CHAPTER-4
DESIGN AND METHODOLOGY

Research in the area of memory has consistently shown that some facets of memory are more affected by increasing age than others. Among these source monitoring has been found to be sensitive to aging. Neuropsychological investigations have shown that aging results in decline in the functioning of specific brain areas. Thus, the source monitoring deficits may be a result of this decline. The aim of present investigation was to study the developmental and neuropsychological aspect of source monitoring.

Design

To achieve the objectives delineated in Chapter III the investigation was conducted in two phases.

Phase I

A multi group (5 groups) quasi experimental design was used to study the developmental aspect of source monitoring. Subjects of the 5 developmental age groups (age range 13 to 75 yrs) were administered a source monitoring task in the following manner:

<table>
<thead>
<tr>
<th>Presentation Phase</th>
<th>Testing Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixty items to be presented, each for 2 sec. with an interstimuli interval of 3 sec. Stimuli to be varied in terms of source (Red &amp; Blue) and nature of presentation (Perceived/Imagined, Hindi/English)</td>
<td>Rest Pause of 15 minutes</td>
</tr>
</tbody>
</table>
Phase II

In Phase II the relationship between source monitoring performance and neuropsychological functioning was studied. Subjects of each group were divided into two groups on the basis of their source monitoring scores i.e. high source monitoring [HSM, above 75th percentile] and low source monitoring [LSM, below 25th percentile]. Specific items from the AIIMS comprehensive neuropsychological battery, which provided a measure of temporal/frontal lobe function, were administered to the subjects.

Sample

For Phase I a purposive sample of 175 subjects, who volunteered to participate in the study, was taken from various developmental age groups i.e. adolescent, young adult, middle age, early late adult and late late adult. Two later adult stages were considered in sample since earlier research indicated that deficits are more evident in older subjects. Except adolescent group all subjects were at least graduate. Subjects were bilingual (primary language: Hindi) with no apparent memory deficit. For Phase II half of the subjects of each group i.e. above 75 percentile and below 25th percentile were selected on the basis of their source monitoring score. The distribution of subjects for the various groups was as follow:
Table 1 Distribution of Sample

<table>
<thead>
<tr>
<th>Phase-I</th>
<th>Adolescent</th>
<th>Young Adult</th>
<th>Middle Age</th>
<th>Early Late Adult</th>
<th>Late Late Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(13-15 yrs)</td>
<td>(20-25 yrs)</td>
<td>(40-45 yrs)</td>
<td>(60-65 yrs)</td>
<td>(70-75 yrs.)</td>
</tr>
<tr>
<td></td>
<td>n=50</td>
<td>n=50</td>
<td>n=25</td>
<td>n=25</td>
<td>n=25</td>
</tr>
<tr>
<td>Phase-II</td>
<td>LSM</td>
<td>HSM</td>
<td>LSM</td>
<td>HSM</td>
<td>LSM</td>
</tr>
<tr>
<td></td>
<td>n=12</td>
<td>n=12</td>
<td>n=6</td>
<td>n=6</td>
<td>n=6</td>
</tr>
<tr>
<td></td>
<td>HSM</td>
<td>LSM</td>
<td>HSM</td>
<td>HSM</td>
<td>HSM</td>
</tr>
<tr>
<td></td>
<td>n=12</td>
<td>n=6</td>
<td>n=6</td>
<td>n=6</td>
<td>n=6</td>
</tr>
</tbody>
</table>

**Material**

1. **Source Monitoring Task**

For conducting the source monitoring task the following material was required.

(i) **Tachistoscope:**

A portable electric techistoscope PT – 123 manufactured by Medicaid was used. It was a metallic rectangular box mounted on four legs in a slightly backward position. It had a screen 2"x3" with a capacity to display 2"x2" slide. There were two switches one for adjusting the time in terms of seconds and other for multiplier by which exposure time could be varied from 0.1 to 10 sec. It was a small and light weight equipment which could be held in the hand, thus it could be used in field as well as in the lab. It had a ready signal (audio indicator) to alert the subject. Stimulus presentation could be controlled by the experimenter/subject (with the help of remote).
(ii) Stimuli Material

One hundred and twenty concrete nouns of approximately equal familiarity were chosen for the source monitoring task. Sixty of these were selected as initial stimuli for the experiment. Sixty slides (2” x 2”) were prepared, half of which were for perceived (picture + name) and half for imagery (only name) trials. Each slide for the perceived trials showed a picture of the object with its name below it. For the imagery trials, the name of an object appeared on the slide. Half of object's names appearing on the slide were written in red color and the others were in blue color. In the same manner, half were written in Hindi and half were in English language. For recognition testing a test sheet with 120 concrete nouns was prepared by intermixing 60 of the initial names with 60 new names. The old and new item's name were written with black ink in a random sequence.

2. Neuropsychological Testing

For the neuropsychological testing AllIMS comprehensive neuropsychological battery (Gupta, Jain, Khandelwal, Mahapatra, Maheshwari, Mehta, Sundaram & Tandon) in Hindi was used. The battery comprises of AllIMS comprehensive Neuropsychological Battery in Hindi – Theory and Practice, Manual for instructions and Administration of Items, Response Booklet, Booklet containing scoring sheets and items required for administration of battery (Match box, Maze Test, Marbels with container, five wooden cubes, blind goggles, single window counter (manual taper), stop watch, stimulus cards).
The Battery contains 160 items related to the motor, tactile, visual, the receptive speech, expressive speech, reading, writing, arithmetic tasks. It is an effective instrument for the identification and laterlization of brain dysfunction. Specific test items discriminate damage to specific areas of the brain. The format of the AIIMS Neuropsychological Battery allows for the design of specific scales identified for picking up damage in each localized area of the brain. Eight scales of items for localizing brain damage have been derived. These are as follow:

<table>
<thead>
<tr>
<th>Lobe Scales</th>
<th>Item Counts</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Frontal</td>
<td>42</td>
<td>0 – 168</td>
</tr>
<tr>
<td>Left Sensory Motor</td>
<td>14</td>
<td>0 – 56</td>
</tr>
<tr>
<td>Left Parietal – Occipital</td>
<td>17</td>
<td>0 – 68</td>
</tr>
<tr>
<td>Left Temporal</td>
<td>24</td>
<td>0 – 96</td>
</tr>
<tr>
<td>Right Frontal</td>
<td>21</td>
<td>0 – 84</td>
</tr>
<tr>
<td>Right Sensory Motor</td>
<td>16</td>
<td>0 – 64</td>
</tr>
<tr>
<td>Right Parietal – Occipital</td>
<td>12</td>
<td>0 – 48</td>
</tr>
<tr>
<td>Right Temporal</td>
<td>15</td>
<td>0 – 60</td>
</tr>
</tbody>
</table>

For the present investigation, the battery was not used as a diagnostic tool. Since, specific items of the battery provide an index of the functioning of specific brain areas, 102 items which provided a measure of frontal/temporal lobe functioning were used. The details of the lobe scales used in the present investigation is as follows:

The Left Frontal Lobe Scale

The Left Frontal (LF) lobe scale included 42 items. Among these fourteen items assess simple motor movements of right hand and fingers with spatial organization, motor movements of right foot,
oral movements of various kinds and one paper pencil test. Two items assess the ability to understand the content of a sentence/paragraph. Three items intend examining expressive speech particularly the complex system of grammatical expressions by filling a words missing in a sentence/paragraph and their articulation. Three items from writing scale assess the skill to write sentences on dictation, automatic writing skills and the visual confrontation writing. Eight items are from arithmetic scale-writing numbers in words on dictation, simple arithmetic operations (addition, subtraction, multiplication and division) and also items assessing the application of principles of induction and decoction. There are twelve items from the intellectual processes scale eliciting general information, comprehension for social skills, proverbs, ability to determine opposites, form analogies and concepts, and abstractive skills.

The Left Temporal Lobe Scale

The Left Temporal (LT) lobe scale includes 24 items. Among these seven items are from receptive speech scale: these items require identification of phonemes/nonsense words and the other four items require understanding of simple/complex commands by exhibiting motor rather than verbal response. One item is from expressive speech scale expecting the subject to repeat verbally presented sentences. There are eight items from writing scale – two items expecting the subject to identify first and seconds letters of the verbally presented words; two expecting the subject to copy/write letters shown on a card; three items requiring writing of letters, words and a sentence on dictation and one item assessing automatic
writing skills. One item is from arithmetic scale requiring the subject's complex computational skills (using more than one type of arithmetic operation). Five items are identified from memory scale – two items assessing verbal remote and recent memory; one assessing immediate verbal recall of words; and two assessing verbal recall with homogenous and heterogeneous interference. There are two items from intellectual processes scale – one expecting the subject to use logical reasoning for numbers and the other one expecting the subject to identify the missing elements in a complex geometric configuration – task similar to that of Raven's Progressive Matrices Test.

The Right Frontal Lobe Scale

The Right Frontal (RF) lobe scale includes 21 items. Among these fifteen items are from motor scale – eight of which measure motor movements of left extremities and the other seven are paper pencil tests which measure constructional dyspraxia. There are three items which belong to visual functional scale – two are devoted to assess visual spatial functions and one expects the subject to do three dimensional analysis of a picture. Two items are picked up from arithmetic scale and both the items expect the subject to identify the significance of number placement. One item belongs to intellectual processes scale and this item is devoted to maze learning.

The Right Temporal Lobe Scale

The Right Temporal (RT) lobe scale includes 15 items. Among these one item belongs to motor scale which assesses ability to identify how hard he is touched on his left hand. Four items are from the visual functions scale – three of them requiring
identification/counting of objects/birds presented through stimulus cards and the one requiring three dimensional analysis of a picture. Two items are picked up from the expressive speech scale – both the items naming objects/body parts shown visually on stimulus cards. Two items on the arithmetic scale expect the subject to identify the significance of number placement. Six items belong to memory scale which are devoted to recognition task (of birds/animals shown on stimulus card); one of immediate memory for digits – backward; one to immediate memory for digits – backward; one to immediate recall of designs (visual memory); and the last two items are devoted to evaluate nonverbal recall with homogenous and heterogeneous interference. As per the manual, the battery has been recommended for use with subjects of 15 years or more, since the sample for the present study ranged from 13 year to 75 year, an initial testing was done on 13-15 year old subjects. No major differences were found in the performance of 13-14 year old subjects as compared to 15 year old.

METHODOLOGY

Subjects were tested individually in two phases (source monitoring and neuropsychological testing). The subjects of the 2 lower developmental stages i.e. (adolescent, young adult) were tested at their school/college. However, remaining subjects were tested at their homes.

Phase I

For conducting the source monitoring task the tachistoscope was set on a table in a semi-dark room. Subject was called in the room and a comfortable chair was provided at a distance of 2 feet,
such that the exposure window of tachistoscope was at the eye level of the subject. Initial rapport was established and following instructions were given –

"A stimuli will appear in the window of this apparatus for a brief period. A sound alarm of 1 sec. will precede the presentation. After the sound alarm, the light in the window will be switched on and you will then see the stimulus. As each stimulus appears look at it carefully. Stimuli will appear in a verbal form or verbal + pictorial form. Names of the items will appear either in Hindi or in English language. The names of some of the items would be written either in red or blue color. You have to pay attention to the stimulus as well as color in which the stimulus is written. If there is any doubt you can ask me before we begin."

After giving the instructions to the subject, tachistoscope was connected to the electric supply. Time multiplier was adjusted with the help of rotary switch for 2 sec. The subject was asked to look at the screen. Slide was inserted in the tachistoscope's housing slit and treat switch was pushed. The equipment gave 1 sec sound alarm for alerting the subject and then the slide was illuminated for 2 sec. The light went off after 2 sec. The slide was removed and the second slide was inserted. The time gap between presentation of two slides was approximately 3 sec. All the 60 slides were presented one by one to the subject in this manner.

After the presentation of the 60 slides a rest pause of 15 minutes was given to the subject. After the rest pause the subject was recalled to the testing room and the following instruction were given –
"You will be given a test sheet in which the earlier presented object names will appear along with some new object names. Against each name you have to indicate your responses in two categories New/Old if old Red/Blue i.e. if the items name was presented earlier in red colour then you have to indicate 'R' in front of the item and if it was in blue colour then you have to indicate 'B'."

The subject was provided the test sheet with 120 items All the subjects were tested for source monitoring in same manner.

For scoring the responses of the subjects, initially the frequency of correct recognition score was computed i.e. correct identification of old or new items. Further, the correct source identification (R/B) frequency was computed. Each item which had been correctly identified was given 1 mark while wrong identification was given 0 mark. The right responses of the subjects on the source monitoring task were further categorized on the basis of nature of stimulus i.e. Perceived/Imagined and Hindi/English.

**Phase II**

On the basis of the source monitoring performance the subjects of each age group were further divided into two groups i.e. HSM and LSM groups. For the HSM group, subjects whose source monitoring performance was above the 75th percentile of that age group were taken while for the LSM group subjects whose source monitoring performance was below the 25th percentile of the group were taken. These subjects were administered the neuropsychological functioning test. Thus, the sample for this phase consisted of 84 subjects. AllMS comprehensive neuropsychological
battery was administered to each of these subjects in an individual setting. Instructions were given as follow:

"You will have to perform some simple tasks related to reading, writing, arithmetic, motor, visual and memory functions. Try to do each task to the best of your ability."

After these general instructions, instructions for each item was read from the manual. Sample items (one each) from the various scales have been presented here:

1. Motor Functions Scale

   एक डिब्बे में रखी गोलियाँ और एक खाली कप प्रयोज्य के सामने रखते हुए परीक्षक उससे कहें – अब आपको दाएं हाथ से रखी गोलियाँ एक-एक करके (परीक्षक को कप की ओर इशारा करता है) इस कप में डालनी है। मेरे "तैयार" बोलने पर आप कार्य के लिए तैयार हो जाये। जब मैं "जुल" बोलूं तो आप कार्य जल्दी-जल्दी करना शुरू कर दें और "बस" बोलने पर कार्य बन्द कर दें।

समय–सीमा : 10 सेकंड।

2. Tactile Functions Scale

   परीक्षक प्रयोज्य को अपने चशमा पहनाकर कहें – "अपने दोनों हाथों को मेरे सामने रखें। परीक्षक गाइड की तीली का मसाले वाला सिरा प्रयोग करते हुए धीरे या जोर से दाएं हाथ के ऊपर रखा माफ को दबायो और प्रयोज्य से पूछें कि दबाया ज्यादा है या कम। प्रयोज्य के गलत उत्तर की परवहन न करते हुए परीक्षक आगे कहें – मैं कई बार यह तीली जोर से दबाऊँगा/दबाईंगी और कई बार धीरे से। आपको बतलाना है कि कब मैंने तीली जोर से दबायी और कब धीरे से।?

   (प्रत्येक खोल यही अंशुली से लगभग 4 – 5 से मी. ऊपर होना चाहिए।) गाइड की तीली का रंग निम्न कम में करायें : धीरे से; जोर से; जोर से; धीरे से।

3. Visual Functions Scale

   परीक्षक प्रयोज्य से कहें – मैं एक कार्ड (वी आई एस – 1) पर भरे कुछ वस्तुओं के चित्र दिखाऊँगा/दिखाईंगी। चित्रों को देखकर आप बतायें कि वे
4. Receptive Speech Scale

परीक्षक प्रयोजन से कहें — मैं आपको एक—एक करके कुछ निर्देशक शब्द सुनाऊंगा / सुनाकर। सुनने के बाद आप उन्हें ज्ञात करेंगे कि कैसे है। (परीक्षक को ध्यान रखना है कि प्रयोजन के द्वारा हर एक निर्देशक शब्द का अर्थ अक्सर ठीक बोला जाना आवश्यक है। चाहे बाद के अक्सर ठीक से बोले गये बाये न हो या नही।)
शब्द : नीर; जीक; नीक; खीक।

5. Expressive Speech Scale

परीक्षक प्रयोजन से कहें — आब मैं आपको जो कार्ड (ई एक्स पी — 1) दिखाऊंगा / दिखाकर। उस पर कुछ वस्तुएं बनी है। आप पहले कर उनके नाम बतायें। (यदि प्रयोजन ध्यान में दर्शाये वस्तु का नाम न लेकर उसके उपयोग के विषय में बताता है तो उत्तर गलत माना जायेगा)। वस्तुओं के चित्रों के नाम: कैंटी, त्रिसूल, ऐनक, छाता।

6. Writing Scale

परीक्षक प्रयोजन से कहें — अब की बार फिर मैं एक — एक करके कुछ शब्द बोलुंगा / बोलेंगी। आप हर एक शब्द का दूसरा अक्सर मुझे बतायें। समय—सीमा : 10 सेकंड प्रति शब्द। शब्दों को बोलने का ब्रांड : कमल, सहमत, खिचे, गदगढ।

7. Arithmetic Scale

परीक्षक प्रयोजन से कहें — इस बार भी आप दायों तरफ से गणनातिपय पढ़ें। जैसे इस कार्ड (ए आर आई — 4) पर लिखें 346 को 643 पढ़ा जायेगा। इसी प्रकार दिये गये कार्ड (ए आर आई — 5) पर लिखें गणनातिपय उलटी तरफ से पढ़ कर सुनायें।
समय — सीमा : 10 सेकंड प्रति प्रश्न।

8. Memory Scale

परीक्षक प्रयोजन को कार्ड (एम ई एम — 1) देते हुए कहें — इस कार्ड बने पश्चिमों को ध्यानपूर्वक देखें। परीक्षक 10 सेकंड बाद कार्ड अपने के लेकर प्रयोजन को दूसरा कार्ड (एम ई एम — 2) देते कहें — पहले कार्ड में देखे पश्चिमों को इस कार्ड में पहचानकर बतायें। कार्ड (एम ई एम — 1) पर बने पश्चिमों के नाम: मोर, लोता, मुर्गी, बतख।
9. Intellectual Processes Scale

रोशनक प्रयोजन से कहें - कृपया बोले गये शब्दों के विलोम (विशेषतः अर्थ वाले) शब्द बतलाइये।
समय - सीमा : 5 सेकंड प्रति शब्द।
प्रश्न शब्द:

1. सच्चा (उत्तर : झूठा)
2. कँचा (उत्तर : नीचा)
3. आदमी (उत्तर : औरत)
4. मोटा (उत्तर : पतला, महीन या बारीक)

Responses of the subjects were recorded in response booklet available for the purpose. Scoring was done with the help of manual for each item. Scores of the subjects were in 2 categories on the basis of the lobe scales i.e. FL and TL for each subject.

The raw score of the subjects have been tabulated in Appendices B-I and B-II. These scores were further statistically analysed. The detailed results and discussion have been presented in the next chapter.