CHAPTER V
DISCUSSION

The semantic memory content and process components were assessed in 106 neuro-typical participants, 26 people with aphasia and 29 people with dementia using a wide range of linguistic test stimuli. The responses obtained were scored appropriately and analyzed data were statistically treated. The statistical results were significant across several measures among the clinical and control groups. The results were tabulated and the significant facts were extracted. Later on the discussions and theoretical implications were engendered to corroborate or contradict the literature studies. Over decades, the study on semantic memory has been extensively carried out by several researchers using one or more cognitive linguistic stimuli. The study has been focused both in neuro-typical and brain injured population. The results and outcomes of these studies have been diverse and loaded with speculative inferences. On a parallel note, the current study revolved around several cognitive linguistic tasks that have been used extensively to study the content and process nature of semantic memory, yielding numerous fascinating and confounding results. The results as discussed under (a) performance of content and process tasks across the groups and age groups (neuro-typical); (b) performance of content and process tasks within groups and age groups; (c) performance of semantic memory (content and process) across severity and types of condition; (e) influence of cues across the groups; (f) overall configuration and modularity of semantic memory across groups.
5.1. The nature of content and process in semantic memory

The content of semantic memory refers to the building blocks of the semantic memory component. The content structure of an individual is behaviourally measured using the tasks such as the confrontation naming, word association, priming tasks, comprehension tasks. The scores vary propositionally with the intactness of the cognitive system in an individual. The present study included the confrontation naming (picture and object modality); word association (paradigmatic and syntagmatic) and the sentence comprehension (yes/no questions and sequential commands) tasks. The performance in each of these across the neuro-typical and PWA and PWD are discussed as below.

5.1.1. Performance of confrontation naming tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Several authors suggest that language tests especially the picture naming task is a best measure to continuously track the cognitive loses as any semantic, lexical or phonological deficits can be identified through this. The picture naming task is a test that has been commonly used to study semantic memory, and appears in several forms. The results of confrontation naming across the groups (control and clinical groups) have shown a significant difference for picture and object naming tasks except between the PWA and PWD groups for object naming. Picture confrontation naming was found to be significant across all the groups. Naming task includes a chain of processes which are initiated at the perceptual level (sensory perception) and then the conceptual level (recognition level) and semantic lexical level (identification of lexical label) and then the phonological-articulator level (acoustic utterance of the target word).
The results of the current study revealed a significant difference in the confrontation naming task between neuro-typical and aphasia participants; and neuro-typical and dementia participants. Word finding difficulty has been the most common deficit in persons with dementia and aphasia (Kirshner, Webb & Kelly, 1984; Williams & Canter, 1987). In the current study, the results were found to be significant for confrontation picture and object naming between the clinical and control group which is in consensus with the study by Hodges et al, 1992. However, the confrontation object naming did not exhibit any significant difference between the aphasia and dementia participants (Basso, Razzano, Faglioni, & Zanobio, 1990; Thomas & Goswami, 2015) and even across the neuro-typical age groups. However, contradicting studies by Nebes and Brady (1990); Ober, Jagust, Shenaut and Stillman (1991) report that the semantic processing has no age related effects. The earlier studies report additional perceptual deficits in neurological impaired conditions such as the dementia and aphasia other than the lexical deficits in picture naming tasks (Harley, 1998). Thus, it may be proposed that the use of real objects in the confrontation naming task provided the additional visual and tactile (sensory) perceptual features to the clinical and neuro-typical groups and thus resulting in similar performances in both the persons with dementia and aphasia and thus yielding no significant difference.

The picture naming task was proved to yield significant measures across the normal aging and the clinical groups. The results are in consensus with the earlier finding reported by Abhishek and Prema 2013; Arpita, 1997; Bayles and Tomoeda, 1983; Shanthala, 1997. In normal ageing, the quantitative and qualitative analysis of errors reveal a significant drop across the age groups especially the older age groups (Brown &
Mitchell, 1991). This result is justified with the assumption that the neurological insult in the clinical groups affects the complete semantic feature activations (required for a lexical recognition) and thus failing to reach the activation thresholds of semantic-linguistic processing. Thus, resulting in collapse at the semantic and label retrieval stages in confrontation naming when compared to the neuro-typical participants (Watamori, Fukusako, Monoi & Sasunuma, 1991). In the neuro-typical group, the responses decrease with age because of the irregular use, inaccessibility and reduced cognitive process (Nicholas, Barth, Obler, Au & Albert, 1997). The prominent feature of naming difficulty is manifested in individuals with Alzheimer's disease (AD) because of the synaptic loss in AD which results in the loss of neural connectivity leading to impairments and degradation of semantic knowledge and the lexical-phonological connections (Kirshner, Webb, & Kelly, 1982; Mazurek & Beal, 1991; Terry et al, 1991; Wilson, Kaszniak, Fox, Garron & Ratusnik, 1981). Similarly, in persons with aphasia the errors are proposed to be as a result of the lexical-semantic access problem from the conceptual and lexical stores (Abhishek & Prema 2013; Arpita, 1997; Shanthala, 1997). The processing of the naming task can be explained on the grounds of the lexical naming models such as the functional architecture of the lexical system (Caramazza, 1988) as seen in Figure 5.1. amodal models of semantic memory (Riddoch et al, 1988) and the Organized Unitary Content Hypothesis i.e. OUCH (Caramazza, Hillis, Rapp, Romani, 1990).
Figure 5.1. Functional structural model of naming

These models have been laid out and a probable understanding of confrontation naming may be possible as shown in Figure 5.2.
The results of the present study are similar to the findings of earlier studies and it may be proposed that confrontation naming can be used as a useful task in differentiating the clinical population from the neuro-typical population. The picture naming task has been found more effective task as compared to the object naming task in both clinical and control groups.
5.1.2. Performance of word association tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Word association tasks included the syntagmatic and paradigmatic tasks performed across the clinical and neuro-typical age groups. The clinical groups performed poorer and showed a significant difference in comparison to the neuro-typical groups in syntagmatic and paradigmatic tasks. The differences were also found to be significant between the aphasia and dementia participants in syntagmatic and paradigmatic tasks. Interestingly, the performance of the syntagmatic association task was better than the paradigmatic association task in both persons with dementia and aphasia. The results were as reported in earlier studies wherein the performance in word association deteriorates in persons with dementia and aphasia when compared to normal individuals (Gewirth, Shindler & Hier, 1984; Kumar & Goswami, 2012; Laatu, Portin, Revonsuo, Tuisku, & Rinne 1997). The authors propose that the reduced performance in the association tasks indicates the deterioration of the conceptual networks and knowledge in the semantic memory. The network associations fail in these clinical cases and the mechanism producing syntactic networks may show less resistance to deterioration as opposed to the semantic associations (Baker & Seifert, 2001; Dell, Oppenheim & Kittredge, 2008). It may be further discussed that the mechanism producing paradigmatic associations are affected initially and it comparatively progresses at a faster rate possibly due to the loss or inaccessibility of semantic features. Thereby producing poorer paradigmatic conceptual (associative relations) than the syntagmatic syntactic associations (Sonali, Kathryn, Bayles & Trosset 1990). The naming of verbs and syntactic structures generally involves more neuro-anatomical network areas and also
involves more of executive and other cognitive processes which is relatively spared or slow to be affected in the clinical populations (Hillis, Oh & Ken, 2004; Piatt, Fields, Paola & Troster, 1994). The absence of such conceptual loss or semantic deficits in neuro-typical population yields better paradigmatic and syntagmatic word association ability especially in the younger age groups. But as the age increases, these associations ability are reduced in terms of accuracy and cognitive flexibility thereby resulting in relatively poorer scores than the younger age group participants. Similarly in a study by Strauss Hough (2004) also report of better performance of the control group (neuro-typical) as compared to the persons with Alzheimer's disease on naming and category concept generation tasks. The older adults showed poorer performance owing to the impaired lexical access but relatively spared category naming as opposed to the clinical group. Persons with Alzheimer's disease had difficulty in the category naming tasks suggesting deficits in the earlier stage of conceptual knowledge. The results of the current study also corroborate that the pattern of regression may also be predicted from paradigmatic to syntagmatic associations as reported by Baker and Seifert (2009). These tasks thus, prove to be an essential tool to assess the language function and level of impairment in neuro-cognitive disorders. Similarly, during the rehabilitation purpose, these tasks may be emphasized and treatment goals may be appropriately taken.

5.1.3. Performance of sentence comprehension tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Deterioration in the comprehension skills has been reported in individuals with aphasia and dementia. Similarly, in the current study, the responses on tasks of yes/no sentence comprehension and the sequential commands were reduced in persons with
aphasia and dementia as compared to the neuro-typical individuals. The comprehension of sentences is deteriorated in persons with aphasia (Kumar & Goswami, 2012). The comprehension of commands and sentences are also affected in persons with dementia (Rogers, Ivanoiu, Patterson & Hodges, 2006) when compared to the neuro-typical group. The deficits in the semantic memory and the connected networks may tend to affect the robust performance of the comprehension tasks in persons with dementia and aphasia. The comprehension task involves more complex processing and thus, requires additional attentional and feedback system. Thus, with the inadequate working memory, processing and attention abilities in these clinical groups results in significantly poorer performance as opposed to the neuro-typical group. However, the clinical groups equally underperformed resulting in no significant difference between aphasia and dementia in both the tasks. This may suggest that the performance on comprehension is affected further owing to the deterioration of lexical knowledge but with relatively spared syntactic network associations the performance of both clinical groups remains similar. Some studies also report of poor comprehension skills in all modality such as the auditory, orthographic, visual and even olfactory (Bozeat et al., 2000; Coccia et al., 2004).

5.1.4. Performance of sentence inference tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Sentence inference tasks involve the judgment of the accuracy in the semanticity or syntactic structure of the target sentence. The task in the current study involved the participant to judge on the semantic concept embedded in the sentence provided. The participants were to comprehend the sentence, judge on the semantic content of the
sentence and say whether the presented sentence is right or wrong and, if the sentence is semantically wrong, then the participant had to correct the sentence appropriately. This involves the assessment of the content and processing skills of the semantic memory in an individual. The present study revealed that the sentence inference ability was significantly impaired in persons with dementia and aphasia and in the neuro-typical age groups. Similar results were shown by persons with Alzheimer's disease when compared to healthy normal participants in a study by Laatu et al, 1997. This may be attributed to the fact that the semantic inferencing ability is affected as the semantic memory conceptual levels are impaired. The impairment in paradigmatic association tasks correlate to the impairment in the inferencing ability in individuals with semantic memory deficits. The results are in consensus with the findings that tasks such as the lexical decisions and assessments of the priming effects on coordinate (lion-tiger) and attribute relationships (zebra- stripes) showed significant greater degree of loss in the attribute loss along with the semantic memory deficits in persons with Alzheimer's disease (Giffard et al. 2001). The results also elicit a hierarchical network of deterioration of the attribute knowledge initially and followed by the coordinate knowledge. The use of inferencing tasks have resulted in significance differences in the older neuro-typical groups also thus indicating the hierarchy of deterioration in neuro-typical age groups. The processing skills of the lexical-semantic storage deteriorate prior to the content of semantic memory. Also the fact that the inference task involves complex cognitive process of judgment and then probable accurate correction. The excessive process may affect the speed of processing in neuro-typical individuals and also the lexical decision
flexibility phenomena. Thus, inferencing task may be a complex but significant task to measure the performance in clinical and the older neuro-typical population.

5.1.5. Performance of generative naming tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Generative naming tasks have been extensively used in neuro-behavioural studies and the results have been significant between the neurologically impaired and neuro-typical individuals. These include the category and phonemic naming tasks. Generative naming or the fluency tasks explores both the semantic concepts and the distribution and organization of these lexical (Adrados et al., 2001). In the present study, in persons with aphasia and dementia the generative naming performance is poorer compared to the normal aging population. The performance of the generative naming is also reported to be deteriorating as the age increases in neuro-typical population for category and letter naming, more so in the category naming. In the current study, the performance of the category and phonemic naming was found to be affected in the persons with aphasia and dementia which confides with the previous findings of Abhishek and Prema 2013; Arpita, 1997; Bayles and Tomoeda, 1983; Shanthala, 1997. The performance across the age groups also corroborate the results of Auriacombe et al (2001); Tombaugh, Kozak and Rees (1999). The performance of persons with dementia was significantly different when compared to a neuro-typical group with number of words generated by persons with AD being exactly half as that generated by normal population (Hodges et al., 1992). The deterioration in semantic memory is evident across the age groups and the clinical population. Generative naming (category and letter fluency) is greatly influenced by age, education, occupation (Tombaugh, Kozak & Rees, 1999; Tomer & Levin, 1993). The results
confide with the hypothesis that age affects cognition by slowing down the cognitive and working memory performance (Salthouse, 1994). It may also be as a result of the inconsistent semantic network activations as the age progresses which is evident with increased self corrections and overt and covert repetition of words. The deficits of generative naming in clinical population is assumed to be as a result of degraded semantic memory both at the activation and accessibility issue and the inefficiency to generate logical ideas (Bayles & Tomoeda, 1983; Chertkow & Bub, 1989). The generative naming task is also among the toughest tasks among other semantic tasks. This could be explained as the performance of this task is depended on high attention, rapid activation of semantic knowledge on specific items and their lexical or name production. This also includes the strong feedback and organizational ability to keep track of items already generated. The present study however refutes the results of previous studies of Rogers, Ivanoiu, Patterson, & Hodges, 2006, who report a better performance in the letter naming task than the category naming in the neurologically impaired groups. The results (category naming better than the letter naming) in this study further propose that the semantic memory are categorically organized than phonemically. Also the familiarity and frequency of use of lexical in a category further enhance and strengthen the lexical-semantic network and the search strategies. Thus, the performance of the generative naming is significantly poorer in both persons with aphasia and dementia. The results of the present study are contradictory to the findings of a preliminary study which was done to explore the confrontation and generative naming across languages and conditions in five bilingual persons with aphasia and dementia each (Pallavi, Shylaja, Chengappa & Ravi, 2012). The participants were assessed using 30 picture stimuli set and one generative naming category (animal).
However, the results revealed no significant difference between the conditions on both the tasks. The authors concluded that both these tasks may be included in a test battery but not considered as a single measure to assess the SM in PWD and PWA.

5.1.6. Performance of generative responsive naming tasks across groups (neuro-typical, aphasia and dementia participants) and neuro-typical age groups:

Generative responsive naming has also been used to elicit lexical knowledge as a response to the semantic association sentence. In the present study the responsive naming response elicited significant difference between the clinical and the control groups. The responsive naming task involves relatively lesser cognitive taxing task in comparison to the lexical generative naming task. The responsive naming includes the comprehension of the semantic associative features which aids to promote the word finding ability in an individual. A specific semantic feature attribute is primed (e.g. grass is green i.e feature and vocabulary of colour) and the corresponding feature in target item or lexical (e.g. milk is white i.e. colour feature) is expected to be activated. Generally, in neuro-typical individuals, the interactive stages of naming include a conceptual level followed by the semantic/ lemma level and finally the phonological level. The concept activation is entangled with several feature excitation and inhibition processes (Hinton & Anderson, 2014). Whereas, in neurologically impaired population, this interactive processes of activation and inhibitions are disrupted resulting in naming errors. The disruption may occur at different levels depending on the etiology and area affected. Consequently, the type and number of errors differs. Thus, it may be studied that a disruption or erosion at the conceptual or features level as in the case of persons with dementia will result in incomplete or inaccurate activation and thereby decrease in
responsive naming responses. The degraded activation at the conceptual level eventually affects the activation at the lexical or lemma level and phonological levels. Similarly, any disruption at the lemma level could result in inconsistent or inaccessible activations and also resulting in semantic paraphasic errors. The disruption at this level may also affect the following phonological level activation resulting in phonemic paraphasic errors. These errors are more evident in persons with aphasia (Drew & Thompson, 1999). In responsive naming, there is a cognitive load on the working memory (auditory) to comprehend and activate the priming features, then inhibiting the same followed by screening, selecting and activating the specific target feature and finally naming the item. These cognitive processes are affected in brain damaged population thus resulting in poorer performance in comparison to the neuro-typical population. Here again, it may be proposed that in individuals with dementia and aphasia the poor comprehension result in poor semantic association ability which in turn results in their limited performance in the responsive naming compared to the neurologically healthy participants.

The correlation of the performances across tasks in the clinical and control groups highlights the uniqueness of the nature and functioning of the semantic memory in the neurologically impaired population and neuro-typical groups.

5.2. Nature of content and process (semantic memory) within groups:

The tasks were statistically tested within each of the control and clinical groups. The results of the current study yielded corresponding and interesting data. Overall, the performance across the content and process tasks was significant within the neuro-typical
group. The performance between confrontation object and picture naming and the generative category and phonemic naming showed a significant difference within each of the age groups. However, the performance between the comprehension tasks did not vary across age. This supports the previous studies on language in aging. The lexical semantic processing across age in neuro-typical group is less affected for the comprehension tasks. The picture naming was affected more than the object naming owing to the effect of perceptual errors affecting majorly in the older age group. The generative naming was greater in the category naming as opposed to the letter fluency which is attributed to the semantic conceptual organization. The organization of a semantic system strongly influences the mechanism, speed and efficiency of the retrieval of words (Noh & Rieger, 2004). Some of the network models such as the enriched conceptual network (ECN) propose a network with clusters of semantically related words, more frequent words stronger associations and the influence of the age of acquisition of words (Goni et al., 2010). Thus, stronger the conceptual nodes and closer the semantic connectivity better the activation and faster recall of and higher the word fluency scores. Thereby, lesser networking of features and further the semantic connectivity, lesser the number of words recalled as seen in the phonemic fluency task. The performance of the generative task reinstate the concept that in a neuro-typical individual, the concept networking in the semantic memory is strongly based on the semanticity rather than phonemically or any other mode of arrangements.

In the aphasia group, the performance is significantly varied only in the generative naming tasks. The generation naming tasks have been a significant task to assess the semantic memory performance in the aphasia group. Other tasks failed to elicit
a significant difference within the aphasia group participants. The neurological condition in aphasia has been impaired which greatly affects the lexical retrieval of names in the confrontation naming tasks. Thus, the effect of perceptual recognition is similarly masked in any modality (picture and object naming) thus depicting no significant difference. The non significant performance between the word association tasks (paradigmatic and syntagmatic) and the sentence comprehension tasks (yes/no and sequential commands) indicates that the performance in persons with aphasia is based on the lexical accessibility and hence no major difference due to the modality or the semantic- syntactic structure. The semantic concept remains intact. The accessibility problem is further evident in the generative naming tasks. Wherein, the concepts and lexical recognitions are intact but the accessibility greatly affects the recall in letter fluency tasks where the semantic association or network distance is not closely connected.

Whereas, in the dementia groups, the confrontation naming task (picture and object) did not yield a significant difference which may be because of the degraded semantic memory and thus no contextual or dimension specific cues facilitate the semantic activation for lexical generation. Interestingly, in the generative naming tasks the dementia group yields no significant difference between the letter and category tasks. This could be strongly considered as the outcome of the degraded semantic memory resulting in storage deficits of the concepts. This in turn indicates that in persons with dementia the storage and degradation of the semantic concepts further effects the network associations between lexical words and produces proportionally poorer and slower number of words for the generative naming task. However, as discussed earlier, the comparatively intact syntactic structures in persons with dementia aids in better
performance in the syntagmatic association and the comprehension tasks thus producing significant difference between the tasks.

In both the clinical and control groups the scores were the highest in the comprehension tasks followed by the association tasks and then confrontation naming and responsive naming and the least scores across the generative naming tasks. This could be attributed to the relatively better syntactic associations compared to the semantic associations. These results of the study further validate the findings that in neurologically impaired conditions the semantic memory is greatly affected and are more sensitive to deficits than the syntactic attributes. Overall the content and process tasks scores were significantly different as shown in Figure 5.3.

![Bar chart showing comparison of content and process performance across normal, aphasia, and dementia groups.](image)

**Figure 5.3.** Comparison of content and process performance across the groups
The descriptive measures reveal better performance of the content tasks as compared to the process tasks. The studies in aging populations reveal that the cognitive processing and flexibility gets affected prior to the loss of concepts. This phenomenon could further substantiate the performance of process tasks being more affected than the content tasks in SM also in the clinical groups. The responses in the aphasia group are affected more than the dementia group which could be attributed to the influence of severity and type of the disorder in both the groups.

5.3. Effect of severity and type of disorder on the tasks of semantic memory:

The results of the current study depicted the significance of severity of the clinical condition on the performance of tasks. The severe group of participants showed a significant difference across all the tasks for both persons with aphasia and dementia. The level of atrophy is proportionate to the severity of the semantic impairment (Mummery, Patterson, Price, Ashburner, Frackowiak & Hodges, 2000; Nestor, Fryer & Hodges, 2006). Studies have also revealed that language structural networks and associations are greatly influenced by the severity of stroke-induced aphasia (Gleichgerrch et al, 2015). The performance across the recall, recognition and word learning tasks are varied and influenced greatly by the individuals' aphasia severity, area of impairments and the semantic processing affected (Dignam, 2015). The findings of the study by Bayles, Tomoeda, Kaszniak and Trosset (1991), also report that the task difficulty and dementia severity play a significant role on the semantic memory in dementia. Naming performances, category recall, recognition etc are also influenced by the severity of dementia (Bayles, Tomoeda, & Trosset, 1991; Shuttleworth & Huber,
1988). Also the naming errors of severe persons with dementia indicate the deterioration of the semantic memory (Goldstein, Green, Persley & Green, 1992). These studies support the findings of the present study that the performance of the persons with aphasia and dementia are greatly affected when compared to the neuro-typical individuals owing to the severity of the conditions.

Similarly, the influence of type of the disorder also hampers the performance across tasks to measure the semantic memory. In the present study the performance of the non fluent aphasia group were found to be significant than the fluent group in comparison with the dementia participants. The fluency output is affected in individuals with non fluent aphasia (Bird & Franklin, 1995). The current study included more of non fluent and severe aphasia participants. Thus, attributing to the underperformance of the aphasia participants as opposed to the dementia group.

5.4. Effect of cues on the tasks of semantic memory

The present study depicted the use of cues across the clinical population. The results revealed that the phonemic cues were greatly used by persons with aphasia whereas the persons with dementia used more of the semantic cue. The probable assumption for this disparity would be the increased semantic memory deterioration in persons with dementia. They fail to receive the facilitation of the phonemic cues as seen in the aphasia group. Debate has been ongoing on whether semantic memory deficits are caused because of the storage or the access deficits. Cueing studies in neurologically impaired population have been widely used to bring clarity in this debate. Laatu et al.,
(1997) reported that the amount of cues provided relates to the access deficit whereas the type of information retrieved relates result in semantic memory impairments.

Specific studies in persons with aphasia highlighted that phonemic cueing significantly facilitated their performance. The external support aids the retained knowledge to be activated. This also indicates that phonemic cueing benefits in conditions where there is no semantic memory erosion as in persons with very early dementia and aphasia (Neils, Brennan, Cole, Boller & Gerdeman, 1988). However in persons with dementia the results have been contrasting. These participants did not benefit with phonemic cueing for spontaneous recall tasks (Jefferies & Ralph, 2006). Persons with dementia show consistency across tasks and external support (i.e. cueing) as opposed to the persons with aphasia, indicating the general concept being degraded. They highlight that responses provided by persons with aphasia include more of associative words than words which are categorically related thus suggesting a uncontrolled semantic retrieval and irrelevant associations (Humphreys & Forde, 2005).

Further, the limited benefits with phonemic cues in picture naming in persons with dementia highlight the fact that semantic knowledge is impaired. In the present study, the results corroborate the previous findings that persons with aphasia benefit more with the phonemic cues as compared to the persons with dementia who utilized more of the semantic cues. The external cues provided act as a facilitator to boost the thresholds of the less activated targets. The cue utilized is an indirect indicator of the breakdown level of naming and also that the limited activation at that level needs corresponding external cues. That is, for example, the phonemic cue would boost the activation of the target word at the phonological level as the semantic features and lexical recognitions would
have been sufficiently activated and fail to benefit further with semantic cues. Similar phenomena may be followed in the vice-versa condition. Based on these studies a simulated model of activation of levels of naming based on the external cue is proposed in the clinical groups of aphasia, dementia and in control group of neuro-typical individuals as shown in Figure 5.4. The proposed hypothesis finds support from the explanations by Bayles and Tomoeda (1983) on the misnamings by persons with dementia on confrontation naming. The authors proposed that the PWD were unable to match the incoming signal (visual) with its correlating semantic reference which could be the result of the absence of the reference or the reference being non-meaningful. Faust, Balota, Multhaup (2004) also propose that the picture naming phonological errors in persons with AD could be the result of the reduced inhibitory control over the activated competitors thus resulting in the breakdown of the phonological representations of the lexical items.
In persons with dementia, the degraded conceptual store affects the threshold level and amount of target activation thus affecting the activation at the lemma/lexical level and phonological level proportionally. The unrelated or wrong utterances (seen as slant activations) may occur as a result of the deviant activations occurring at various levels. Similarly in persons with aphasia, it may be observed that the activations threshold level are adequate though may not be more in quantity (this explains the reduced performance when compared to neuro-typical individuals) at the conceptual and lemma level. Whereas at the phonological level the threshold level of activation is limited that requiring more of phonemic cues to facilitate the target response. The reduced number and deviant activations explain the accessibility problem in the aphasia group. The proposed model explains that in neuro-typical individual the activation threshold level and amount of activation are adequate at all the three levels of naming, thus producing better target responses. As the age increases the cognitive performance decreases affecting the occasional faulty errors or increased time in word finding and so on. The disturbance at the feedback levels also affect the naming performance thus also resulting in increased use of self corrections as seen in the present study too.

Thus, it may be concluded that the study on the use of cues across the clinical and control groups have provided significant contribution towards the study of lexical-semantic activations and interactions. The use of cues has considerably highlighted on the deficit mechanisms in persons with aphasia, dementia and neuro-typical individuals.
Further these could be further explored to understand the better performance of dementia group in comparison to the aphasia group.

5.5 Comparison of semantic memory performance in persons with dementia and aphasia.

Several content and process tasks such as the confrontation naming, generative naming, comprehension and inference tasks were used in the current study to assess the deterioration in semantic memory. The cumulative scores across the tasks have shown better performances of the persons with dementia when compared to the persons with aphasia. The improved performance in dementia could be attributed to many correlating factors which are discussed below.

Information are retrieved and accessed from the semantic memory depending on the linguistic and conceptual level of an individual. Deterioration of conceptual features are depended on the age of acquisition that is, concepts, features and lexical that are acquired early in life show the most resistance to deteriorate (e.g. word 'ball' deteriorates later than the unfamiliar word 'javelin'). Earlier the acquisition of a word, stronger and frequent the network connections and activations and thus better preservation and recovery of these words (Bozeat et al., 2000; Funnell, 1995). However, in the present study, unfamiliar target items are also included. And as the severity of deterioration increases the quantity and quality of conceptual errors also increase significantly. Thus in persons with dementia the errors (such as semantic error, no response) are significant only in severe dementia.
The nature of impairment differs in both the disorders i.e. as described earlier; the semantic store is affected and degraded in persons with dementia when compared to persons with aphasia which is due to the accessibility problem. Several studies have attributed the storage deficits (e.g. dementia) to the damage in the anterior temporal lobes (Coughlan & Warrington, 1981; Warrington, 1975). Whereas, the accessibility deficits (e.g. stroke induced aphasia) are caused as a result of the lesions in temporo-parietal or, fronto-parietal regions (Forde and Humphreys, 1995; Warrington and Crutch, 2004; Warrington and McCarthy, 1983). These studies have further provided inputs on patterns to distinguish between the storage and access deficits. These include the effect of familiarity consistency across various tasks and use of cues. Earlier studies by Bozeat et al., 2000, have reported that the persons with dementia are sensitive to word frequency, consistent across tasks which are contrary to the performance in persons with aphasia. The authors further propose that in persons with dementia the consistency is present even across item which is measured using different input modalities thus suggesting an amodal conceptual representation. Whereas, the performance across persons with aphasia varies with input modalities and task demands thus suggesting that the deficits are due to accessibility issue at the lexical level (which could be modality specific in nature). In persons with aphasia the semantic information are temporarily inaccessible thus producing inconsistent responses.

The differences between the two groups of disorders are further explained in terms of the lesion size, location, type of the disorder, severity of the problem and post onset cognitive and behavioral changes. The structural reorganization after stroke and dementia (atrophy) differ considerably in quantity and quality. In the present study, there
was no significant effect of schooling on the performance of the neuro-typical individuals as mentioned in previous studies (Hodges et al., 1999; Perri et al., 2005). These studies also confirm the poorer performance of the clinical groups in comparison to the control group in the cognitive-linguistic tasks. The degradation of the conceptual knowledge in persons with dementia is also affected by the severity of the condition (Crutch & Warrington, 2008; Woollams, Lambon Ralph, Plaut, & Patterson, 2007). Type of aphasia also strongly affects the performance in persons with aphasia. Studies have reported significant difference in naming tasks between the non-fluent and fluent persons with aphasia. Non-fluent persons with aphasia performed poorer than the fluent aphasia in naming, picture description tasks though not significantly different (Bassoa, Razzano, Fagionic, & Zanobio, 1990) which coincides with the results of the present study. In the current study too, the performance of the non fluent persons with aphasia was poorer than that of the fluent aphasia in the content tasks especially, though not significant. The performances differed across the tasks though not significant and on the whole the performance was similar between the two types of aphasia also reported by Kohn and Goodglass, 1985. These results corroborate the previous findings that the responses in persons with aphasia are inconsistent. Thus, the performance in persons with aphasia reflects a executive control deficit in contrast to the semantic knowledge degradation in persons with dementia.

5.6. Other Factors in the study of SM

Several other factors have been reported by researchers which may contribute to the performance of the semantic memory in neuro-typical and brain damaged individuals. These include the age, gender, occupation, socio economic status, education, linguistic
status (multilingual or monolingual), handedness, site of lesions family support and other environmental factors involved in the learning process of a neuro-typical or individual with brain damage. Some of these socio demographic variables were reported in the present study however, the effect of these on the performance was not considered as the scope of this study. So, it is inappropriate to conclude whether these factors influenced the test performances.

5.6. The Modularity of Semantic Memory

Over the years, the Fodorean theory of modularity concept in semantic memory has been studied. The theory exhibits the concept of SM being non-modular in nature as opposed to the modular sensory inputs to the SM. However, the studies in neurologically impaired population suggest specific pattern semantic impairments and thus leading to a controversy to the nonmodular nature of the SM. A series of neuro-imaging studies in the neurological-impaired populations depict associate specific areas of semantic impairment functioning in persons with dementia and aphasia. The studies reveal the deficits centered on the anterior temporal lobes in persons with dementia, whereas the persons with aphasia centered their deficits in the temporoparietal and frontal areas (Bozeat, Ralph, Patterson, Garrad & Hodges, 2000; Rogers, et al, 2004). These studies further suggest the correlation between scores, the consistency across modality tasks in persons with dementia suggesting a single store of amodal semantic memory. The anterior temporal lobe form a central cortical hub from which several other modality specific network connections are generated (Damasio et al., 2004). It is also proposed that frequently used items form stronger representations and thus are tougher to degrade in the early stages of the disease (Rogers et al, 2004). Whereas in persons with aphasia, the
anterior temporal lobe remains intact thus displaying inconsistent responses resulting with deficits in the posterior temporal lobe and inferior parietal areas indicating an absence of semantic memory degradation in them and the variations in systematic semantic control in each trial (Chertkow, Bub, Deaudon, & Whitehead, 1997; Saygin, Dick, Wilson, Dronkers & Bates, 2003). Similarly, neuroimaging studies in neuro-typical individuals also highlight a central store at the anterior temporal lobe (Devlin et al, 2000). These neuro-anatomical based findings inspire the behavioral study findings and aid in proposing the mechanism based computational models such as the Rogers et al, (2004) model and the extended Rogers et al model by Jefferies and Ralph (2006). They propose that the core semantic memory is centered in the anterior temporal lobe which forms the amodular conceptual frame with sets of modality specific intermediate semantic units as shown in Figure 5.5. These units receive interactions from various modality inputs. In persons with dementia, these units and the amodular core SM are affected thus leading to consistent degraded semantic representations. This central SM unit is connected to other cortical representations across various sensory input regions thus creating a task-specific or modality specific semantic control system. This semantic control system functions (Saffran, 2000), in the lexical level and thus gets affected in persons with aphasia. Thus, the persons with dementia display a degraded modality specific intermediate units and amodular semantic memory and in persons with aphasia the lexical level and semantic control is affected. The varying semantic control requirements control the consistency of responses. The information activated at the semantic concept level will be affected in the control mechanism in persons with aphasia.
These levels of SM organization may be examined in the current study. The responses of persons with the conceptual SM are consistent with better responses owing to the less severe dementia conditions. The cues taken also support the level of deficits in semantic memory. The core conceptual level is thus considered to have an amodular semantic framework with modular intermediate units. Whereas the semantic control level is modular in nature as a result of the inconsistent extraction of semantic or lexical information.
To sum up since semantic memory deficits has been accepted as a part of most neurological diseases, and so there has been a need for neuropsychological tests that can be used to study semantic memory. The most commonly used neuropsychological tests available today only measure semantic memory indirectly, and do not capture the phenomenon completely. The tasks include both concrete and abstract concepts.

It may be believed that the effect on semantic memory may be a continuum with the least deteriorations in neuro-typical individuals owing to the general aging reduced cognitive process flexibility, network associations, feedback errors and greater impairment at the phonological level. Higher up, includes the deterioration in persons with aphasia which is the result of the neurological insult at specific areas thus affecting the accessibility to various semantic lexical or lemma level and finally the increased deterioration of semantic memory as in persons with dementia, affecting the storage of semantic concepts i.e. the semantic memory degradation.