Effects of Age, Gender & Bilingualism on Cognitive-Linguistic Performance

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Abstract

The aging process involves a series of changes in the mental and physical functioning of humans. These changes alter the way in which elderly people communicate. In order to assess, rehabilitate and communicate effectively with elderly people we need to examine our concepts of 'age'. Literature reports that the language development is influenced by many other factors like socioeconomic status, parents' educational level, etc. Similarly, many factors influence one's cognitive abilities. One among them knows many [two or more] languages. It is reported in the literature that knowing second language enriches the cognitive skills in children. It is unknown that the same enhancement might be present in adults. If it is true in young adults, whether the same effect is also observed in elderly individuals is questioned. The aim of the study was to evaluate changes, if any, on the performance of the Cognitive-Linguistic Assessment Protocol (CLAP). Two group of subjects participated in the study. Group I & II consisted of forty young and old individuals respectively. Each group had twenty Monolinguals & twenty Bilinguals. Equal number of males & females participated in each group. The results revealed that younger individuals were better on cognitive linguistic tasks than elderly individuals. Similarly, Bilinguals were better on all the domains of CLAP. Gender difference was not observed in any of the tasks. The study highlights the age and language-related performance differences on cognitive-linguistic skills.

Introduction

"Old age is not a disease; it is strength and survivorship, triumph over all kinds of vicissitudes and disappointments, trials and illnesses"

- Maggie Kuhn, (1979)

Aging is one of the most universal and inevitable physical, social and scientific changes confronting man. Man is gifted with a few skills such as thinking, reasoning, judgment, memory, speech, language, communication, reading, writing etc. These skills are unique to human beings and clearly distinguish from other lower animal species. The aging process involves a series of changes in the mental and physical functioning of humans. These changes alter the way in which elderly people communicate.

Communication is the most significant characteristic of human being throughout the entire span of life. The acquisition, development and maintenance of communication capabilities in human beings are dependent on the adequate functioning and appropriate integration of distinct neural networks. Human communication skills demand the synergy of voice, speech, language and cognition. A communication result from the interactions of

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cognition & language and it is a complex interaction that takes place between different aspects of memory, attention and language itself.

More recently, with increasing focus on communication in human society, research is geared towards the relationship that exists between communication and the other human capabilities collectively know as "Cognitive skills". Cognition involves a wide range of mental processes such as attention, pattern recognition, memory, organization, language, reasoning, problem solving, classification, concepts and categorization (Best, 1999).

Normal aging often refers to the most common or usually encountered functional state of the nervous system and other anatomical substrates in the population of older individuals (Civil & White house, 1991). Normal aging is accompanied by changes in the ability to process, understand and use language. There is no global decline in linguistic functions. In fact, certain abilities like vocabulary development and discourse abilities continue to improve into late adulthood. However, decline in certain cognitive functions like attention, memory, recall, etc, have been reported.

Elderly often complains of reduced mental skills such as poor memory and mental testing confirms this perception (Mc Glone, Gupta, Humphrey, Oppenheimer, Miosen & Evans, 1990). Changes occur in the ability to communicate and to co-ordinate language abilities with cognition, memory and attention skills. These changes result from a complex interaction of internal senescent processing changes, neurocognitive changes and biological changes. This interaction leads to great variability in the ability of elderly people to function in every day life. This variability in behavior and capacity is a constant challenge to clinicians working with the elderly individuals.

A general decline in reaction time has also been documented in elderly individuals. These cognitive changes impinge on linguistic abilities leading to such problems as:

1. Difficulty in word retrieval processes (Kemper, 1992; Maxim, 1999).
2. Decline in complex discourse processes (Ulatowska, Cannito, Hayashi & Fleming, 1985).
3. Slight diminution in language performance in terms of use of semantic information structures, reduction in clause structures and verb phrases used (Brownwell & Joanette, 1993).

Many number of studies reported that there is some amount of influence of society on language performance. Similarly the socio-economic status plays a significant role in language development. Individual variations in language ability are not only because of socio-economic differences or societal differences but also due to gender difference that is not uncommon. Bellis & Wilber (2001) reported that there is gender difference in inter-hemispheric transfer time tasks. Yang (2000) found woman were superior in accuracy in colour- lexical matching or translating tasks than men. Many research studies hinted gender difference on cognitive linguistic tasks, but a few studies did not. Tsang and Lee (2003) found there was no gender difference in the performance on confrontation naming task.

It is reported in the literature that bilingualism is associated with more effective cognitive processing than monolingualism. The assumption is that the constant management of two competing languages enhances 'executive functions' (Bialystok, 2001). Studies reported that performances of bilinguals in cognitive linguistic tasks were better than monolinguals with respect to:

1. Verbal fluency task and grammatical word generation task (Rosselli, Ardilla, Salvatierra, Marquez, Mattos & Weekes, 2002).

2. Stroop effect (Rosselli, Ardilla, Santisi, Mdel, Salvatierra, Conde & Lenis, 2002).
3. Controlled processes (Bialystok, Craik, Klein & Viswanathan, 2004).

In children (Kormi-Nouri, Moniri & Nilsson, 2003) and in adults (Bialystok, Craik, Klein & Viswanathan, 2004) it is reported that bilingualism creates advantages in terms of cognitive abilities. It needs to be studied whether the bilingual advantage observed in children and in adults persists over in old age.

Gender differences in Communication:

Number of stereotypes exist pertaining to differences in the speech and writing of men and women. This stereotype exists across all linguistic features. For instance, Kramer, (1974) characterizes the stereotyped speech of women as being weaker and less effective than the speech of men.

Kramer (1974) found no differences in the use of adverbs or pronominal adjectives in women and men of written language. She concluded that as long as women continue to play subordinate roles their speech would be stereotyped as being separate and unequal. Very little research has been conducted regarding the communication differences between the genders. The information that exists were concentrated on written language samples rather than on oral language and related to only semantic aspects of language than any other.

A study by Yang (2000) found that the women were superior in accuracy in colour lexicon matching or translating tasks than men. Ardila, Rosselli, Ostrosky-Solos, Marcos, Granda and Soto (2000) reported that women outperformed men in syntactic comprehension.

Influence of language experience on cognition:

Recent cognitive studies have shown that knowing a second language extends rather than diminishes the individuals' capabilities (Kormi-Nouri, Moniri & Nilsson, 2003). Harris (1992), De Groot and Kroll (1997) suggest that bilingualism has an effect on cognitive processing at least for children and younger adults.

In children learning a second language in childhood is associated with an increase in cognitive abilities and mental processes when compared to those of monolingual children (Diaz & Klinger, 1991; Francis, 1999). Research by Bialystok (1993 & 2001) has shown that bilingual children develop control processes more readily than do monolingual children but the two groups' progress at the same rate in the development of representational processes. The reason according to them could be that the joint activity of the two systems requires a mechanism for keeping the languages separate so that fluent performance can be achieved without intrusions from the unwanted language.

Bilingual advantages have been reported across a variety of domains, for e.g. creativity (Kessler & Quinn, 1987), problem solving (Brain, 1975, Kessler & Quinn, 1980) and perceptual disembedding (Duncan & De Avila, 1979). This bilingual advantage have not always been found, some studies reported negative effects (Mac Namara, 1966) and others found no differences (Rosenblum & Pinker, 1983).

There are a few studies on lexical processing tasks which have reported bilingual disadvantages and those tasks include:

1. Lexical decision (Randell & Fischler, 1989)
2. Semantic fluency (Gollan, Montaja & Werner, 1992)

Michael & Gollan (in press) point out that these deficits are quite limited and it is attributed to the bilinguals as they need to maintain a vocabulary base approximately twice as that of a monolingual. The poor performance in semantic fluency tasks may be attributed to the weaker links between words and concepts for bilinguals (Michael & Gollan, in Press).

Research in cognitive aging has advanced enormously in the past few decades, producing detailed studies and sophisticated models of age-related changes in cognitive functions. In perceptual processing older adults are less able to ignore irrelevant stimuli (Rabbitt, 1965) and were less able to attend selectively to important aspects of the environment. These effects are more in monolinguals when compared to bilinguals. Hasher & Zack (1988) argued that much of the observed decline in cognitive functioning is the result of a decline in the effectiveness of inhibitory processes. Less effective attention processes result in less efficient detection, discrimination and selection of wanted stimuli, reduced resistance to interference and impaired inhibition of information that is unimportant or irrelevant (Mc Dowd & Shaw, 2000).

Bialystok, et al. (2004) studied the effect of bilingualism on cognitive control in older adults. They compared the performance of monolingual and bilingual middle-aged and older adults on the Simon task. They took forty participants who comprised into two language groups and two age groups. Twenty of them were younger adults in the age range of 30-54 years and twenty were older adults ranging in age from 60- 88 years. In each age group half the participants were monolingual English speakers and the other half were Tamil-English bilinguals. They found that bilinguals had smaller Simon effect & less disrupted by interference than the monolinguals. From their study they concluded the following points:

1. Bilingualism reduces the age-related increase in processing costs (Working memory cost)
2. Bilingualism provides a defense against the decline of the executive processes that occur with normal cognitive aging and
3. Bilingual advantages in children for controlled processing are sustained into adulthood.

Kamath (2001) developed a cognitive-linguistic assessment protocol for adults in Kannada. She studied cross-sectionally the cognitive-linguistic performance of thirty six normal individuals who were divided into six age groups in the age ranging from 40 to 70 years in five years intervals. Each group consisted of three males and three females. She found small differences in the performance of subjects across the age groups on each sub-tests and with respect to gender. But the differences found were not statistically significant. In females a small decline in episodic memory and a steady decline in organizational skills were reported. She did not find any decline in males in any of the tasks. The old-old geriatric population was not included in the study. The educational level, linguistic experience and the socio-economic status were not controlled in her study. Given the prevalence of bilingualism in Indian society it is important to establish the precise effects of bilingualism on cognitive processing and the way in which these effects are modulated by aging.

Need for the study

With increasing interest in topics of gerontological concern from 1970's it was realized that practically not much is known about language functioning in the later years of life (Ulatowska et al. 1985). In the Indian context very few studies have been done to explore the language abilities in the elderly (Nidhi & Raksha, 1994; Raksha & Nidhi, 1994; Kamath 2001). Thus there is need for more detailed information on language performance in the elderly population.

The literature hints that the negative effects of aging is absent in bilinguals i.e., bilingualism attenuates the negative effects of aging on cognitive control in older adults (Bialystok, et al. 2004). Till date, cognitive-linguistic performance as a function of bilingualism has not been studied in Indian context. Hence, an attempt for the same was made to study and explore the relation between bilingualism and cognitive-linguistic performance in normal young adults and old individuals.

With this brief background information, the main objectives formulated for the present study were:

1. To assess age related changes, if any, in the performance on various cognitive-linguistic tasks
2. To assess gender-contingent variation, if any, in performance on different cognitive - linguistic tasks
3. Bilingual advantages if any, in performance on different cognitive-linguistic tasks

Also, the secondary aims of the study were:

1. To compare the performance of timed and untimed tasks on CLAP (Cognitive-Linguistic Assessment Protocol by Kamath, 2001)
2. To compare working memory cost scores across the groups
3. To establish average time taken for the timed tasks across the groups.

Method

Subjects:

Two groups of subjects (young and old age) were taken up for the study in the age range of 20-30 years (Mean age: 24.5 yrs) and 70-80 years (Mean age: 76.4 yrs) respectively. Each group consisted of 20 subjects. Of the 40 subjects, 20 were Kannada monolinguals and 20 were Kannada-English bilinguals. Equal numbers of male and female subjects were considered for the study. The subjects were sub-grouped as given in table 1.

Table 1: Demographic data of subject sampled.

Subjects	Young (20-30 yrs)		Old (70-80 yrs)	
	Male	Female	Male	Female
Monolinguals (K)	10	10	10	10
Bilinguals (K-E)	10	10	10	10

Subject selection criteria

The following criteria were considered for the selection of mono and bilingual subjects:

1. Subjects with Kannada as Mother tongue.
2. Kannada monolingual subjects should have minimum of graduation with Kannada as medium of instruction.
3. Kannada-English balanced bilingual subjects were selected on the basis of Australian Second Language Proficiency Rating (ASLPR by Ingram, 1985).

4. The subjects should not have any history of neurological and/or psychological disorders.
5. The subjects should not have any gross deficits in communication.
6. Additionally, the subjects should not have any significant deficits in hearing sensitivity for speech and should have normal/suitably corrected vision.
7. The subjects should not have a history of drug /alcohol abuse.
8. The subjects should be physically fit during the testing period.

Screening Procedure:

An additional screening procedure was undertaken to ensure mental and auditory abnormalities.

i) ***Mini Mental State Examination*** (MMSE) was administered and subjects scoring greater than or equal to 25 points on the MMSE (As followed by Folstein, Folstein & McHugh, 1975) were considered for the study.

ii) ***Auditory discrimination task*:** The auditory discrimination task consisted of repeating five spondee words. The objective was to assess speech discrimination ability in the same environment in which the battery of tasks would be administered. The spondees chosen were such that they contained both low and high frequency sounds. Here, the task to the subject was to say the odd one out in the three interval forced choice condition. To participate in the study the subject had to discriminate all five spondees correctly.

Tools used:

Cognitive-Linguistic Assessment Protocol (CLAP) for adults developed by Kamath (2001) in Kannada was used for assessing the cognitive-linguistic abilities of young as well as older Mono and Bilinguals. CLAP consists of four domains and the test items are as shown in table-2. In the present study, additionally three tasks in CLAP were considered as timed tasks, they are co-ordinate naming, sentence formulation and categorization tasks which were not considered as timed tasks by Kamath (2001).

Procedure:

Subjects were selected from the residential areas, colleges and old age homes in the city of Mysore (Karnataka State). The screening test viz Mini Mental State Examination and the speech discrimination screening test were carried out to confirm adequate candidacy for the present study. Subjects scoring greater than or equal to 25 points on the Mini Mental State Examination (as per Folstein, Folstein & McHugh, 1975) and full scores on the speech discrimination screening tasks were considered for the study.

The cognitive linguistic assessment protocol was administered on only those subjects who passed the screening tests. Instructions specific to the task were given in Kannada. The scoring was carried out simultaneously for each task as per the scoring procedure scheduled for each item.

The data was subjected to appropriate statistical analysis. In addition, general trends in the responses of the subjects and specific responses, i.e. accuracy timing and quantitative and qualitative performance were noted down, for a detailed descriptive analysis of cognitive-linguistic performance of young as well as geriatric subjects. The data obtained was

tabulated and subjected to appropriate statistical analysis i.e. Univariate ANOVA was used to find group effect. Tukey's significant test used as post hoc test was used to find any significant group difference and three-way ANOVA also used to find interaction effect in order to investigate the aims of the present study.

Table 2: The various domains of CLAP

SI. No.	Domains	Test Items	Max. Scores
1.	**Attention, Perception & Discrimination**		
	Visual	a. Letter cancellation	10*
		b. Contingent letter cancellation	10*
		c. Word cancellation	10*
	Auditory	a. Sound counts	5
		b. Letter-pair cancellation	5
		c. Word-pair discrimination	10
		d. Months-backward naming	10*
2.	**Memory**		
	Episodic memory	a) Orientation and recent memory questions	10
	Working memory	a) Digit forward	5
		b) Digit backward	5
	Semantic memory	a. Co-ordinate naming	5*
		b. Super ordinate naming	5
		c. Phonemic fluency	5*
		d. Generative naming task	5
		e. Sentence repetition	10
		f. Carry out commands	10
3.	**Problem solving**		
		a. Sentence disambiguation	10
		b. Sentence formulation	5*
		c. Predicting outcome	10
		d. Compare and contrast	10
		e. Predicting cause	10
		f. Why questions	5
		g. Sequential analysis	10
4.	**Organization**		
		a) Categorization	10*
		b) Analogies	10
		c) Sequential events	40*

* Items are timed tasks

Results and Discussion

The results of these sections of CLAP across the groups were discussed in detail.

I. Attention, perception and discrimination:

The Attention, perception and discrimination domain was divided into two main sub-sections i.e., Visual and Auditory tasks. The visual tasks consisted of three tasks assessing Letter cancellation, Contingent letter cancellation & Word cancellation tasks. The auditory tasks consisted of four tasks assessing Sound count (ability to count occurrence of sound),

Letter pair discrimination, Word pair discrimination & finally Month backward naming task. The mean scores on this domain across the group of subjects were as shown in the table.

Table 3: Mean & SD values for Young and Old mono & bilingual, male & female subjects

Ages	Language	Gender	Mean	S.D	Total
YOUNG	Monolingual	Male	56.60	1.35	56.20
		Female	55.80	3.12	
	Bilingual	Male	57.20	3.19	57.45
		Female	57.70	1.25	
OLD	Monolingual	Male	51.70	4.92	52.40
		Female	53.10	3.07	
	Bilingual	Male	56.80	1.55	55.75
		Female	54.70	2.98	

From the table 3 it is seen that younger bilinguals performed well on attention, discrimination and perception sub-sections. Older monolinguals performed poorly than any other groups. In general younger subjects performed better than older individuals. Similarly, bilinguals were better than monolinguals. No significant gender difference was observed under this section.

Since there was significant group difference observed [F (1, 3) = 10.902, $\boldsymbol{p < 0.001}$], Tukey's significant test was used as a post-hoc test to see the significant sub-group difference. It was found that the three groups of subjects (older bilinguals, young monolinguals and young bilinguals) differ significantly from the elder monolingual group. But within three groups there was no significant group difference.

Results indicated that the groups in same column indicate no significant difference and groups in different columns indicate significant difference at 0.05 level. Three-way ANOVA was used to find any significant interaction effect for the three factors age (2), language group (2) and gender (2). The results of ANOVA revealed significant effects on two factors that were observed (young subjects and bilingual group) and there was no significant interaction effect noticed among age, language and gender factors [F (1, 72) = 3.375, p = 0.07]. The main effect was significant for age [F (1, 72) = 17.725, $\boldsymbol{p < 0.001}$] and language group [F (1, 72) =12.398, **p<0.001**] but it was not observed for gender [F (1, 72) = 1.250, p = 0.703]. Visual attention and auditory attention sub-tests were included in the attention, perception & discrimination domain. The younger bilinguals performed better in this domain than the other three groups, whereas elderly monolinguals performed lesser than the other three groups (elder bilinguals, young monolinguals & young bilinguals). This was significant at 0.05 level. However, within the three groups there was no significant difference observed.

The younger adults (both monolinguals and bilinguals) were precise and fast in the visual and auditory sub-tests. They got higher scores in this domain when compared to older individuals. This indicates there is age-related normal decline in the performance of elderly individuals. Early research had reported of modality differences in attention, with the elderly having greater difficulty in visual modality (Maxim, 1999). Bayles and Kaszniak (1987) also found the age-related perceptual disadvantages when visual stimuli were very brief or rapidly changing. Further, they noted that older adults have reduced size of the perceived visual units. This may lead to a reduction in the total amount of visual information that can be initially captured and further analyzed.

Several authors (Kahneman, 1973; Hoyer & Plude, 1980) reported age-related attention capacity decrements. Also, aging is associated with deficits in the ability to extract relevant from irrelevant information (Rabbitt, 1965). In this present study, there was a general

decline with age. The elderly bilinguals performed better than the elderly monolinguals in the attention, perception & discrimination domain. This was significant at 0.05 level. The reason could be the years of language experiences in managing two languages simultaneously enhancing the cognitive functions (Bialystok, et al. 2004). Also, Bialystok, Craik, Grady, Chau, Isii, Gunji and Panter (2005) reported that the management of two language system led to systematic changes in frontal executive functions. There was no gender difference observed significantly in this domain. This was in consonance with the findings of Kamath (2001) who did not notice any gender contingent variations on the similar tasks.

II. Memory:

The memory sub-section on CLAP consists of three main tasks, i.e. recent memory questions, working memory and semantic memory. The mean scores on memory section are as follows:

Table 4: Mean and SD scores for memory tasks for mono/bilingual young and old subjects

Age	Language	Gender	Mean	S.D	Total
YOUNG	Monolingual	Male	50.30	2.4	50.30
		Female	50.30	3.2	
	Bilingual	Male	54.80	1.6	55.65
		Female	56.50	2.2	
OLD	Monolingual	Male	43.90	3.05	44.85
		Female	45.80	4.18	
	Bilingual	Male	51.80	2.61	50.15
		Female	48.50	4.24	

From the table 4 it can be seen that young bilinguals performed better followed by young monolinguals than by elderly bilinguals and elderly monolinguals in that order respectively. Among the young bilinguals & elderly monolinguals females performed better than males. But elderly bilingual males performed better than females of that group. In all the three memory tasks, young bilinguals' performance was superior to any other group. Elderly bilinguals performed well on working memory tasks than their counter parts.

Since there was significant group difference for the memory domain observed [F (1, 3) = 34.275, $\mathbf{p < .001}$], Tukey's honestly significant test was used as a post-hoc test to see the significant sub-group difference. It was found that elder monolinguals were significantly differing from other three groups. On the other hand, there was no significant difference between elderly bilinguals & young monolinguals. The young bilinguals were significantly different and better from the rest of the groups.

Three-way ANOVA was used and it was found that the main effect was significant for age [F (1, 72) = 52.84, $\mathbf{p < 0.001}$], and language [F (1, 72) = 49.98, $\mathbf{p < 0.001}$]. There was no significant interaction effect observed for other combination of factors and it was found significant except for three factors i.e. age, language and gender at 0.05 level [F(1, 72) = 5.245, $\mathbf{p < 0.05}$]. The obtained results may be because of age-related normal cognitive decline which may attenuate to some extent through managing dual-language system. The results obtained in this study corroborate the earlier research findings. A decline in episodic memory skills with aging has been reported in literature (Craik, 1977; Maxim, 1999). The decline in episodic memory could be related to the difficulties in retrieval of information available in the long term memory. Literature reports of age-related changes in working memory are highly variable. Age-related working memory was observed by Craik and Rabinowitz (1984). Several researchers reported that the semantic memory is more resistant to aging as compared

to other memory processes, though processing time may be longer and more variable with age (Raksha & Nidhi, 1994; Maxim, 1999). These deficits in semantic memory processes are more a result of retrieval deficits probably than a lexical access problem.

The results of the present study agree with the literature mentioned above on episodic, working & semantic memory that the younger adults performed much better than elderly individuals. Among the elderly participants, monolinguals performed significantly poorer than bilinguals. This may be due to age-related memory erosion/decline or memory degradation (Barresi, 1986).

There was no gender difference noticed in young monolinguals. But in young bilinguals and in elderly monolinguals, females performed better than males in memory domains. But this was not statistically significant at 0.05 level. This present study was in consonance with the findings of Kamath (2001), who did not find any gender difference on memory tasks. The bilingual participants were significantly better in memory domain than the monolingual language group. The present study supports the findings of Kormi-Nouri et al. (2003); Bialystok, et al. (2004), where better cognitive control was reported in bilinguals than monolinguals.

III. Problem solving

The problem solving sub-section consisted of tasks such as sentence disambiguation, sentence formulation, predicting out comes, compare & contrast, predicting cause, why question and sequential analysis. The mean scores on problem solving section of CLAP across the groups are as shown in the table 5.

Table 5: Mean and SD scores for problem solving tasks for mono/bilingual young and old subjects

Age	Language	Gender	Mean	S.D	Total
YOUNG	Monolingual	Male	56.30	1.25	54.05
		Female	51.80	2.29	
	Bilingual	Male	55.30	1.33	55.65
		Female	56.00	2.00	
OLD	Monolingual	Male	50.80	2044	51.70
		Female	52.60	2.50	
	Bilingual	Male	54.90	2.02	54.35
		Female	53.80	3.01	

The problem solving scores were poor for the elderly individuals than the young adults. Among the elderly individuals there was a significant difference between monolinguals and bilinguals on these sub-sections. In young monolinguals, males performed better than females. But it was not so in elderly monolinguals, where females were better on this task.

For the sub-group difference, Tukey's significant test as a post hoc test was used since there was significant group difference observed [F (1, 3) = 11.258, $p < .001$]. The elderly monolinguals performed less significantly than the other three groups [young mono, elder bilingual and young bilingual] but within the three groups there was no significant difference observed.

Three-way ANOVA was used to find any interaction effect. ANOVA results revealed that there was a significant main effect observed for age [F (1, 72) = 13.85, $\mathbf{p < 0.001}$], language [F (1, 72) = 18.77, $p < 0.001$], between age & gender [F (1, 72) = 5.26, $p < 0.05$],

between age, language & gender [F (1, 72) = 17.05, $\mathbf{p < 0.001}$]. The present findings support the findings of Brain (1975) and Kessler and Quinn (1980) who observed bilingual advantages in the problem solving tasks. In general younger participants performed better than the elder adults. There was a significant age effect observed in this study. This was statistically significant at 0.001 level. Literature reports of difficulty in comprehension of ambiguous sentences in the elderly individuals. These deficits are related to difficulties in finding strategies or changing to new strategies (Maxim, 1999). This increased rigidity or difficulty in changing set leads to deviances in ability to generate concepts necessary to solve a problem. The present findings of the study are not in consonance with the findings of Kamath (2001) where she did not find any significant age-related decline in problem solving tasks. This may be because of small sample size used in her study.

IV. Organization:

The organization section consisted of categorization, analogies and sequential events. The mean and SD of organization scores are as shown in the tabular column.

Table 6: Mean & SD of Organization scores across groups

Age	Language	Gender	Mean	S.D	Total
YOUNG	Monolingual	Male	41.40	8.93	40.70
		Female	40.00	4.13	
	Bilingual	Male	55.20	3.08	52.80
		Female	50.40	5.46	
OLD	Monolingual	Male	28.50	3.8	32.50
		Female	36.50	4.94	
	Bilingual	Male	35.80	7.14	35.90
		Female	36.00	5.05	

The organization section scores were better in young adults than old individuals. In a similar manner, bilinguals' performance was better than the monolinguals. Between group difference and within group difference was observed for the entire three sub-tasks of organization domains. Elderly females' scores were relatively better on organization tasks when compared to males (table 9).

As there was significant group difference for the organization domain [F (1, 3) = 50.072, $\boldsymbol{p < .001}$], the scores were subjected to Tukey's significant test used as a post-hoc test for significant sub-group difference. Elder monolinguals and bilinguals together were significantly differing from other two groups but between them there was no significant difference (they performed at the lower level). Young monolinguals were better than elderly-mono, bilingual groups but less than young bilingual group. Bilingual young adults performed extremely better on the organization sections. This was statistically significant at 0.05 level.

Three-way ANOVA was used to find any significant group interaction for age (2), language (2), gender (2). The results of ANOVA revealed that the main effect was significant for age [F (1, 72) = 100.04, $\boldsymbol{p < 0.001}$], language [F (1, 72) = 38.15, $\boldsymbol{p < 0.001}$], but not for gender [F (1, 72) = 1.159, p = 0.691]. Also there was significant interaction effect observed between age and language [F (1, 72) = 12.02, $\mathbf{p < 0.001}$], between age and gender [F (1, 72) = 8.23, $\boldsymbol{p < 0.05}$], and between age, gender, language [F (1, 72) = 4.98, $\mathbf{p < 0.05}$]. The present findings indicate that managing dual language system enhances one's organization skills and influence the cognitive abilities and mental processes when compared to those of monolinguals. This present findings support the finding of Diaz and Klinger, (1991).

In general, elderly participants performed significantly poorer than young adults in the organization skills. This was significant at 0.01 level. This finding supports the finding of Kemper (1992) and Hamm and Hasher (1992), who reported that the elderly individuals have greater difficulty in processing grammatically encoded information about relationships between events.

V. Summary of CLAP scores across the groups:

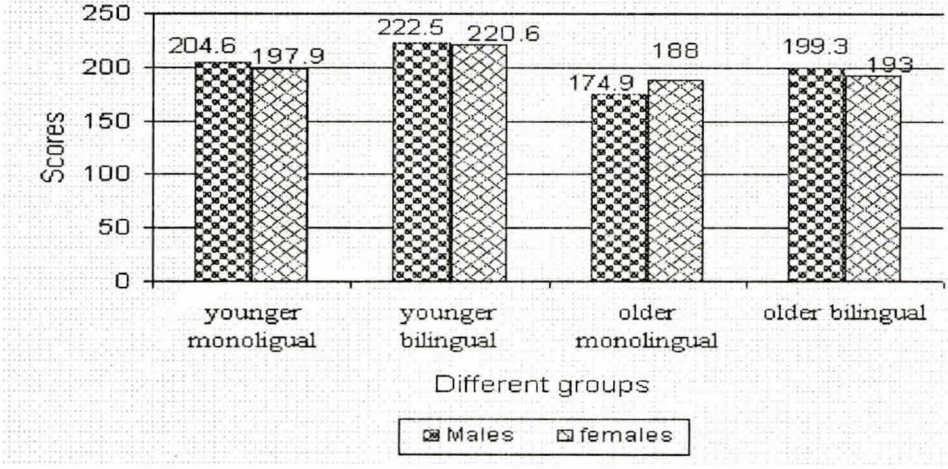
The following table 7 shows the total scores of CLAP that were obtained adding all the sections.

Table 7: Mean and S.D. of total CLAP scores across groups

Age	Language	Gender	Mean	S.D	Total
YOUNG	Monolingual	Male	204.60	12.54	201.25
		Female	197.90	8.54	
	Bilingual	Male	222.50	6.05	221.55
		Female	220.60	7.56	
OLD	Monolingual	Male	174.90	7.34	181.45
		Female	188.00	11.56	
	Bilingual	Male	199.30	8.47	196.15
		Female	193.00	11.34	

The mean scores were more for young adults than elderly individuals. Among the two age groups, bilinguals performed better on CLAP tasks than monolinguals. Except in older monolingual group male subjects performed well than the female subjects but it was not significant. The results are depicted graphically as shown in Graph 1.

Graph 1: Summary of total CLAP scores across subjects



Since there was significant group difference observed on the total scores on CLAP [F (1, 3) = 61.756, p < **.001**], Tukey's significant test used as a post-hoc test was done to see the significant sub-group difference. It revealed that the elder monolinguals' performance was significantly much lower than other three groups. The elderly bilinguals & young monolinguals differed significantly together than other groups. However, there was no significant difference between them. The young bilinguals differ significantly from rest of the groups and performed well on CLAP tasks.

Table 8: Sub-groups obtained from Tukey's post hoc test for total CLAP scores.

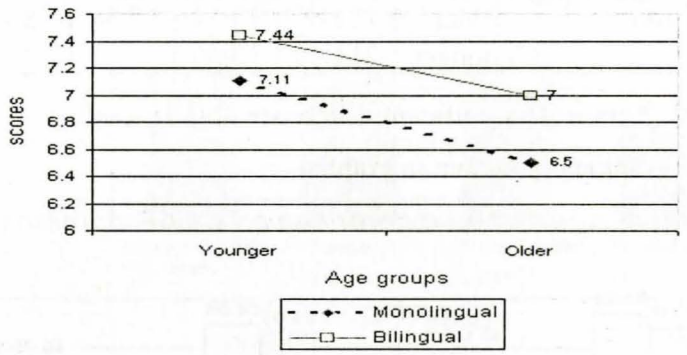
Elder Monolinguals		
	Elder Bilinguals	
	Younger Monolinguals	
		Younger Bilinguals

The table 8 indicates that the groups observed in different columns indicate no significant difference and groups in same column indicate significant difference at 0.05 level. Three-way ANOVA was done to find any interaction effect, which revealed that there was a significant main effect found for age [F (1, 72) = 11.72, $p < 0.001$], Language [F (1, 72) = 68.78, $p < 0.001$] and between age, language & gender [F (1, 72) = 8.22, $p < 0.01$].

VI. Working memory cost:

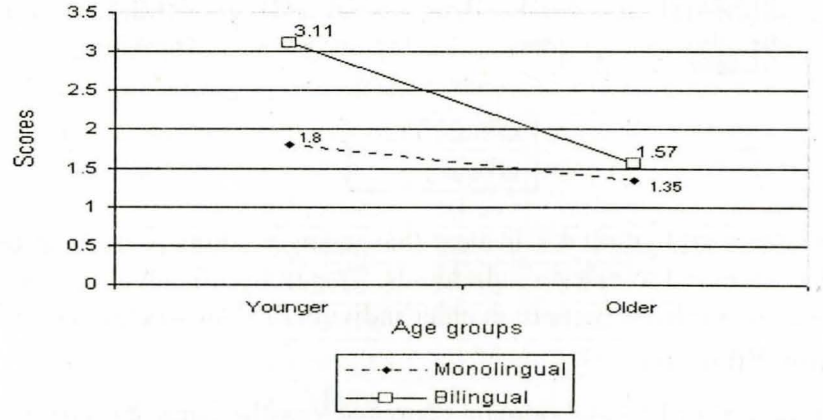
Working memory cost was calculated as the score difference between the timed tasks and untimed tasks. As the untimed tasks are considered as the control condition, in that subjects do not have the time pressure to complete the task, whereas timed task has time bound for the completion of the task.

Graph 2: *Scores on simple condition [Untimed task]*



The Graph 2 displays scores for both language groups in simple/control condition (untimed task) and shows that the scores in the simplest condition did not distinguish between language groups as well as age groups.

Graph 3: *Working memory cost scores across groups*



The graph 3, shows the working memory cost, calculated as the mean score difference between timed and untimed tasks, which indicates high working memory cost for young adults than older individuals i.e., timed task scores – untimed task scores. Among the

participants, bilinguals had more working memory cost than monolinguals. The working memory cost was relatively same in older mono and bilinguals. This may be because of age-related processing decline. This present findings support the remark made by Bialystok, et al. (2004) where they concluded that bilingualism attenuates the negative effect of aging.

VII. Age group difference:

Independent samples t-test was used to find out the group differences. The scores on all the sections across the age groups are as shown in the table 9.

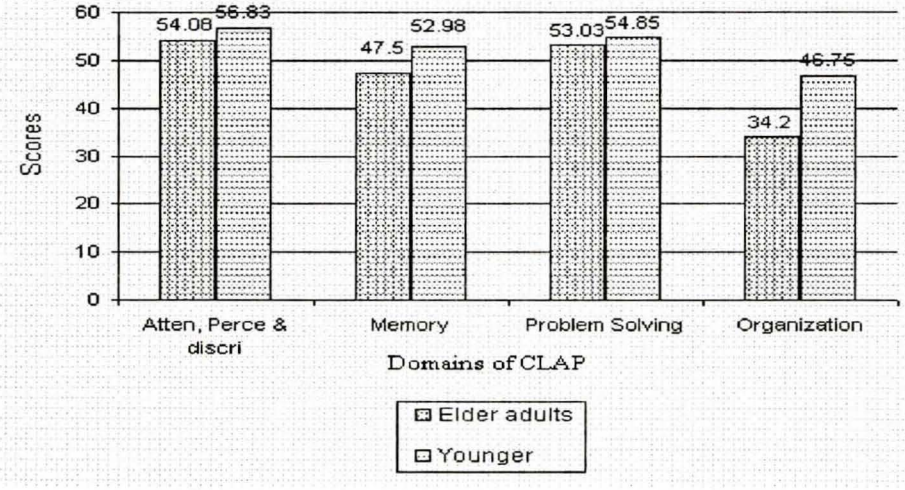
Table 9: Mean and SD of CLAP section-scores across age-groups

Domains	Age	Mean	S.D	t	df	Sig.
Atten, Per, & Discri.	Elder	54.08	3.75	-.3.89	78	0.000*
	Younger	56.86	2.43			
Memory	Elder	47.50	4.95	-5.63	78	0.000*
	Younger	52.98	3.64			
Problem solving	Elder	53.03	2.89	-3.02	78	0.003*
	Younger	54.85	2.50			
Organization	Elder	34.20	6.15	-7.56	78	0.000*
	Younger	46.75	8.50			
TOTAL	Elder	188.80	13.12	-7.54	78	0.000*
	Younger	211.40	13.66			

* indicate significant difference at 0.01 level.

The results are graphically shown in graph 4.

Graph 4: *Age-Group differences on CLAP domains*



From the table 9 and graph 4 it is clear that younger adults performed better in all the CLAP tasks when compared to elderly individuals. This is significant at 0.01 level. In general variability of scores was relatively more in elder individuals than younger adults.

VIII. Language group difference:

The mean and SD of CLAP domain scores across the language groups are shown in table 10. Among the monolinguals and bilinguals the group difference was found by using independent samples t-test. The results are graphically as shown in the graph 5, which

indicates that the bilinguals are better in cognitive linguistic tasks than monolinguals. There were relatively more variations observed in bilinguals in the CLAP scores.

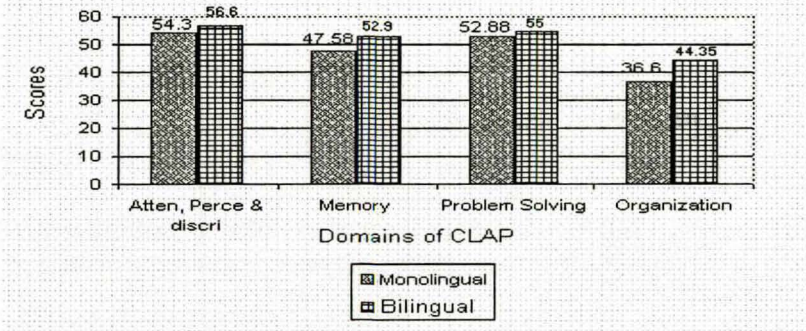
Table 10: Mean and SD of CLAP section-scores across Language-groups

Domains	Language	Mean	S.D	t-value	df	Sig.
Attention, Perception, & Discrimination	Monolingual	54.30	3.80	-3.89	78	.000*
	Bilingual	56.60	2.58			
Memory	Monolingual	47.58	4.63	-5.63	78	.000*
	Bilingual	52.90	4.13			
Problem solving	Monolingual	52.88	2.99	-3.02	78	.003*
	Bilingual	55.00	2.24			
Organization	Monolingual	36.60	7.55	-7.56	78	.000*
	Bilingual	44.35	10.15			
Total	Monolingual	191.35	14.99	-7.54	78	.000*
	Bilingual	208.85	15.46			

* indicate significant difference at 0.01 level.

The results are graphically shown in graph 5.

Graph 5: *Language-group difference on CLAP domains*



IX. Gender group difference:

In all the groups studied, there were equal number of males and females participated. Independent-samples t-test was used to find out any gender effect. The mean and S.D of CLAP domain scores between the gender is tabulated in table 11.

Table 11: Mean & SD of CLAP section-scores across Gender-groups

Domains	**Gender**	**Mean**	**S.D**	**t-value**	**df**	**Sig.**
Attention, Perception, & Discrimination	Males	55.58	3.75	0.32	78	.74 NS
	Females	55.33	3.12			
Memory	Males	50.20	4.62	-0.06	78	.94 NS
	Females	50.28	5.63			
Problem solving	Males	54.33	2.76	1.22	78	.22 NS
	Females	53.55	2.89			
Organization	Males	40.23	11.57	-0.22	78	.81 NS
	Females	40.73	7.54			
Total	Males	200.33	19.25	0.11	78	.90 NS
	Females	199.88	15.81			

NS indicate non significant.

The results age graphically as shown in Graph 6.

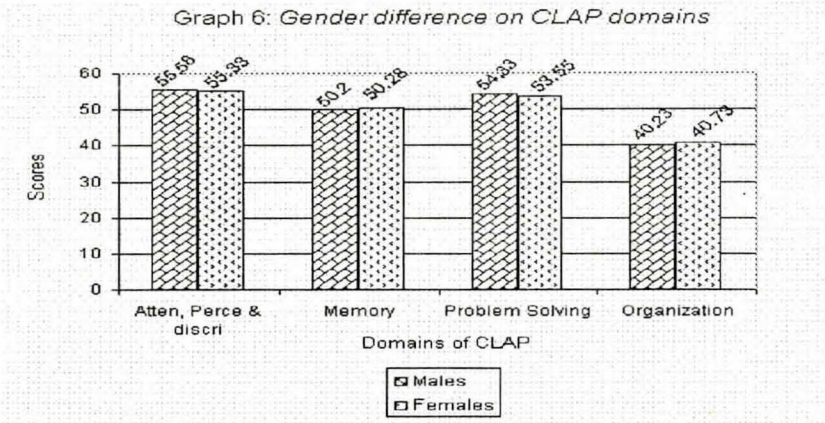


Table 12: Average time taken for the timed tasks across Age, Language & Gender-groups (in seconds)

Variables	Parameters	Types	LC	CLC	WC	MBN	CN	SF	C
AGE GROUP	Mean	Young	16.23	19.38	17.7	23.00	13.1	67.7	52.38
		old	33.08	40.08	36.4	38.55	38.5	74.0	64.88
	t-value	Young	-7.67	-7.78	-8.49	-3.08	-7.5	-1.0	-3.13
		old							
	Sig.	Young	.000*	.000*	.000*	.003*	.000*	.227	.002*
		old							
LANGUAGE GROUP	Mean	Mono.	27.55	31.88	29.7	39.42	23.7	78.8	66.15
		Bilin.	21.75	27.58	24.3	22.13	16.3	62.9	51.10
	t-value	Mono.	2.04	1.22	1.81	3.48	3.25	2.90	3.88
		Bilin.							
	Sig.	Mono.	.044*	.224	.074	.001*	.002*	.005*	.000*
		Bilin.							
GENDER GROUP	Mean	Male	22.83	27.13	25.3	27.88	19.2	80.2	60.85
		Female	26.48	32.33	28.8	33.67	20.8	61.5	56.40
	t-value	Male	-1.26	-1.48	-1.15	-1.09	-0.6	3.48	1.05
		Female							
	Sig.	Male	.209	.141	.250	.277	.489	.001*	.293
		Female							

LC-Letter Cancellation; CLC-Contigent Letter Cancellation; WC-Word Cancellation; MBN-Month Backward Naming; CN-Coordination Naming; SF-Sentence Formulation; C- Categorization * indicate significant at 0.05 level.

The results revealed that there was no significant difference between males and females across the CLAP sections, which is shown in the graph 6. Hence it can be concluded that there was no gender differences on cognitive linguistic tasks performances and the findings were in consonance with the findings of Kamath (2001) where she did not find significant gender difference. But on the total CLAP scores the age-language specific gender difference was noticed. That is, elderly females of monolingual group performed better than elderly females of bilingual group. But the younger males (both monolingual & bilingual) performed better on all domains of CLAP when compared to younger females. But it was not statistically significant.

X. Average time taken for the timed tasks by subjects

The average time taken for the completion of timed tasks (except sequential events) was tabulated (table 12) across the groups. From the table 12 it may be seen that the time taken to complete the timed tasks like Letter cancellation, contingent letter cancellation, word cancellation, month backward naming, co-ordinate naming and categorization was more for

older participants than the younger adults. This was significant at 0.05 level [except sentence formulation task]. Similarly, among the language groups, bilinguals took less time compared to monolinguals to complete the timed tasks [except contingent letter cancellation & word cancellation task]. But there was no significant difference between the genders in the average time taken, [except for sentence formulation task], wherein males took longer time than females in sentence formulation task. This was significant at 0.05 level. In general younger adults, irrespective of language group, were faster in completing the tasks. Also, the bilingual group was significantly faster than the monolingual group individuals.

Conclusion

1. In general younger adults were better in all cognitive linguistic tasks than the older individuals.
2. Bilinguals' performances were better on all cognitive linguistic tasks. But there was an interaction effect noticed among all the three factors (age, gender and bilingualism) studied.
3. Young bilingual performance was significantly high on all domains of cognitive-linguistic assessment protocol.
4. Younger monolingual and elder bilinguals performed relatively on par with each other.
5. Elderly monolinguals performed at a significantly lower level on all domains of cognitive-linguistic assessment protocol.
4. There was no significant gender difference noticed on all cognitive linguistic tasks.
5. Working memory cost was relatively more in bilingual younger adults than the monolingual younger adults. Similarly it was relatively more in bilinguals than monolinguals.
6. Both younger adults and bilinguals were faster in all the timed tasks on cognitive-linguistic assessment protocol than the elderly individuals.

From the present study findings it can be concluded that the age related changes does occur in terms of cognitive aspects. But some of the cognitive decline intrinsic with the language performance. Hence poor performance might be observed in certain linguistic tasks like phoneme fluency task and other example is semantic memory declines in aging that leads to word finding difficulties (due to retrieval failure and not because of accessing problem). In the present study elderly monolingual group had poorer performance in all the domains of Cognitive-Linguistic Assessment Protocol (CLAP) when compared to elderly bilingual group. The probable interpretation is that the management of dual language system leads to systematic changes in frontal executive functions. Also bilingualism may have certain influence to counteract the negative effect of normal age-related changes. It can be concluded from the present study that bilingual advantage is present in elderly individuals like in children and younger adults because of constant management of dual-language system, which probably enhances the cognitive control.

Implications of the present study

1. The results of this study would serve as a sensitive tool to screen the cognitive-linguistic abilities of the young adults and elderly individuals, monolinguals & bilinguals. The mean scores of the two groups would serve as a norm of reference for clinical screening.
2. The results of this study would enrich the existing theoretical knowledge on the relations among bilingualism / monolingualism and cognition & its effects on aging.

3. Clinically, this study would be helpful to differentiate senile versus senescent changes besides throwing light on the trend of language processing deficits in dementia.
4. The results have implications for positive therapeutic intervention strategies in bilingual patients with not only dementia but also other disorders like aphasia. However, this needs to be explored further.

References

Ardila, A., Rosselli, M., Ostrosky-Solis, F., Marcos, J., Granda, G. & Soto, M. (2000). Syntactic comprehension, verbal memory, & calculation abilities in Spanish – English bilinguals. *Applied Neuropsychology, 7* (3), 3 – 16.

Barresi (1986). Cited in R. Au & N. Bowles (1991). Memory influences on language in normal aging. In D. Ripich (Ed.), *Handbook of geriatric communication disorders*, Pp. 293 – 305. Texas: Pro-ed.

Bayles, K. A. & Kaszniak, A. W. (1987). *Communication and cognition in normal aging and dementia*. Texas: Pro-ed.

Bellis & Wilber (2001). Effects of aging and gender on inter-hemispheric function. *Journal of Speech and Hearing Research, 44* (2), 246 – 263.

Best, J. B. (1999). *Cognitive psychology*, (5th ed). Pp. 15-17. Belmont: Wadsworth Publishing Company.

Bialystok, E. (1993). Metalinguistic awareness: The development of children's representations of language. In C. Pratt & A. Garton (Eds.), *Systems of representation in children development and use*, Pp. 211 – 233. London: Wiley.

Bialystok, E. (2001). *Bilingualism in development: Language, literacy and cognition*. New York: Cambridge University Press.

Bialystok, E., Craik, F. I. M., Klein, R. & Viswanathan, M. (2004). Bilingualism, Aging and cognitive control: Evidence from the Simon task. *Psychol & Aging, 19 (2),* 290 – 303.

Bialystok, E., Craik, F. I, Grady, C., Chau, W., Ishii, R., Gunji, A. & Panter, C. (2005). Effect of bilingualism on cognitive control in the Simon task: Evidence from MEG. *Neuro Imaging, 24* (1), 40 – 49.

Brain, B. (1975). Toward an integration of Piaget and Vygosky: Bilingual considerations. *Linguistics, 160*, 5 – 19.

Brownwell, H. H. & Joanette, Y. (1993). In J. Maxim (1999). Aging and Language. In F. Fabbro (Ed.), C*oncise encyclopedia of language pathology*. Oxford: Elsevier.

Civil, R. H. & Whitehouse, P. J. (1991). Neurobiology of the aging communication system. In D. Ripich (Ed.), *Handbook of geriatric communication disorders*, 5-19, Texas:

Craik, F. I. M. (1977). Cited in R. Au & N. L. Bowles. (1991). Memory influences on language in normal aging. In D. Ripich (Ed.), *Handbook of geriatric communication disorders*. Pp. 293 – 305. Texas: Pro- ed.

Craik, F. I. M. & Robinowitz, J. C. (1984). Cited in R. Au & N. L. Bowles. (1991). Memory influences on language in normal aging. In D. Ripich (Ed.), *Handbook of geriatric communication disorders*. Pp. 293 – 305. Texas: Pro- ed.

DeGroot, A. M. B. & Kroll, J. F. (1997). *Tutorials in bilingualism: Psycholinguistic perspectives*. Mahwah, New Jersey: Erlbaum.

Diaz, R. M. & Klinger, C. (1991). Toward on explanatory model of the interaction between bilingualism and cognitive development. In E. Bialystok (Ed.), *Language processing in bilingual children*. Cambridge: Cambridge University Press.

Duncan, S. E. & De Avila, E. A. (1979). Bilingualism and Cognition: Some recent findings. *National Association for bilingual education Journal, 4*, 15 – 50.

Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975). Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*, 189 – 198.

Francis, W. S. (1990a). Cognitive integration of language and memory in bilinguals: Semantic representation. *Psychological Bulletin, 125*, 193 – 222.

Gollan, T. H., Montaja, R. & Werner, G. (1992). Semantic and letter fluency in Spanish - English bilinguals. *Neuropsychology, 16*, 562 – 576.

Hamm, V. F. & Hasher, L. (1992). Cited in J. Maxim (1999). Aging and Language. In F. Fabbro (Ed.), *Concise encyclopedia of lang. pathology*. Pp. 142-146. Oxford: Elsevier.

Harris, R. J. (1992). *Cognitive processing in bilinguals*. Amsterdam: North Holland.

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension and aging: A review and a new view. In G. H. Bower (Ed.), *The psychology of learning and motivation. Vol. 22*, Pp. 193 – 225. San Diego, C. A.: Academic Press.

Hoyer & Plude (1980). Cited in Bayles, K. A., & Kaszniak, A. W. (1987). *Communication and cognition in normal aging and dementia*. Texas: Pro-ed.

Ingram, E. D. (1985). How native like? Measuring Language Proficiency in Bilinguals. *Journal of applied Linguistics*, XI (2), 47 – 64.

Kahneman (1973). Cited in Bayles, K. A., & Kaszniak, A. W. (1987). *Communication and cognition in normal aging and dementia*. Texas: Pro-ed.

Kamath, A. (2001). Cognitive – Linguistic Assessment Protocol for adults. *Unpublished Master's Dissertation*, University of Mysore, Mysore.

Kemper, S. (1992). Cited in J. Maxim (1999). Aging and Language. In F. Fabbro (Ed.), *Concise encyclopedia of language pathology*. Pp. 142 – 146. Oxford: Elsevier.

Kessler, C. & Quinn, M. E. (1980). Positive effects of bilingualism on science problem-solving abilities. In J. E. Alatis (Ed.), *Current issues in bilingual education: Proceedings of the Georgetown round table on Languages and Linguistics* (Pp. 295 - 305). Washington, DC: George Town University Press.

Kessler, C. & Quinn, M. E. (1987). Language minority children's linguistic and cognitive creativity. *Journal and Multilingual and Multicultural development, 8*, 173 – 186.

Kormi-Nouri, R., Moniri, S. & Nilsson, L.G. (2003). Episodic and semantic memory in bilingual and monolingual children. *Scandinavian Journal of Psychology, 44*, 47 – 54.

Kramer, C. (1974). Cited in V. G. Walker, C. J. Hardiman, D. L. Hedrick & A. Holbrook (1981). Speech and Language characteristic of an aging population. In Lass (Ed.), *Speech & Lang: Advances in basic research and practice*. NY. Academic Press, Inc.

Mc Dowd, J. M. & Shaw, R. J. (2000). Attention and Aging: A functional perspective In F. I. M. Craik & T. A. Salthouse (Eds.), *The handbook of aging and cognition.* (2nd edn), Pp. 221 – 292. Mahwah, New Jersey: Erlbaum.

Maggie Kuhn, (1979). Bayles, K. A. & Kaszniak, A. W. (1984). *Communication and cognition is normal aging and dementia.* Texas: Pro-ed.

Maxim, J. (1999). Aging and language. In Fabbro (Ed.), *Concise encyclopedia of speech language pathology.* Pp. 142 - 146. Oxford: Elsevier.

Mc Glone, J., Gupta, S., Humphrey, D., Oppenheimer, S., Miosen, T. & Evans, D. R. (1990). Screening for early dementia using memory complaints from patients and relatives. *Archives of Neurology, 47,* 1189 – 1193.

Michael, E. B. & Gollan, T. H. (in Press). Being and becoming bilingual: Individual differences and consequences for language production. In J. R. Kroll and DeGroot (Eds.), *Handbook of bilingualism.* New York: Oxford University Press.

Nidhi, M. & Raksha, H. R. (1994). Response patterns on a word association test: Effects of aging. *The Journal on Indian Speech & Hearing Association, 13,* 72 – 75.

Rabbitt, P. (1965). An age decrement in the ability to ignore irrelevant information. *Journal of Gerontology, 20,* 233 – 238.

Raksha, H. R. & Nidhi, M. (1994). Generative naming in the elderly: Evidence of an age related decline? *The Journal on Indian Speech & Hearing Association, 13,* 52 – 55.

Randell, S. E. & Fischler, I. (1989). Effects of concreteness and task context on recall of prose among bilingual and monolingual speakers. *Journal and Memory and Language, 28,* 278 – 291.

Rosselli, M., Ardila, A., Salvatierra, J., Marquez, M., Matos, L., Weekes, V. A. (2002). A cross-linguistic comparison of verbal fluency tests. *International Journal of Neuro - science, 112 (6),* 759 – 776.

Rosselli, M., Ardila, A., Santisi, M. N., Mdel, R., Salvatierra, J., Conde, A. & Lenis, B., (2002). Stroop effect in Spanish-English bilinguals. *Journal of Neuropsychology society, 8 (6),* 819 – 827.

Rosenblum, T. & Pinker, S. A. (1983). Word magic revisited: Monolingual and bilingual children's understanding of the word object relationship. *Child Development, 54,* 773.

Tsang & Lee (2003). The effect on aging on confrontation naming ability. *Archives of Clinical Neuropsychology, 18* (1), 81 – 90.

Ulatowska, H. K., Cannito, M. P., Hayashi, M. M., & Fleming, S. G. (1985). Language abilities in the elderly. In H. K. Ulatowska (Ed.), *The aging brain: Communication in the elderly.* Pp. 125 – 140. London: Taylor & Francis.

Yang, Y. (2000). Sex and skill differences in translation of English colour words by Chinese students. *Perceptual Motor Skills, 91* (3 pt 2), 1181 – 1192.