==========
Language in India www.languageinindia.com **ISSN 1930-2940 Vol. 22:10 October 2022**
==========

Comparison of Visual Word Recognition in Adult and Geriatric Population

Nisthul Bensi, Dr. Satish Kumaraswamy and Mr. Mishal K
Dr. MV Shetty college of Speech and Hearing
Mangaluru, Karnataka 575013

==========

Introduction

Speech perception refers to the set of operations that transform an auditory signal into representations of a form that makes contact with internally stored information – that is, the stored words in a listener's mental lexicon. **(**Brain Mapping, 2015)

Word recognition refers to a component process of language. Word recognition transforms written and spoken forms of words into linguistic representations. Historically, word recognition also referred to lexical decision performance. (Moreno, 2001)

Word recognition is the process of recognizing a word's pronunciation when it is presented to the eye and does so automatically and without conscious effort. It is difficult to focus on understanding material when reading requires purposeful, laborious decoding. The ability to read words with meaning is an important early goal because reading comprehension is the ultimate goal of training children to read. Visual word recognition plays a big role in reading. Although it seems that readers have minimal issue identifying words that are visually presented, the procedures by which orthography is translated into phonology and semantics are far from straightforward.

When a stimulus's features match the orthography (or spelling) of an entry in the mental lexicon, recognition of the word takes place. In visual word recognition, the entire word may be viewed at once (if it is short enough).

It is well acknowledged that spoken and written word recognition uses semantic and syntactic representations. But whether spoken and written words have different lexical representations has been hotly contested. Some academics contend that a word must first be transformed into a sound representation in order to gain semantic and grammatical information about it. If so, all that is needed for each word is a phonological representation (e.g., one that shows the sequence of component phonemes and the stress pattern).

However, extensive neuropsychological data shows that words have independent phonological and orthographic representations, and that access to word meaning for written words can occur without phonological conversion. According to recent neuroimaging data, certain brain areas are selectively active in grapheme-to-phoneme conversion during visual

word recognition, whereas others are selectively activated in direct lexical access without such conversion. Nonetheless, the phonological representation of a written word appears to be computed automatically (via an implicit "sounding out" or "letter–sound" translation process) for healthy persons.

Word recognition refers to the presumed mental storage, retrieval, and use of a person's sight words. Without word recognition, every word would have to be decoded through phonics every time it was read.

In visual word recognition, a whole word may be viewed at once (provided that it is short enough), and recognition is achieved when the characteristics of the stimulus match the orthography (i.e., spelling) of an entry in the mental lexicon. Speech perception, in contrast, is a process that unfolds over time as the listener perceives subsequent portions of the word. Upon hearing the first syllable of a spoken word such as the “un” in “understand,” several words may be consistent with the input (e.g., “under,” “until,” and “untie”). As subsequent portions are perceived the pool (or “cohort”) of words will be narrowed down, until only one word remains. In visual word recognition, a letter level intervenes between visual processing and lexical access. In auditory word perception, it is often assumed that a phoneme level intervenes between the acoustic input and lexical access. Phonemes are assumed to be the basic sound units of speech perception and production).

Yap (2015) discusses the cognitive processes that skilled readers use in order to recognize and pronounce individual words and description of methods and a selective review of empirical literature, with an emphasis on how the recognition of an isolated word is modulated.

Ransom (2021) investigated on face mask and speaking style affect audio-visual word recognition and memory of native and non-native speech and found out that they have implications for communication in classrooms and hospitals where listeners interact with teachers and health care provides, often times non-native speakers, through their protective barriers.

Hershman (2022) determined a pupillometric study of developmental and individual differences in cognitive effort in visual word recognition and found out that they have the potential to open up new avenues of research in the study of skill growth in word recognition and many other domains of skill learning.

Words are the building block of language and are the interface between written and spoken language. Recognition of printed word is both essential to the important skill of reading and among the earliest routes for the experimenter to access higher cognition. In this light, it is little surprise that the identification and pronunciation of written words are among the earliest studied (Cattell, 1886) and most studied aspects of cognition.

Visual word recognition is studied both in its own right, in terms of the processes of recognizing a word and the performance of word-based tasks, but also more broadly in context as a link to semantics and concepts, cognitive individual differences, reading prose and learning to read.

Review of Literature

Speech perception' thus refers to the set of operations that transform an auditory signal into representations of a form that makes contact with internally stored information – that is, the stored words in a listener's mental lexicon. (Mapping 2015)

As seen in newborns' capacities to perceive speech, speech perception—the process by which we use cognitive, motor, and sensory processes to hear and interpret speech—is a consequence of innate preparedness ("nature") and sensitivity to experience ("nurture"). Studies on young children from birth have revealed that they react differently to voice cues, pointing to a significant intrinsic component to language. By demonstrating that the language a baby hears during the first year of life causes the newborn to start creating a different set of sounds (babbling) particular to the language spoken by its parents, further research has demonstrated the significant influence of environment on language acquisition.

The speed of access to lexical representations in both young and older individuals has been the subject of numerous studies in the field of visual word recognition. Word objective frequency, which provides a statistical estimate of the frequency of a printed word in a sample of texts (Howes & Solomon, 1951), is crucial among the lexical variables used to assess the orthographic level (e.g., Monsell, 1991, Whaley, 1978). Although this effect varies with ageing, high-frequency words are identified quicker and more precisely than less common terms (e.g., Balota,2004, Robert, 2009). The subjective estimation of a printed word's frequency can also be done using behavioral metrics gleaned from evaluations of performances. As a result, it is feasible to estimate.

Western Studies

Armstrong, Perera & Frost (2013) done a study on what, when, where and how of visual word recognition, a long-standing debate in reading research is whether printed words are perceived in a feed forward manner on the basis of orthographic information, with other representations such as semantics and phonology activated subsequently, or whether the system is fully interactive and feedback from these representations shapes early visual word recognition. Then conclude that, consistent with interactive accounts, higher-order linguistic representations modulate early orthographic processing.

Ferraro, Kitzan & Petros (2010) has done a study on the role of vocabulary ability during visual word recognition in younger and older adult and they concluded that the differences in reaction times for words and pseudo-words were greater in the older adults. The importance of vocabulary ability during word recognition and lexical processing is discussed.

Clark, Guediche & Lallier(2020) done a study on compensatory cross-model effects of sentence context of visual word recognition in adults and the results show a significant cross-modal interaction between the congruency of the auditory sentence context and visual crowding, suggesting that interactions can occur across multiple levels of processing and across different modalities to support reading processes. These findings highlight the need for reading models to specify in greater detail how top–down, cross-modal and interactive mechanisms may allow readers to compensate for deficiencies at early stages of visual processing.

Perea, Sigut & Martínez (2022) involved in the impact of visual cues during visual word recognition in deaf readers and they conclude that the finding supports the idea that, when it comes to visual word recognition, deaf readers rely more heavily than ordinary hearing readers on visual cues. Overall, the findings point to various mechanisms that underlie successful word identification in both hearing and deaf readers.

Sung (2022) investigated the age-related differences in word recognition tasks according to visual interference and noun imagery and they concluded that Elderly adults demonstrated delayed processing when compared with younger adults, whereas age-group differences did not emerge as a function of the interference types.

Simon, Sharafudeen & David (2022) investigated on visual words based static Indian sign Language Alphabet Recognition using KAZE descriptor and they concluded that demonstrate the proposed method obtained an accuracy of 99.23% with KAZE descriptor and MLP classifier.

Rossion & Lochy (2021) did a study on human face recognition lateralized to the right hemisphere due to neural competition with left-lateralized visual word recognition and concluded that the evidence of face recognition performance and its right hemispheric lateralization being modulated by literacy level during development or at adulthood is lacking. Vidal, Viviani & Crepaldi (2021) investigated a general-purpose mechanism of visual feature association in visual word identification and concluded that the results presented in this work suggests that a fundamental processing mechanism behind the processing of visual words also supports the recognition of the other visual objects.

Indian Studies

Mishra, Shekar & Chakraborty (2019) investigated on OCR-VQA: visual question answering by reading text in images and concluded that the various challenges present in this dataset leaving ample scope for the future research. We are optimistic that this new task along with compiled dataset will open-up many exciting research avenues both for the document image analysis and the VQA communities.

Both sense and non-sense words have a greater duration before rehearsal, according to Varghese & Kumaraswamy's (2019) comparison of the duration of sense and non-sense words before and after rehearsal.

Singh, Wang & Shah (2022) the influence of Romanizing a non-alphabetic L1 on L2 reading: the case of Hindi-English visual word recognition and they concluded the findings provide evidence that adopting an additional L1 script might reconfigure the architecture of the bilingual lexicon. Our results support the view that script differences play a critical role in language processing.

Icht, Swead & Mama (2022) investigated on production improves visual and auditory text memory in younger and older adults and they concluded that the more test items were filled in correctly when the relevant information appeared in the produced than in non-produced sentences, showing the learners' ability to use distinctiveness information. The production effects were larger for older than younger adults, in both modalities.

Chaurasiya (2021) investigated on speech intelligibility enhancement in elderly with high-frequency hearing loss through visual speech perception and they concluded that the elderly-individuals of this experiment, whose mother tongue and official language is Hindi and English, respectively, they demonstrate the SIE with HFHL through VSP. This investigation also helps to improve the hearing sensitivity to some extent with VSP.

Babel (2022) did a study on adaptation to social-linguistic associations in audio-visual speech and then concluded that the congruent accent-ethnicity associations facilitate adaptation, and that the mainstream local accent is associated with a more diverse speech community.

Need of the Study

The literature summary above suggests that durational aspects of voice perception are crucial. There have been studies on the durational properties of sense and non-sense words among stutterers, but there is a dearth of useful information in the general population and across genders. The current study examines the durational traits of sense and non-sense words in adults and the geriatric population as a consequence.

Method

Aim

The aim of the study is to compare the durational aspects in visual word recognition in adults and geriatric population.

a) To examine the durational characteristics of visual word recognition in adults.
b) To examine the durational characteristics of visual word recognition in geriatric population.
c) To compare the durational characteristics of visual word recognition in adults and geriatric population.

Participant With Inclusive Criteria

Adults in the age group of 19-30 years and geriatric population from 65-73 years. Each participant was a native of Kerala and was proficient in both reading and writing Malayalam.

Participants With Exclusive Criteria

Adults and geriatric population who weren't fluent in speaking, reading and writing Malayalam language and also adults / geriatric population with speech, hearing, neurological and psychological problems.

Test Materials/Stimulus

Based on frequent usage, 15 pairs of sense and non-sense words totaling 30 terms were evenly separated into sense and non-sense words in increasing order of syllable combinations. The word list developed was validated by 5 SLP's who were in the field for more than 5 years with Malayalam as native language.

Procedure

The person received the finalized wordlists through computer presentation. The information was collected from each person in a quiet, noise-free room with a computer display placed one foot away from them. The PowerPoint presentation with the white background and black text. Each word recognition using PRAAT software was carefully recorded. 15 sense word and 15 nonsense words were presented to each individual and was instructed to read the words quickly and accurately paying attention.

There was a 1minute pause after the words were read before the presentation of the words (sense and nonsense words) was repeated. For the study, a target response was regarded to be the speaker's initial vocal utterance.

A microphone that was connected to a computer was used to record each person's responses. From the start of the word utterance to its conclusion, individual responses were recorded. The acquired values underwent statistical analysis; the outcomes are described in the following section.

Response

Verbal responses were chosen as the study's response mode. The initial statement made by the speaker establishes the desired response. Therefore, each respondent's response was evaluated from the start to the end of their speech.

Statistical Analysis

The collected data was subjected to a statistical analysis. The average number of words per minute was determined. The mean, standard deviation, confidence interval, and unpaired key test were used to examine the collected data.

Results

The aim of the study is to compare the durational aspects in visual word recognition in adults and geriatric population.

a) To examine the durational characteristics of visual word recognition in adults.
b) To examine the durational characteristics of visual word recognition in geriatric population.

c) To compare the durational characteristics of visual word recognition in adults and geriatric population.

The results were examined in order to assess the study's goals.

a) To examine the durational characteristics of visual word recognition in adults:

Table 1:

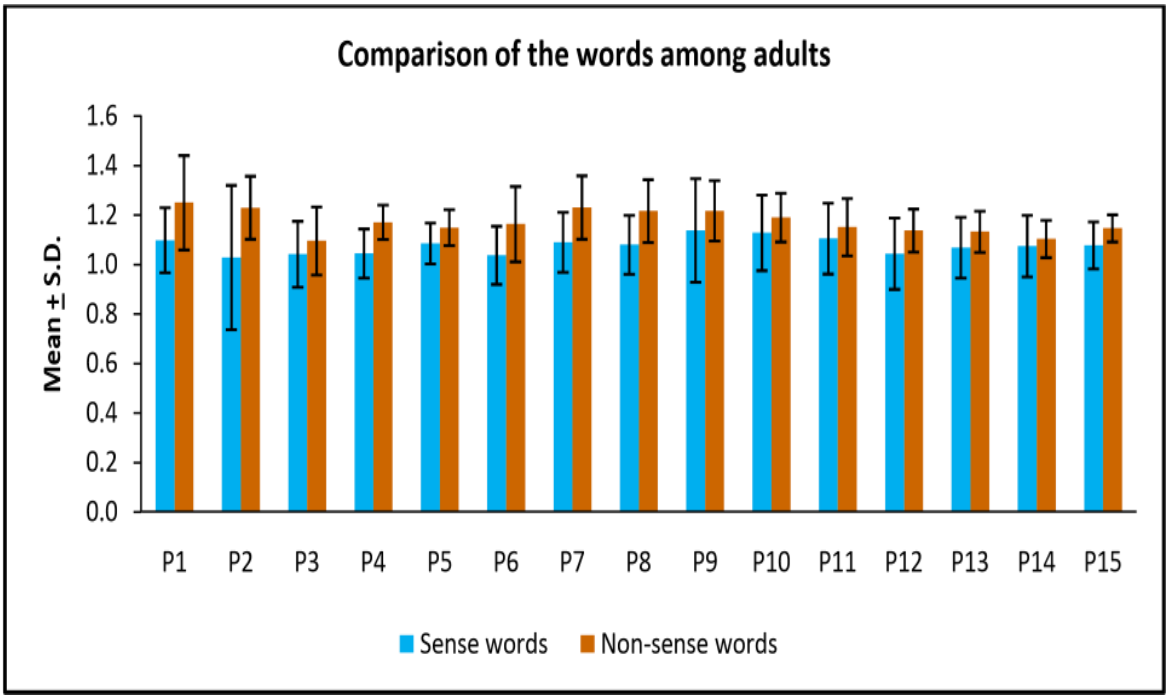
Illustrates the average and range of words per minute for sense and non-sense words in adults.

	Among adults				"t"	p value
	Sense words		Non-sense words			
	Mean	S.D.	Mean	S.D.		
P1	1.099	0.131	1.250	0.191	-2.539	0.017*
P2	1.029	0.291	1.230	0.127	-2.448	0.021*
P3	1.042	0.133	1.096	0.138	-1.087	0.286
P4	1.045	0.099	1.171	0.070	-4.021	< 0.001*
P5	1.086	0.083	1.150	0.073	-2.253	0.032*
P6	1.038	0.117	1.164	0.152	-2.537	0.017*
P7	1.090	0.122	1.231	0.128	-3.081	0.005*
P8	1.080	0.119	1.216	0.127	-3.026	0.005*
P9	1.138	0.209	1.217	0.122	-1.264	0.217
P10	1.129	0.153	1.190	0.098	-1.314	0.199
P11	1.105	0.143	1.152	0.116	-0.977	0.337
P12	1.044	0.144	1.138	0.087	-2.162	0.039*
P13	1.069	0.123	1.133	0.083	-1.681	0.104
P14	1.075	0.124	1.104	0.075	-0.769	0.448
P15	1.078	0.095	1.147	0.055	-2.418	0.022*

(* Significant)

Fig 1:

Illustrates the mean value of words per minute for sense and non-sense words in adults.



b) To examine the durational characteristics visual word recognition in geriatric population

Table 2:

Illustrates the average and range of words per minute for sense and non-sense words in geriatric population

	Among geriatrics				"t"	p value
	Sense words		Non-sense words			
	Mean	S.D.	Mean	S.D.		
P1	1.204	0.337	1.267	0.277	-0.560	0.580
P2	1.237	0.241	1.191	0.221	0.549	0.587
P3	1.143	0.196	1.210	0.255	-0.808	0.426
P4	0.964	0.239	1.183	0.185	-2.806	0.009*
P5	1.139	0.249	1.179	0.180	-0.510	0.614
P6	1.215	0.311	1.271	0.192	-0.595	0.557
P7	1.200	0.289	1.236	0.161	-0.429	0.671
P8	1.264	0.309	1.220	0.194	0.462	0.648
P9	1.166	0.237	1.241	0.133	-1.071	0.293
P10	1.270	0.254	1.261	0.193	0.105	0.917
P11	1.189	0.265	1.232	0.126	-0.556	0.583
P12	1.210	0.304	1.172	0.137	0.441	0.663
P13	1.497	0.345	1.294	0.322	1.663	0.107
P14	1.468	0.283	1.332	0.299	1.282	0.210

P15	1.726	0.233	1.801	0.109	-1.126	0.270

(*Significant)

Figure 2:

Illustrates the mean value of words per minute for sense and non-sense words in geriatric population.

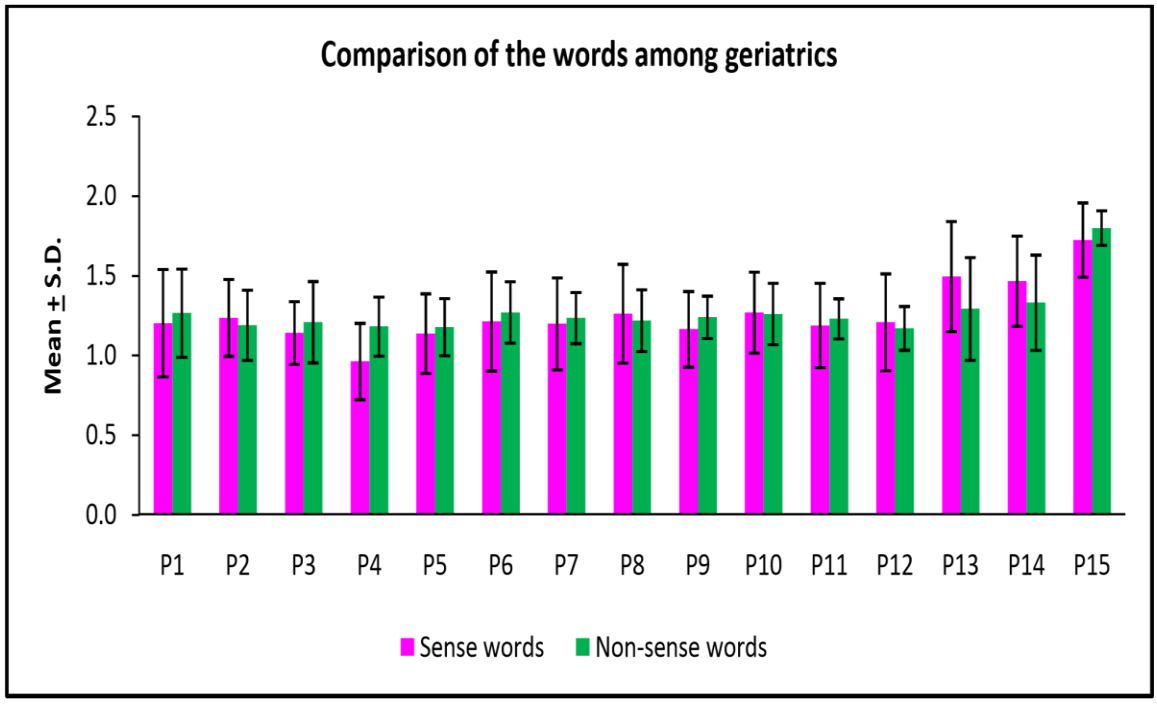


Table 2 and Figure 2 show that non-sense words were observed to have longer duration in geriatrics than sense words. A statistical comparison of the sense and non-sense words of geriatrics reveals a considerable difference.

c) Shows the comparison of the durational aspects of visual word recognition in adults and geriatric population

Table 3:

Illustrates the average and range of words per minute for sense words in adults and geriatric population

	Sense words				"t"	p value
	Adults		Geriatrics			
	Mean	S.D.	Mean	S.D.		
P1	1.099	0.131	1.204	0.337	-1.130	0.268
P2	1.029	0.291	1.237	0.241	-2.134	0.042*
P3	1.042	0.133	1.143	0.196	-1.646	0.111
P4	1.045	0.099	0.964	0.239	1.214	0.235
P5	1.086	0.083	1.139	0.249	-0.783	0.440
P6	1.038	0.117	1.215	0.311	-2.065	0.048*

P7	1.090	0.122	1.200	0.289	-1.352	0.187
P8	1.080	0.119	1.264	0.309	-2.145	0.041*
P9	1.138	0.209	1.166	0.237	-0.336	0.739
P10	1.129	0.153	1.270	0.254	-1.849	0.075
P11	1.105	0.143	1.189	0.265	-1.084	0.288
P12	1.044	0.144	1.210	0.304	-1.907	0.067
P13	1.069	0.123	1.497	0.345	-4.526	< 0.001*
P14	1.075	0.124	1.468	0.283	-4.934	< 0.001*
P15	1.078	0.095	1.726	0.233	-9.977	< 0.001*

(* Significant)

Figure 3:

Illustrates the mean value of words per minute for sense words in adults and geriatric population

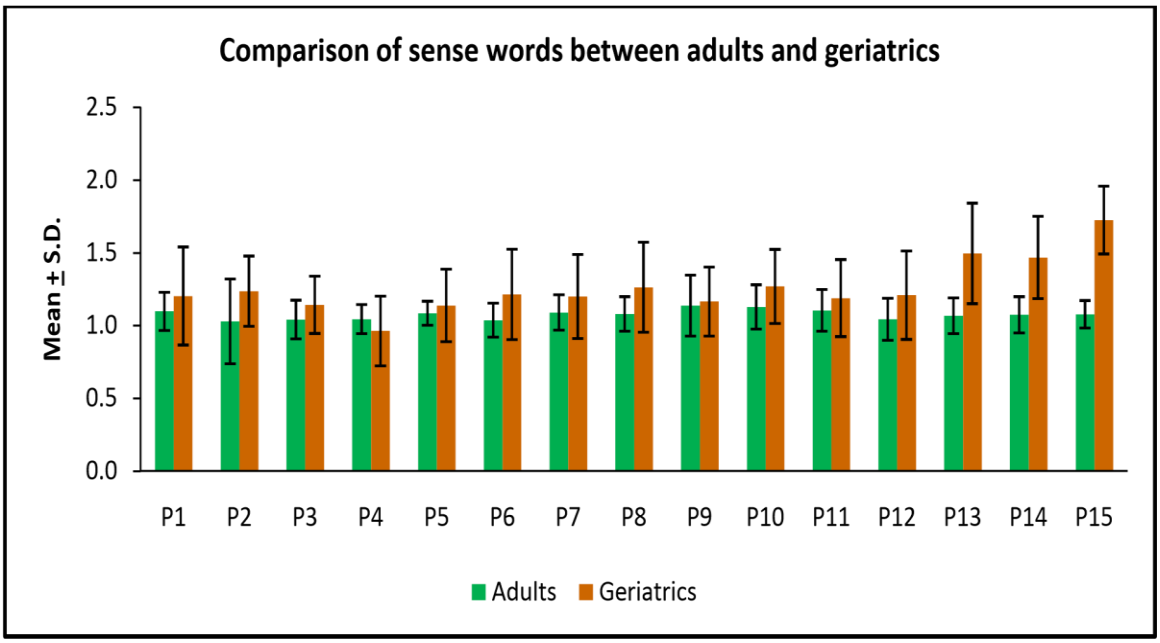


Table 3 and Figure 3 show that sense words were observed to have longer duration in geriatrics than adults. A statistical comparison of the sense words in adults and geriatrics reveals a considerable difference.

Table 4:

Illustrates the average and range of words per minute for non-sense words in adults and geriatric population

	Non - sense words				"t"	p value
	Adults		Geriatrics			
	Mean	S.D.	Mean	S.D.		
P1	1.250	0.191	1.267	0.277	-0.192	0.849

P2	1.230	0.127	1.191	0.221	0.591	0.559
P3	1.096	0.138	1.210	0.255	-1.528	0.138
P4	1.171	0.070	1.183	0.185	-0.237	0.814
P5	1.150	0.073	1.179	0.180	-0.592	0.559
P6	1.164	0.152	1.271	0.192	-1.697	0.101
P7	1.231	0.128	1.236	0.161	-0.106	0.917
P8	1.216	0.127	1.220	0.194	-0.068	0.946
P9	1.217	0.122	1.241	0.133	-0.507	0.616
P10	1.190	0.098	1.261	0.193	-1.274	0.213
P11	1.152	0.116	1.232	0.126	-1.810	0.081
P12	1.138	0.087	1.172	0.137	-0.805	0.427
P13	1.133	0.083	1.294	0.322	-1.872	0.072
P14	1.104	0.075	1.332	0.299	-2.865	0.008*
P15	1.147	0.055	1.801	0.109	-20.818	< 0.001*

(* Significant)

Figure 4:

Illustrates the mean value of words per minute for non-sense words in adults and geriatric population

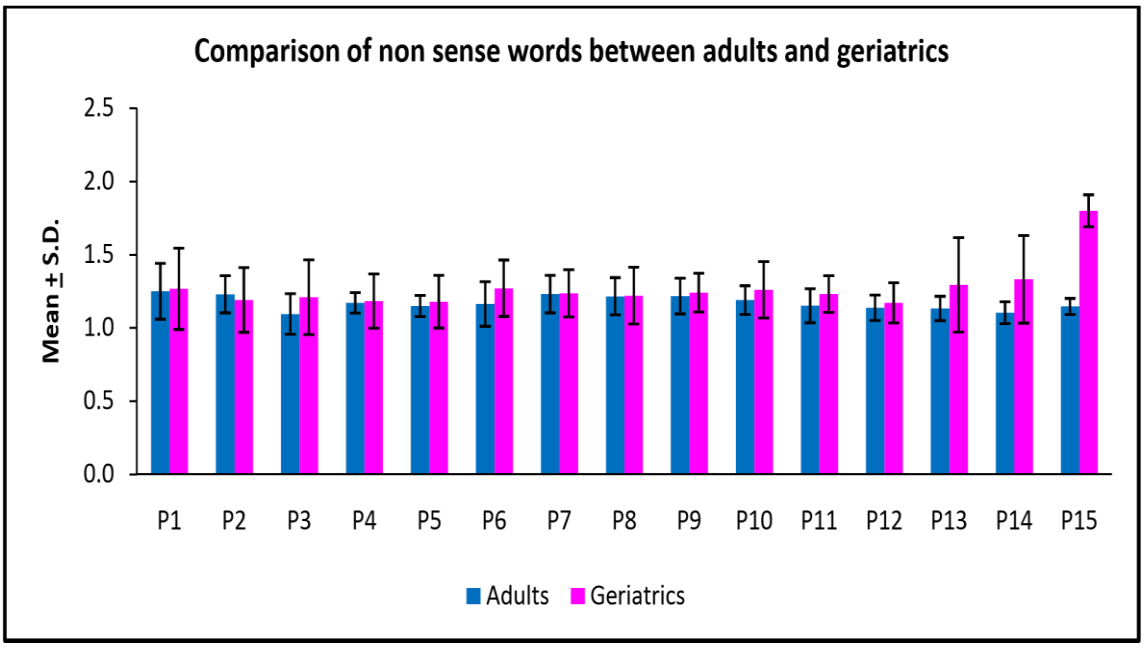


Table 4 and Figure 4 show that non-sense words were observed to have longer duration in geriatric than adults. A statistical comparison of the non-sense words in adults and geriatrics reveals a considerable difference.

Discussion

Geriatric population have longer word duration than adults, according to analysis of the durational features of sense and non-sense words in adults and geriatric populations.

Both sense and non-sense words have a greater duration before rehearsal, according to Varghese & Kumaraswamy's (2019) comparison of the duration of sense and non-sense words before and after rehearsal.

Icht, Swead, & Mama's (2022) study on the topic of how producing sentences helps younger and older adults' visual and auditory text memory came to the conclusion that more test items were correctly filled out when the information appeared in the produced sentences rather than in non-produced sentences, illustrating the learners' capacity to use distinctiveness information. In both modalities, older persons had larger production effects than younger adults.

The overall findings were:

The comparison between the word duration in adults and geriatric population have significant results.

It also gives us the difference between the sense and non-sense words in both adults and geriatrics and also the durational aspects in the sense and non-sense words.

Summary and Conclusion

The literature summary above suggests that durational aspects of speech perception are crucial. The current study contrasts the durational properties of sense and non-sense words during visual presentation in adults and geriatric participants.

Adults aged 19 to 30 and the geriatric population, aged 65 to 73, were further separated into 15 adults and 15 geriatrics. Each participant was a resident of Kerala and was proficient in Malayalam reading and writing.

Each person received 15 sense words and 15 non-sense words, with instructions to read the words quickly, accurately, and carefully. Each person received a computer presentation of the final wordlists. Each person's data was collected in a silent, well-lit, noise-free room with a computer display placed one foot away from them. Black text was typed on a white background in the PowerPoint presentation. Each word recognition was carefully recorded using the PRAAT program.

The responses were collected using a computer-connected microphone. From the beginning through the end of each person's word utterance, reaction latencies were measured. Responses and their length were recorded using the PRAAT program.

Limitation of the Study

- The sample size was hardly limited.

Future Suggestions

- The number of participants can be further included
- The further studies can be included with different other age groups.

==========

References

An, H. J., & Sung, J. E. (2022). Age-related Differences in Word Recognition Tasks according to Visual Interference and Noun Imagery. *Communication Sciences & Disorders*, 27(2), 313-329.

Babel, M. (2022). Adaptation to Social-Linguistic Associations in Audio-Visual Speech. *Brain Sciences journal*, 12(7), 845.

Balota (2004) & Robert (2009). Volume 60, Issue 3, July 2010, Pages 163-172. *European Review of Applied Psychology.*

Brain Mapping, D. Poeppel, Speech Perception, ,Academic Press,2015*Neuroscience and Biobehavioral Psychology*, Pages 429-434,

Cattell, J. M. (1886). The time taken up by cerebral operations. Mind, 11 , 377 – 92 . Retrieved from http://psychclassics.yorku.ca

Carreiras, M., Armstrong, B. C., Perea, M., & Frost, R. (2014). The what, when, where, and how of visual word recognition. *Trends in cognitive sciences*, 18(2), 90-98.

Chaurasiya, H. (2021). Speech intelligibility enhancement in elderly with high-frequency hearing loss through visual speech perception. *Indian Journal of Otology*, 27(1), 30.

Clark, C., Guediche, S., & Lallier, M. (2021) . Compensatory cross-modal effects of sentence context on visual word recognition in adults. *Reading and Writing, AnInterdisciplinary Journal*34(8), 2011-2029.

Gutierrez-Sigut, E., Vergara-Martinez, M., &Perea, M. (2022). The impact of visual cues during visual word recognition in deaf readers: An ERP study. *International Journal of Cognition*, 218, 104938.

Howes & Solomon, (1951), Monsell (1991) &Whaley (1978). Volume 60, Issue 3, July 2010, Pages 163-172. *European Review of Applied Psychology.*

Icht, M., Taitelbaum-Swead, R., & Mama, Y. (2022). Production improves visual and auditory text memory in younger and older adults. Gerontology, *International Journal of Experimental, Clinical, Behavioral and Technological Gerontology* 68(5), 578-586.

Kitzan, L. J., Ferraro, F. R., Petros, T. V. & Ludorf, M.(1999). The role of vocabulary ability during visual word recognition in younger and older adults. *The Journal of general psychology,* 126(1), 6-16.

M.A. Moreno, G.C. van Orden, in International Encyclopedia of the Social & Behavioral Sciences, 2001

Mishra, A., Shekhar, S., Singh, A. K., & Chakraborty, A. (2019, September). Ocr-vqa: Visual question answering by reading text in images. In 2019 *International conference on document analysis and recognition (ICDAR)* (pp. 947-952). IEEE.

Rossion, B., & Lochy, A. (2021). Is human face recognition lateralized to the right hemisphere due to neural competition with left-lateralized visual word recognition? A critical review. *Brain Structure and Function*, 1-31.

Smiljanic, R., Keerstock, S., Meemann, K., & Ransom, S. M. (2021). Face masks and speaking style affect audio-visual word recognition and memory of native and non-native speech. *The Journal of the Acoustical Society of America*, 149(6), 4013-4023.

Singh, A., Wang, M., & Faroqi-Shah, Y. (2022) . The influence of romanizing a non-alphabetic L1 on L2 reading: the case of Hindi-English visual word recognition. *Reading and Writing, An Interdisciplinary journal*35(6), 1475-1496.

Sharafudeen, M., David, S., & Simon, P. (2022). Visual Words based Static Indian Sign Language Alphabet Recognition using KAZE Descriptors. *In Evolution in Signal Processing and Telecommunication Networks* (pp. 93-101). Springer, Singapore.

Shechter, A., Hershman, R., & Share, D. L. (2022). A pupillometric study of developmental and individual differences in cognitive effort in visual word recognition. *Scientific reports*, 12(1), 1-7.

Varghese & Kumaraswamy (2019). ISSN 1930-2940 Vol. 19:5 May 2019. *Language in India.*

Vidal, Y., Viviani, E., Zoccolan, D., & Crepaldi, D. (2021). A general-purpose mechanism of visual feature association in visual word identification and beyond. *Journal of Current Biology,* 31(6), 1261-1267.

Yap, M. J., & Balota, D. A. (2015). Visual word recognition. *American psychological association*, (26-1).

==========

	Mr. Nisthul M Bensi, Postgraduate Student Dr. MV Shetty college of Speech and Hearing Mangaluru, Karnataka 575013 nisthulbensi1998@gmail.com
	Dr. Satish Kumaraswamy Professor and Principal Dr. MV Shetty college of Speech and Hearing Mangaluru, Karnataka 575013 sat8378@yahoo.com

	Mr. Mishal K Associate Professor Dr. MV Shetty college of Speech and Hearing mishalknr@gmail.com