is transfer.

Transfer of Learning: According to Dictionary of Education, “The improvement facilitation or modification of a certain learning without direct training through learning or practice in a related activity, reciprocal modification in learning”.

According to Encyclopaedia of educational research, “The term learning will be applied to special kind of transfer phenomena in which there is great similarity between training condition and test condition”. According to Culhrie and Powers:- Transfer may be defined as power of extending and applying behavior.

The transfer is application of knowledge gained it's the carry over skills, habit, attitudes and other responses. 2.2.1 Types of Transfer:-

1. Positive transfer
2. Negative transfer
3. Unilateral transfer
4. Bilateral transfer
5. Vertical transfer
6. Horizontal transfer

**There are different kinds of transfer:**

**a) Positive Transfer:** Its effects occur if experience facilitates the acquisition of a new skill or solution of a new problem placed in the new situation. The learner performs significantly better than he would without the benefit of past training.

**b) Negative Transfer:** Its effects are inferred if past experience renders more difficult or slows down the acquisition of a new skill or the solution of a new problem. Placed in the same situation, the learner performs more poorly than he would perform without training.

**c) Zero Transfer:** It denotes the fact that performance in the new situation is neither aided nor hindered by the past training. A statement that there's no zero transfer can mean only that with the measuring device of our disposal, no transfer effect from our situation to other situation can be detected.

**Aim:** To demonstrate the phenomenon of bilateral transfer.

**Materials required:**

1. A mirror tracing board / mirror drawing apparatus.
2. Stop watch
3. Response sheet Mirror Drawing Apparatus:

The apparatus operates on A.C. Mains. It consists of a metallic plate with star pattern groove placed on the wooden board of the apparatus and a mirror in front and perpendicular to the board. It can be adjusted in front of the subject in such a way that the subject can view the star pattern through the mirror. An adjustable plate is also provided in front of the metallic plate in order to obstruct the direct view of the star to the subject, i.e., The plate is adjusted in such a way that the subject can see the star by only looking through the mirror. The metallic plate and a stylus is connected to electric current in such a way that whenever the stylus touches the metal plate the electric circuit pathway is closed and a light burns. The grooved area of the metallic plate is hollow and it is placed over the wooden board so that if the stylus travels through the groove, it does not conduct electricity so long as it does not touch the metal plate.

The apparatus is connected with a Digital Error Counter and Digital Timer. As soon as the subject places the stylus at the starting point of grooved path of the star the Digital Timer immediately starts recording time in seconds and its decimal parts. And whenever there is an error the digital error counter automatically records one error in digital form.

**Procedure:** The experiment will be done in three conditions.

- i. In the first pre-test condition the subject will be given three trials in which he will trace the star pattern viewing its image in the mirror with his left hand in the clockwise direction.
- ii. In the second test condition the subject will learn to trace the star pattern with his right hand in the anti-clockwise direction. In this practice / learning condition he will be given as many trials till he reaches the pre-set criterion of three errorless consecutive trials.
- iii. In the third post-test condition the subject again traces the star pattern three times with his left hand in the clockwise direction.

**Instructions:** “I shall put the stylus (handing over) in your (left/right) hand and place it at the starting point on the star pattern. On hearing “START” you will start moving the stylus in the groove in pre-indicated direction (Clockwise/Anticlockwise) tracing the pattern, viewing it in the mirror, taking care that you do not touch either of the boundaries (inner or outer) of the star pattern and taking the least time. As soon as you reach the starting point again the trail will complete and you will stop on hearing “STOP”. Touching the boundaries will be an Error. Your performance will be of high quality if it is errorless and quick. Please pay attention to your feeling and thoughts too, you will be required to give introspection report.

**Result:** The Average of Errors and the Time taken are computed separately for all the three experimental conditions. The difference between the average time and average errors in two experimental conditions upright between pre-test and post-test condition give the result of Transfer of learning or Bilateral transfer experiment.

**Interpretations:** If the differences in the averages in both the experimental conditions (averages in post-test conditions minus the averages in pre-test conditions) are positive, the transfer of learning is positive. This implies that there is a positive effect of learning of the subject with his/her right hand on the performance with his/her left hand, which means that after the learning of mirror drawing with right hand, there was certain improvement in the mirror drawing with his left hand. This improvement is exhibited in terms of decrement in the average errors and time in post-test experimental conditions as compared to the pre-test experimental conditions.

Table 1 showing the experiment results

| Trial.No |                | Experimental Conditions  |                          | Difference |
|----------|----------------|--------------------------|--------------------------|------------|
|          |                | Right Hand<br>(Pre-test) | Left Hand<br>(Post-test) |            |
| 1        | Errors         | 4                        | 6                        | 2          |
|          | Time (in.sec.) | 24 s                     | 20.98 s                  | 3.02 s     |
| 2        | Errors         | 3                        | 5                        | 2          |
|          | Time (in.sec.) | 24.47 s                  | 23.4 s                   | 1.07 s     |
| 3        | Errors         | 9                        | 2                        | 7          |

|  |                       |      |      |      |
|--|-----------------------|------|------|------|
|  | <b>Time (in.sec.)</b> | 30 s | 16 s | 14 s |
|--|-----------------------|------|------|------|

Difference in Average Errors = Average No. of Errors in pre-test conditions - Average No. of Errors in post-test conditions=**5.33+4.33=9.66**

## **MENTAL FATIGUE**

### **Introduction:**

Mental fatigue is caused by lack of novelty, boredom and monotony. As work progresses the quality and quantity of work goes down. Mental Fatigue may be decreased by change of activity. Sometimes certain incentives can also help us to overcome boredom. A work curve plotted to show work output shows an increase in the beginning and at the end.

Mental fatigue refers to the feeling experienced after or during prolonged periods of cognitive activity and has been associated with a temporary inability to maintain optimal cognitive performance. Increased mental effort can induce mental fatigue. In short-term, it can impair vigilance, reaction time, and physical performance, reducing work capacity. This is particularly true in real-world situations, where some jobs require sustained concentration, such as police officer, medical worker, and pilot. These occupations often endure long work hours with high stress, increasing the risk of accidents that lead to injury and substantial economic loss. Moreover, people in a state of constant fatigue over a long period have a higher risk of morbidity. Therefore, it is crucial to measure mental fatigue in people whose work requires high levels of mental effort to prevent health problems and subsequent economic loss.

Mental fatigue is of high interest for research in the field of air traffic management research because research activities often focus on air traffic controllers or pilots whose tasks are prolonged and repetitive, yet cognitively demanding. They require sustained attention, vigilance and readiness to react to unexpected and time-critical situations. These tasks therefore have a high potential for inducing mental fatigue. Simultaneously, the effects of mental fatigue can lead to slips in the air traffic controller's or pilot's attention, to errors and in consequence to an increased risk of incidents or accidents.

What is mental fatigue?

During or after your medical treatment, you may sometimes feel mentally tired. This is called mental fatigue. Mental fatigue can come and go. Mental fatigue will make it hard to pay attention or focus on a task for long periods of time. You may feel mental fatigue after doing work that takes a lot of mental energy. You may feel mental fatigue if you feel a lot of stress for a long period of time. Often when you feel physical fatigue, your mind will feel fatigued as well.

During diagnosis, treatment, and even after treatment you may feel stress from:

- your diagnosis (finding out your illness or condition)
- the decisions you need to make
- your treatments

- needing to make plans and solve problems It is possible that you will find it hard to:
- pay attention to information
- understand new information
- make decisions and plans
- solve problems
- focus your thoughts
- remember things

There are certain activities that may help to reduce mental fatigue. These are called restorative experiences.

**Problem:** To study the effect of fatigue on mental efficiency.

**Plan:** The experiment is conducted in two series:

- a) Before Interpolation
- b) After Interpolation. The results of the two series are compared.

**Materials:**

1. Adding sheets
2. Stop clock
3. Writing materials

**Procedure:**

**I Series:** The subject is seated comfortably and he is given an adding sheet and instructed as follows: - “Here are some units of numbers, go on adding each of the four units in the first column and enter the total at the bottom of the four units. Then go to the second column, third column and so on until I say ‘pause’ when I say ‘pause’ leave 2 units and then go on adding as usual. After sometime I will say ‘Stop’, you should stop immediately and draw a vertical line to show that you have totaled up to that point”. With these instructions the subject is allowed add for 5 minutes with a pause after each minute. At the end of 5 minutes adding sheet is collected back and the number of correctly totaled units is noted down.

**II Series:** The subject is given some problems like division, multiplication, subtraction (other than addition) etc. for ten minutes as interpolation activity. After this, the adding sheet is to be given to the subject again for another 5 minutes and the same procedure is followed as in the first series.

**Precautions:** The correctly added units have to be checked only after the II Series.

**Analysis of Results:**

| S.No | Total Performance | Total Wrong | Total Correct |
|------|-------------------|-------------|---------------|
| 1    | 245               | 0           | 245           |

The total number of units added in every minute and the total added in 5 minutes is to be noted down for I-series and II-series separately. The number of units correctly added are the net scores.

# DEPARTMENT OF PSYCHOLOGY

Numerical

## Cancellation Sheet for Mental Fatigue Testing

Name Aryaman Mishra Class Psychology Lab Age 21  
Date 08-04-2022 Occupation Student Time 12:33 pm

INSTRUCTIONS : It is a list to find out how fast and correctly you can do the task. You are required to strike of 2, 5, 7, 9, while you are recording the each line. You have to work fast and correctly. If in the course of work you are given any time signal put a vertical line at the place where you are working and proceed until you are asked to stop. You can ask for another test sheet if you complete working on this sheet with in the line given to do so.

|   | Analysis |    |    |    |       |
|---|----------|----|----|----|-------|
|   | 2        | 5  | 7  | 9  | Total |
| 8 9 0 7 8 9 7 6 5 3 7 4 8 5 9 6 0 8 2 1 7 6 4 8 2 3 7 8     | 2        | 2  | 5  | 4  | 13    |
| 5 0 7 8 9 7 6 5 3 2 4 5 6 9 6 0 9 2 1 7 6 4 8 2 3 7 8 5     | 3        | 3  | 4  | 3  | 13    |
| 6 7 8 9 5 6 4 3 2 1 6 7 8 9 0 6 7 5 3 2 5 6 7 8 9 4 0 3 8 8 | 1        | 3  | 2  | 2  | 8     |
| 1 2 8 9 4 5 6 7 8 0 9 2 3 4 5 6 5 7 5 4 6 7 9 0 5 4 3 7 6 8 | 2        | 3  | 4  | 2  | 11    |
| 3 4 6 5 7 9 4 2 7 5 6 3 1 0 3 9 5 6 1 2 8 4 7 5 6 0 8 7 5 3 | 2        | 4  | 3  | 3  | 12    |
| 1 2 3 6 5 4 8 9 0 6 5 4 7 8 8 2 3 9 8 5 3 2 0 7 5 9 8 2 5 6 | 4        | 4  | 2  | 1  | 11    |
| 1 9 3 5 7 8 6 2 1 3 6 5 4 7 8 9 6 3 2 1 4 5 6 9 8 7 4 1 2 3 | 3        | 3  | 3  | 2  | 11    |
| 5 8 9 6 3 2 1 7 5 4 8 9 6 3 2 1 4 7 8 9 6 5 4 1 2 5 8 9 6 4 | 3        | 4  | 2  | 3  | 12    |
| 4 5 6 8 7 9 6 5 4 7 8 9 6 5 2 3 1 4 7 8 9 6 5 4 1 2 3 4 8 4 | 2        | 3  | 3  | 3  | 11    |
| 4 5 7 8 9 2 1 7 8 5 6 3 4 8 9 7 5 1 2 3 5 4 7 9 5 4 6 2 1 3 | 3        | 5  | 4  | 3  | 15    |
| 4 7 8 9 5 4 7 8 1 2 3 0 4 7 8 9 6 5 2 0 1 0 9 0 7 4 6 1 0 8 | 2        | 2  | 4  | 3  | 11    |
| 4 5 1 0 2 9 7 3 0 1 8 5 6 0 7 9 4 1 2 9 8 7 4 0 2 9 6 3 4 8 | 3        | 2  | 3  | 3  | 11    |
| 9 8 0 7 5 6 4 1 2 3 0 7 8 4 5 6 1 8 2 3 9 7 2 5 8 6 4 0 3 5 | 2        | 4  | 3  | 1  | 10    |
| 7 8 5 1 2 6 9 8 7 0 5 8 9 7 8 6 4 1 2 0 8 9 7 2 6 4 8 7 2 3 | 4        | 2  | 5  | 4  | 15    |
| 1 5 9 7 5 3 2 6 9 8 7 4 5 6 3 2 4 8 9 7 5 6 3 1 0 2 0 5 8 0 | 3        | 5  | 3  | 3  | 14    |
| 9 5 1 0 3 5 7 9 5 1 2 3 6 9 7 5 3 1 6 4 7 9 3 1 0 8 6 9 5 4 | 1        | 5  | 3  | 5  | 14    |
| 8 5 2 6 5 4 7 5 3 9 5 1 2 5 8 4 2 6 7 1 0 3 9 8 4 2 0 5 8 2 | 5        | 6  | 2  | 2  | 15    |
| 7 4 1 2 3 6 9 8 7 5 3 6 5 4 2 5 8 7 8 6 1 2 0 5 8 0 9 6 3 4 | 2        | 4  | 3  | 1  | 10    |
| 9 5 1 7 8 9 3 2 1 4 5 8 7 4 5 1 2 3 6 0 2 5 0 4 9 9 7 7 0 3 | 3        | 4  | 4  | 4  | 15    |
| 3 2 1 7 5 3 1 5 9 6 5 4 2 0 1 0 8 3 7 2 1 9 4 6 5 2 8 7 9 0 | 4        | 4  | 2  | 3  | 13    |
| Total Performance   | 54       | 72 | 64 | 55 | 245   |
| Total Wrong   | 0        | 0  | 0  | 0  | 0     |
| Total Correct   | 54       | 72 | 64 | 55 | 245   |

Time 4 min 59.5 seconds

59.5 in la row



**Discussion:**

Compare the number units correctly added before and after interpolation. The difference will indicate the level of mental fatigue in the subject.

Total number of 2,5,7,9=255

Found=245

Missed=10

**Conclusion:**

Find out the effect of interpolation activity as a factor of mental fatigue.

It is known that chronic fatigue is associated with sympathetic hyperactivity. However, the relationship between autonomic function and mental fatigue caused by a prolonged mental load in healthy humans is still unclear. Thus, in order to clarify the mechanisms underlying mental fatigue, we examined the association between mental fatigue and autonomic functions.

After the relaxation session, low-frequency component power (LF), high-frequency component power (HF) and low-frequency component power/high-frequency component power ratio (LF/HF ratio) were not changed from baseline. In contrast, after the fatigue session, the HF and LF/HF ratio were significantly changed from baseline; specifically, the HF was lower and LF/HF ratio was higher as compared to those after the relaxation session.

Sympathetic hyperactivity based on decreased parasympathetic activity is associated with mental fatigue induced by prolonged cognitive load.

## **TOWER OF HANOI – PROBLEM SOLVING TEST**

Tower of Hanoi consists of three pegs or towers with disks placed one over the other. The objective of the puzzle is to move the stack to another peg following these simple rules. Only one disk can be moved at a time. No disk can be placed on top of the smaller disk.

**Definition**

There is a problem when a goal is not immediately able to be achieved (e.g., Reitman, 1965; Newell & Simon, 1972).

Problem-solving is the identification and selection of solutions to the problem.

Directed and Undirected Thinking

- Directed: Goal-oriented and rational: Requires a clear well-defined goal
- Undirected: Meanders (day dreams, dreaming, drifting thoughts, etc.) Plays a role in creativity and poorly-defined problems Well-Defined and ill-Defined Problems.

## **Types of Problems**

Problems vary from ill defined to well defined. In a well defined problem such as a mathematical equation or a jigsaw puzzle both the nature of the problem and the information needed to solve it are available and clear. Thus, one can make straightforward judgments about whether a potential solution is appropriate. With an ill defined problem, such as how to bring peace, not only may the specific nature of the problem be unclear, the information required to solve the problem may be even less obvious. Greeno (1978) suggested one method of classifying well defined problems based on the general kinds of psychological skills and knowledge needed to solve different problems. Typically, well defined problems falls into one of the three categories viz., (i) Arrangement (ii) Inducing Structure and (iii) Transformation.

## **Characteristics of Difficult Problems**

Some of the typical characteristics of difficult problems are as given below:

- Intransparency (lack of clarity of the situation)
- Commencement opacity. (confusion regarding how to start stating the problem)
- Continuation opacity (Continuing confusion in regard to the problem as there is no clarity)
- Polytelic (The problem has multiple goals and so reaching and selecting a particular goal is difficult)
- Inexpressiveness (inability to express the problem clearly)
- Opposition
- Transience (the problem keeps changing)
- Complexity (The problem is in large numbers of items, too many interrelationships and decisions)
- Enumerability (It is not possible to list it or quantify it)
- Connectivity (There are hierarchy of problems in relation to relationship, communication and allocation )
- Heterogeneity (The problem is not homogeneous and so difficult to handle)
- Dynamics (time considerations)
- Temporal constraints (There is limitation to time factor as it has to be got done within a time period)
- Temporal sensitivity (The problem is influenced and affected by time factor)
- Phase effects ( There are changes in different phases of the problem and these affect the problem from being solved)
- Dynamic unpredictability (The problem is complex and consists of high degree of unpredictability).

## **The Stages of Problem Solving**

The situation that prevails at the beginning of the problem solving task is the initial state. The system then moves through a series of different, intermediate states, designed to lead to the goal. When the goal is achieved, the system is said to have attained the goal state.

Thus there are four molar components of any problem solving activity and these are given below:

- The initial state: How the starting conditions are defined
- The Operators: Moves or operations to move from one state to another
- Intermediate Problem States: Any states that are generated by applying an operator to a state on the way to final goal.
- The goal state: How the final state or goal conditions are described. The internal representation (or mental model) of these four states of a problem is called “Problem Space”.

This problem space varies from one individual to another. It must be kept in mind that each individual's problem space is unique and depends also on the nature of the problem. The initial state of a problem is critical to problem solving and some problem's initial state may lead to efficient problem solving while another may end up in high complexity. Problem solving strategies Creative problem solving Group problem solving Problem solving approach Management problems solving Elementary problem solving Problem solving activities Problem solving worksheets Teaching problem solving Problem solving lesson plans Problem solving skills Art Problem solving.

### **Types of Thinking Involved in Problem Solving**

According to Wertheimer (1959) effective problem solving requires: i) Productive thinking ii) Being sensitive and open to structural requirements iii) Going beyond the knowledge learnt from previous problem solving tasks For productive thinking there is a need to have a grasp of the general principles that apply in the particular problem situation. Since individuals do have a tendency to reproduce thinking appropriate for other situations, they need to think beyond that solution and look for unique solutions. It is important to keep in mind the structure of the problem without which solutions may not come about.

The Kinds of Thinking Processes The kinds of thinking processes involved in problem solving are:

- 1) Analytical Thinking
- 2) Synthetic Thinking.

In analytic thinking, there is nothing more in solution than in the premise. For example if the problem is a simple question like “how many doors are there in your house”, then the answer is simple counting of the doors and adding it up. There can be no other answer and there can also be no other solution.

In contrast, Synthetic Thinking does not contain the conclusion in the premise itself because the solution is not needed in the construction of the mental object. For example, we know that 2 is a divisor of 4, 4 is a divisor of 8, and 2 is also a divisor of 8. In general, it is true that a divisor of a divisor of a number is a divisor of that number.

### **Problem:**

There are 3 pegs ‘from’, ‘using’ and ‘to’. Some disks of different sizes are given which can slide onto any peg. Initially all of those are in ‘from’ peg in order of size with largest disk at the bottom and smallest disk at the top. We have to move all the disks from ‘from’ peg to ‘to’ peg. At the end, ‘to’ peg will have disks in the same order of size.

The goal of the puzzle is to move all the disks from the leftmost peg to the rightmost peg, adhering to the following rules:

- 1) Only one disk can be moved from one peg to another peg at a time.
- 2) A disk can be placed only on top of a larger one.
- 3) A disk can be moved from top only.

### **Approach:**

Take an example for 2 disks:

Let rod 1 = 'A', rod 2 = 'B', rod 3 = 'C'. Step 1: Shift first disk from 'A' to 'B'.

Step 2: Shift second disk from 'A' to 'C'. Step 3: Shift first disk from 'B' to 'C'.

The pattern here is:

Shift 'n-1' disks from 'A' to 'B'. Shift last disk from 'A' to 'C'.

Shift 'n-1' disks from 'B' to 'C'.

Examples:

### **Input: 2**

Output: Disk 1 moved from A to B. Disk 2 moved from A to C. Disk 1 moved from B to C.

### **Input: 3**

Output: Disk 1 moved from A to C. Disk 2 moved from A to B. Disk 1 moved from C to B. Disk 3 moved from A to C. Disk 1 moved from B to A. Disk 2 moved from B to C. Disk 1 moved from A to C.

### **Results and Data analysis**

Data collected from the Tower of Hanoi task include the total time taken to solve, the number of moves to solve, and the number of rule violations. Other aspects such as impulsivity to perform the task, eye movements and other observable behaviours can also be recorded by an examiner conducting the task.

| S.No | No.of Trails | Total time taken | No. of times of violation of rules |
|------|--------------|------------------|------------------------------------|
| 1    | 7            | 11.01            | 0                                  |

### **Strengths and limitations**

#### **Strengths**

The Tower of Hanoi is a simple mathematical puzzle that can easily assess the problem-solving capabilities of an individual. It is a widely used tool for the evaluation of planning and working memory abilities. The Tower of Hanoi puzzle is sensitive to prefrontal damage and dysfunction. The puzzle's difficulty level can easily be increased or decreased with additional disks or pegs respectively.

#### **Limitations**

The Tower of Hanoi cannot be used standalone to understand and assess executive functions of the brain. It can be difficult to employ in individuals unable to cooperate with the process. Other factors such as sleep, anxiety, may also affect the performance.

## **MULLER LYER ILLUSION**

### **(Method of Average Error)**

#### **Introduction:**

Illusion is a false perception. Here the person will mistake a stimulus and perceive it wrongly. For example, in the dark, a rope is mistaken as a snake or vice versa. The voice of an unknown person is mistaken as a friend's voice. A person standing at a distance who is not known may be perceived as a known person. Most of our illusions are visual and auditory. But illusions pertaining to other senses are also possible.

#### **What are Illusions?**

Illusions provide powerful clues about how the brain processes information. Scientifically, they can pose a problem for empirical research as they demonstrate the ways in which even direct observation can be misleading. Most people can be tricked by optical illusions, and scientists can use information about this visual phenomenon to better understand perception and brain organization. Some conditions that affect the brain may also cause illusions. For example, people who experience migraine headaches frequently report seeing auras, which consist of movement or colors along the outer edges of a person's view.

#### **Types of Illusions**

Illusions can occur with any of the five senses. Examples include:

Optical illusions, which may be seen when an image is constructed in such a way that it relays misleading information to the brain. For example, two people of different heights standing on a slanted floor covered in check marks may appear to be standing on a flat floor and thus appear to be the same size.

Auditory illusions, which occur when a person hears sounds that are not actually being made or sounds that are distortions of the actual tones. One well-known example is the Shepard tone, which seems to be constantly rising or falling in pitch but is actually doing neither.

Tactile illusions, which cause the brain to perceive touch stimuli that is not actually present, or that is not present in the way the brain perceives it. Phantom limb syndrome, or the experience of feeling an amputated limb, is an example of a tactile illusion.

Smell and taste illusions, which are not as common as other types of illusions. However, certain people may perceive smells differently than others do, especially when given conflicting information about the stimuli producing the smell. Similar phenomena can occur with taste.

#### **What Causes Illusions?**

Illusions are different from hallucinations in that hallucinations occur without external stimuli. Like hallucinations, though, illusions are not necessarily a sign of a psychiatric condition, and anyone might experience them. They can occur for many reasons, such as the effect of light on an object, insufficient sensory information about an object, or errors in an individual's processing of sensory details. The refraction of light can cause rainbows and mirages, two illusions that are dependent on the atmosphere.

Certain illusions, known as pseudo hallucinations, can be signs of a psychiatric disturbance. One may experience a pseudo hallucination under conditions of anxiety or fear or when he or she projects their feelings onto external objects or people. People in intensive psychiatric care have been reported to see people around them as monsters or devils, for example. Illusions can also be characteristic of certain mental health conditions, such as schizophrenia.

### **Synesthesia**

Synesthesia is a particular type of illusory phenomenon where individuals experience certain sounds as colors. A musician might see green when he or she hears a particular piece of music, for example. Some writers have also reported hearing musical tones when they see a particular word or image. In certain rare and extreme cases, people with synesthesia may become unable to differentiate between seeing and hearing.

The Müller-Lyer Illusion is one among a number of illusions where a central aspect of a simple line image – e.g. the length, straightness, or parallelism of lines – appears distorted in virtue of other aspects of the image – e.g. other background/foreground lines, or other intersecting shapes. These are sometimes called ‘geometrical-optical illusions’ and you can search for others in the Illusions Index.

Illusion, a misrepresentation of a “real” sensory stimulus that is, an interpretation that contradicts objective “reality” as defined by enteral agreement. "or example, a childhood perceives tree branches at night as if they are !goblins may be said to be having an illusion. An illusion is distinguished from a hallucination, an experience that seems to originate without an external source of stimulation. %either experience is necessarily a sign of psychiatric disturbance, or are both regularly and consistently reported by virtually everyone. The nature of Illusions is special perceptual experiences in which information arisen from “real” external stimuli leads to an incorrect perception, or false impression, of the object or event from hitched stimulation comes

### **Statement of Problem:-**

To study the effect of familiarity on the performance of Muller- Lyer illusion experiment. To observe phenomenon of differential over correction as result of familiarity.

### **Aim:**

To determine the extent of Muller-Lyer Illusion by the method of average error.

### **Plan:**

Ascending and descending series to be done alternately. In each trial, the subject manipulates the variable stimulus to make it equal to the standard length of 16 cms.

### **Materials:**

- a) The Muller-Lyer illusion board
- b) Writing materials

### **Experimental Controls:**

- 1. The experimenter should make sure that the subject has understood the instructions.
- 2. The distance between the subject and the apparatus is kept constant.
- 3. The variable line should be held definitely longer in the descending series and shorter in the

ascending series.

4. The starting point of variable line should vary from trial to trial to avoid habituation.

### Procedure:

The subject is made to sit comfortably. The apparatus is placed at a distance of two feet from the subject and the Muller Lyer Illusion board is adjusted to the eye level of the subject. The subject is shown the standard and variable lines.

**Ascending series:** Keep the variable line definitely shorter than the standard line in the ascending series. Instruct the subject to slowly increase the length of the variable line, till he/she feels it is equal to the standard line. When the subject stops moving, the length of the variable line adjusted as equal to the standard line is noted down with the help of the scale provided behind the apparatus, by the experimenter. Ten trials are given.

**Descending series:** The length of the variable line is kept definitely longer than the standard line in the descending series. The subject is instructed to slowly decrease the length of the variable line till he/she feels it is equal to the standard line. The length of the variable line adjusted as equal to the standard line is noted down with the help of the scale behind the apparatus by the experimenter. Ten trials are given here also.

**Note:** the ascending and descending trials are given alternately to eliminate practice effect.

### Instructions:

**Ascending series:** "The line between the two arrow heads is the standard line and its length remains constant. The line between the two feather-heads is the variable line and its length can be varied by manipulation. In this series the variable line is held shorter than the standard line. Slowly increase the length of the variable line till you feel it is equal to the standard line".

**Descending series:** "Now the variable line is held longer than the standard. Decrease the length of the variable line. Stop when you feel the line is equal".

### Precautions:

The distance between the subject and the apparatus should be two feet.

**Table for Individual Data on Muller-Lyre Illusion**

| Sl.No | Extent of error in ascending series | Extent of error in descending series |
|-------|-------------------------------------|--------------------------------------|
| 1.    | 10.8 cm                             | 11.3 cm                              |
| 2.    | 11 cm                               | 12 cm                                |
| 3.    | 10.9 cm                             | 11.2 cm                              |

|       |          |          |
|-------|----------|----------|
| 4.    | 14 cm    | 13.3 cm  |
| 5.    | 12.4 cm  | 12.6 cm  |
| Mean  | 11.82 cm | 12.08 cm |
| Error | 4.18 cm  | 3.92 cm  |

### Analysis of Data:

1. In each trial, the subject's judgment of the length of the variable line is noted by the experimenter. This is the point of subjective equality (PSE).
2. The mean PSE is calculated for each series.
3. The constant error (CE) is calculated in each series.

CE (Asc.) = Mean PSE (Asc.) – Standard Line (16 cms)=**4.18 cm**

CE (Des.) = Mean PSE (Des.) – Standard Line (16 cms)=**3.92 cm**

4. Calculate the mean CE

$$\text{Mean CE} = \frac{\text{CE (Asc.)} + \text{CE (Des.)}}{2} = \mathbf{4.05 \text{ cm}}$$

5. The movement error is calculated by using the formula

$$\frac{|\text{Mean PSE (Des.)} - \text{Mean PSE (Asc.)}|}{2} = \mathbf{0.13 \text{ cm}}$$

### Discussion:

Discuss whether method of presentation has affected the subject's extent of illusion.

Optical illusions can be fun and interesting. But they also serve as an important tool for researchers. By looking at how we perceive these illusions, we can learn more about how the brain and perceptual process work. However, experts do not always agree on exactly what causes optical illusions, as is the case with the Muller-Lyer illusion.<sup>1</sup>

#### The Size Constancy Explanation

According to psychologist Richard Gregory, this illusion occurs because of a misapplication of size constancy scaling. In most cases, size constancy allows us to perceive objects in a stable way by taking distance into account.<sup>2</sup>

In the three-dimensional world, this principle allows us to perceive a tall person as tall whether they are standing next to us or off in the distance. When we apply this same principle to two-dimensional objects, Gregory suggests, errors can result.

Other researchers contend that Gregory's explanation does not sufficiently explain this illusion. For example, other versions of the Muller-Lyer illusion utilize two circles at the end of the shaft. While there are no depth cues, the illusion still occurs. It has also been demonstrated that the illusion can even occur when viewing three-dimensional objects.

#### The Depth Cue Explanation



Depth plays an important role in our ability to judge distance. One explanation of the Muller-Lyer illusion is that our brains perceive the depths of the two shafts based upon depth cues. When the fins are pointing in toward the shaft of the line, we perceive it as sloping away much like the corner of a building. This depth cue leads us to see that line as further away and therefore shorter.

When the fins are pointing outward away from the line, it looks more like the corner of a room sloping toward the viewer. This depth cue leads us to believe that this line is closer and therefore longer.

How Do We Form Impressions of Other People?

The Conflicting Cues Explanation

An alternative explanation proposed by R. H. Day suggests that the Muller-Lyer illusion occurs because of conflicting cues. Our ability to perceive the length of the lines depends on the actual length of the line itself and the overall length of the figure.<sup>3</sup> Since the total length of one figure is longer than the length of the lines themselves, it causes the line with the outward-facing fins to be seen as longer.

Researchers from the University of London suggest that the illusion demonstrates how the brain reflexively judges information about length and size before anything else.

"Many visual illusions might be so effective because they tap into how the human brain reflexively processes information. If an illusion can capture attention in this way, then this suggests that the brain processes these visual clues rapidly and unconsciously. This also suggests that perhaps optical illusions represent what our brains like to see," explained researcher Dr. Michael Proulx.