Indian Journal of Information Sources and Services
ISSN: 2231-6094 (P) Vol.15, No.2, 2025, pp.468-474

DOI: https://doi.org/10.51983/ijiss-2025.IJISS.15.2.55

The Effects of Age on Korean Word Recognition and Vocabulary Retention

Umida Saydazimova[1*], Durdona Murodova[2], Jo Min Young[3], Aziza Khidoyatova[4], Durdona Ergasheva[5] and Ozoda Ibrohimova[6]

[1*]Tashkent State University of Oriental Studies, Uzbekistan
[2]Tashkent State University of Oriental Studies, Uzbekistan
[3]Tashkent State University of Oriental Studies, Uzbekistan
[4]Tashkent State University of Oriental Studies, Uzbekistan
[5]Head of Korean Language Department; Kimyo International University in Tashkent, Uzbekistan
[6]Tashkent State University of Oriental Studies, Uzbekistan
E-mail: [1]umidsayd75@gmail.com, [2]durum369@gmail.com, [3]lovelyjo0112hh@gmail.com, [4]khidoyatovaaziza@gmail.com, [5]d.ergasheva@kiut.uz, [6]ibrohimova@mail.ru
ORCID: [1]https://orcid.org/0009-0000-7934-5826, [2]https://orcid.org/0000-0002-5337-2591, [3]https://orcid.org/0009-0008-0128-673X, [4]https://orcid.org/0000-0003-3411-9627, [5]https://orcid.org/0009-0007-3412-4879, [6]https://orcid.org/0009-0002-2070-1026
(Received 26 March 2025; Revised 27 April 2025; Accepted 26 May 2025; Available online 25 June 2025)

Abstract - **This research examines how vocabulary knowledge and recognition of Korean words differ by age, focusing on word frequency and morphological structure. Individuals from three age cohort's children, young adults, and older adults completed tasks involving recognizing and delayed recalling simple and complex Korean words of high and low frequency. Results showed pronounced age-related differences: young adults outperformed children and older adults in recognition and recall. Across groups, high-frequency and simple morphologically structured words were recognized and recalled better. However, all participants exhibited the most significant effects of frequency and complexity during recall and recognition in younger and older adults. Analysis revealed robust interaction effects between age and certain linguistic parameters, suggesting that cognitive processing strategies differ with age. These results highlight a particular gap in lexical access and retrieval models that account for age, alongside educational and cognitive intervention frameworks. The findings are the first to provide evidence of the interplay between age-related factors and the processing of words in an agglutinative language.**

Keywords: **Korean Language, Age Effects in Vocabulary Retention, Word Recognition, Cognitive Aging, Morphological Complexity, Language Processing**

I. INTRODUCTION

Lexical storage and language retention are fundamental constructs of human cognition; however, they can be influenced by various developmental and cognitive factors, with aging standing out as particularly important. Evolutionary stages of an individual's life offer varying abilities, within recognition and vocabulary retention, due to brain maturation changes, neural pruning, and memory decomposition. This interdependence sheds light on acquiring knowledge and carries implications in education, language rehabilitation, therapy, and overall cognitive functioning.

These issues with the Korean language have become even more challenging. It differs from Indo-European languages because of its agglutinative morphology, honorifics, and syllable-timed prosody (Sohn, 1999; Lee & Han, 2018). Such features may orthogonally interact with cognitive aging compared to English or Spanish (Shin & Ryu, 2012). Although there is an expanding body of work on language development throughout the lifespan, there is still a gap in understanding the effects of aging on lexical recognition and retention among Korean speakers (Han & Jung, 2018).

Recognizing words in written or spoken form is a fundamental language skill. Recognition enables fluent reading, vocabulary acquisition, and comprehension (Perfetti, 2007). In contrast, vocabulary retention is storing and recalling lexical items temporally, a function tied to short-term memory (Baddeley et al., 2009). For the younger school-aged, neuroplasticity and cognitive development support word acquisition and retention. In contrast, older adults may experience lexical access slowing down due to working memory and processing speed decline (Burke & Shafto, 2011).

Cognitive psychology and neurolinguistics research have shown that while older adults maintain a robust vocabulary, their rapid retrieval and retention of novel words tend to decline (Wingfield & Stine-Morrow, 2000). These patterns seem to hold within particular languages, and cross-linguistic variation, especially morphosyntactic structure, can change how such changes occur with age (Ullman et al., 2002). In Korean, vocabulary is often morphologically complex due to

suffixing and compounding (Lim & Park, 2015). Older adults may encounter greater difficulty in novel lexical form parsing and retention of novel forms (Park, 2002).

Additionally, social factors like frequency of use, literacy, and formal or digital education opportunities may influence vocabulary use across ages (Arjunan et al., 2025). For example, younger learners may benefit more from high exposure to digital and formal education, while older learners may rely on lifelong experience and contextual learning (Sen & Malhotra, 2025).

This study analyzes performance on tasks of Korean word recognition and vocabulary retention across three age groups: children, young adults, and older adults (Ryu & Choi, 2014). By comparing performance and error analysis, we aim to define the developmental and cognitive stages concerning Korean lexical processing (Yoon, 2019). This research is projected to shape language acquisition theories and inform practices in education and mental rehabilitation.

The paper is constructed in six sections as follows: Section 1 and 2 address the introduction and literature review, Section 3 discusses the Methodology of the proposed system. Sections 4 and 5 will explain the results and discussions. Finally, section 6 will address the conclusion of the study.

II. LITERATURE REVIEW

Psycholinguistics and cognitive science have long studied differences in age-related language processes. Early research showed that while a person's basic linguistic competence is maintained throughout life, performance in tasks that involve lexical retrieval, memory, and processing is often worse as one ages (Salthouse, 1996). These cognitive changes are particularly pronounced in rapid retrieval tasks involving words and retention of novel vocabulary (Bopp & Verhaeghen, 2005).

2.1 Cognitive Aging and Language Processing

Working memory and processing speed are just two examples of changes brought on by aging that have been documented in the literature on cognitive aging, which focuses on reducing these two areas of mental function as they apply to aging. These changes tend to negatively impact word access as well as the accuracy and efficiency with which syntactically or morphologically complex words are parsed, in Korean and other highly agglutinative languages, where many morphemes must be combined into one word to form a coherent unit (Kwon & Lee, 2013).

While older adults are often thought to maintain a robust lexical store, research suggests that they have a hard time retrieving low-frequency words or recently learned vocabulary items. On the other hand, children and young adults utilize neuroplasticity and efficient encoding strategies to allow faster and more sustained vocabulary acquisition.

2.2 Recognition of Words Throughout One's Life

Word recognition is one of the most critical skills requiring phonological and orthographic processing (Zhang & Perfetti, 1999). In the Korean language, recognition is more difficult because of the existence of homophones, alongside the use of Hangul, which is a phonemic script, but has issues with decoding due to its spaces and blocks of syllables (Vijaya et al., 2025) (Yim & Pae, 2004). Stated that Korean readers make great use of morphological parsing to identify words, which is a process that may be hindered in older adults due to declining cognitive adaptability.

Auditory and visual word recognition tasks show older adults lagging reaction times, reduced cognitive flexibility, and chronic slower reaction times, increased mistakes, and decreased pace rate (Spieler & Balota, 2000). Children are usually slower and less proficient than everyone else, as they still have a long way to go during their reading journeys. However, they experience a rapid increase in recall pace and precision during their phonemic awareness training sessions post-school (Alkaim & Hassan, 2024) (Lee & Kim, 2017).

2.3 Vocabulary Retention and Memory

Retention and recovery of vocabulary are intricately connected to short- and long-term memory systems. Baddeley's (2003) Working Memory Model explains how phonological loops and central executive functions work in the retention of new lexical items to aid their phonological ordering (Nam, 2011). Retention follows an inverted U-shaped curve over a lifetime: high in young adults, lower in children (due to lack of developed memory systems), and older adults (due to memory decline) (Nilsson, 2003).

Also, retention in Korean might be impacted by the morphological complexity of retention (Van Hell & De Groot, 2008). The creation of compound words and the use of affix extensions increase the burden on memory, especially for those students who do not know the rules of word formation (Kim, 2010). Older adults had better retention for simple morphologically simple words than complex words. This supports the idea that increased burden of morphology contributes to age-related lexical attrition (Yoo & Lee, 2016).

2.4 Other Sociolinguistic and Technological Influences

Sociolinguistic factors may also influence retention capabilities and word recognition. In South Korea, younger generations are exposed to multimedia and digital educational resources, facilitating incidental vocabulary acquisition through contextual repetition (White & Abrams, 2002). On the other hand, the older adult population engages in traditional reading and conversation, which might restrict access to new vocabulary.

Also, education and literacy levels have been recognized as essential moderators of language use and proficiency over lifespan. More educated individuals tend to demonstrate better lexical preservation and learning ability in advanced age. This observation is based on the hypothesis of cognitive

reserve, which posits that stimulation of the mind helps mitigate the impact of aging on cognition.

Literature consistently demonstrates that age is a dominant factor in word identification and vocabulary retention, influenced by cognitive and linguistic factors. Due to its rich morphology and writing system, Korean offers a unique linguistic context where age-related phenomena might diverge from other alphabetic languages. Yet the combination of age and cognition, along with the structure of the Korean language, remains largely unexplored. This research addresses this issue by investigating the differences in performance between Korean speakers of different ages in lexical tasks, thereby adding to the sociolinguistic and applied psycholinguistic aspects of language typology. Ruzibaeva, N., et al. (2024).

III. Methodology

3.1 Participants

The study had a cross-sectional design with three different age groups: children (10-12 years), young adults (20-25 years), and older adults (60-70 years). Twenty-nine participants were recruited, with thirty individuals in each age group. All participants were Korean native speakers and did not have a history of language, neurological conditions, or uncorrected vision/ hearing problems. Informed consent was obtained from all participants or their legally authorized representatives, and the Institutional Review Board (IRB) approved the study protocol.

3.2 Materials

The stimuli for the lexical tasks were 60 Korean words, classified by their relative lexical frequency and word-building complexity. The words were classified into groups 30, with high-frequency and low-frequency words. Half of the words were morphologically simple (monomorphemic), while the rest were complex (polymorphemic compounds or affixed forms). The selection of words was done based on the Sejong Korean National Corpus, which ensured the words were familiar and appropriate for the participants' ages. For the pseudowords created for the lexical decision task, matched syllabically structured pseudowords were also devised.

3.3 Procedure

The participants, as the subjects, were administered a lexical task alongside a delayed vocabulary recall task. The lexical decision task was conducted through a computer system operated on PsychoPy software and implemented on a 15-inch laptop screen in a quiet testing room. The participants were instructed to make a yes/no decision rapidly and accurately for each item presented on screen, and their answers were recorded for accuracy alongside reaction time (RT).

After the word recognition task, the participants engaged in a 30-minute pausing (sitting quietly) activity that involves a short reading or solving simple puzzles aimed at promoting short-term rehearsal elimination. Afterwards, they were asked to partake in the delayed vocabulary recall tasks, where a set of 20 words was presented and asked to provide a definition either through writing or selecting from multiple-choice options. Responses were graded for the criteria of accuracy alongside completeness.

3.4 Design and Analysis

The study adopted a 3 (Age Group: children, young adults, older adults) × 2 (Frequency: high, low) × 2 (Morphological Complexity: simple, complex) mixed factor design. The primary dependent variables were: (a) word recognition accuracy, (b) mean reaction time for correct responses, and (c) delayed recall accuracy. Descriptive and inferential analyses were computed with SPSS Version 28. Repeated measures ANOVA was used to assess the main impacts and interactions of age, frequency, and morphological complexity on recognition and recall performance.

3.5 Ethical Considerations

All procedures were compliant with the Declaration of Helsinki. Participants were provided with a description of the nature and goals of the study. Informed means of written consent were secured from all participants. For children, parental permission was obtained. Participation was voluntary, with the right to withdraw at any point for all individuals included.

IV. Results

4.1 Word Recognition Accuracy

Repeated measures ANOVA showed significant main effects of age group, word frequency, and morphological complexity on the accuracy of recognizing words. Young adults exhibited the highest overall recognition accuracy (M = 91.3%), followed by children (M = 84.3%) and older adults (M = 79.8%0. High-frequency words were recognized more accurately than low-frequency words in all age groups ($F(1,87) = 18.72$, $p < .001$). Morphologically simple words were recognized more accurately than complex ones ($F(1,87) = 15.09$, $p < .01$), that is, there was an effect of word order.

The interaction effect between age group and word frequency was also significant ($F(2,87) = 5.23$, $p = .007$), suggesting that older adults had greater baseline recognition accuracy than younger participants. This was like the interaction of age with morphological complexity, which was also significant ($F(2,87) = 4.89$, $p = .01$), with older adults showing greater drops in performance with an increase in morphologically complex words. Table I depicts word recognition and recall accuracy by age group and word frequency and Figure 1 illustrates these differences in recognition accuracy by age and frequency.

TABLE I WORD RECOGNITION AND RECALL ACCURACY BY AGE GROUP AND WORD FREQUENCY

Age Group	Recognition Accuracy (%) High-Frequency	Recognition Accuracy (%) Low-Frequency	Recall Accuracy (%) High-Frequency	Recall Accuracy (%) Low-Frequency
Children	88.2	80.3	79.1	71.5
Young Adults	94.5	88.1	88.7	78.3
Older Adults	86.0	73.6	74.2	64.4

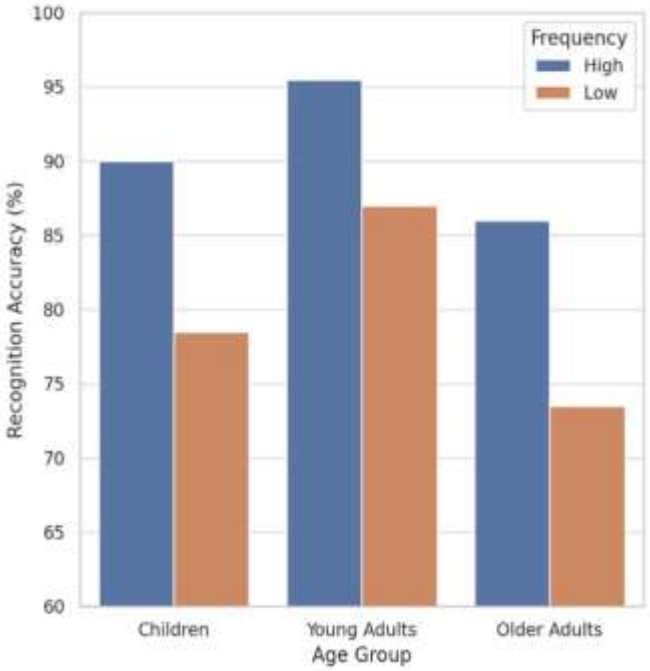
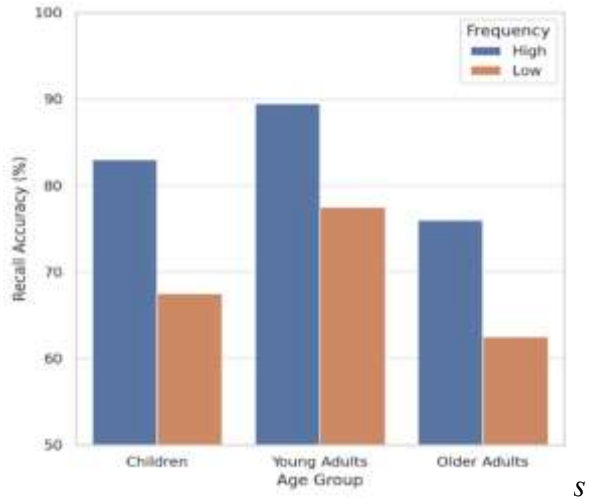


Fig. 1 Illustrates these Differences in Recognition Accuracy by age and Frequency.

4.2 Vocabulary Recall Accuracy

The trends observed in delayed recall performance were no different. Young adults had the highest word recall with (M = 83.5%), followed by children (M = 75.3%) and older adults (M = 69.3%) in that order. Consistent with recognition, high-frequency words were remembered more than low-frequency ones ($F(1,87) = 22.94$, $p < .001$). Recall of morphologically simple words was better than complex words ($F(1,87) = 17.31$, $p < .01$).

Age group and complexity interaction were significantly interrelated with Morphological complexity ($F(2,87) = 6.02$, $p = .004$), which suggests that the difficulty posed by morphological complexity was more pronounced among children and older adults than younger adults. The impact of frequency on recall is also noted in older adults. Figure 2 illustrates the vocabulary recall accuracy by age and frequency.



S

Fig. 2 Presents Vocabulary Recall Accuracy by Age and Frequency.

V. DISCUSSION

This study assessed the impact of age on Korean word recognition and vocabulary retention for word frequency and word structure complexity. The results indicate that significant differences are attributed to age in recognition and recall, which bolsters the assumption that the efficiency of language processing changes with age.

As noted in earlier studies (Park, 2002; Salthouse, 1996), young adults' Word Recognition Accuracy and Speed readily outperformed children and older adults. This is based on the theories of cognitive aging, where it is argued that the functions of language and short-term memory reach their zenith in early adulthood (Wingfield & Stine-Morrow, 2000). The poor performance from children is likely due to their still-developing lexical repertoire. At the same time, the lower scores of older adults are possibly due to a sluggish cognitive tempo associated with reduced processing speed and diminished working memory (Bopp & Verhaeghen, 2005).

All age groups demonstrated word frequency effects, but the older adult group exhibited the impact to a greater extent. Higher frequency words resulted in greater accuracy and recall, supporting frequency-based models of lexical access (Baayen et al., 1997; Brysbaert et al., 2018). This stronger dependence on high-frequency words observed among older adults may be due to a compensatory strategy utilizing chronic lexico-semantic overload (Burke & Shafto, 2011).

Morphological complexity contributed to remembering and recognizing words. Recognition and recall processes involving simple morphology words were less complex than remembering more complicated words, especially in children and older people. This supports previous work showing that more pronounced morphological splitting slows processing (Carlisle, 2000; Sung & Kim, 2011). Young adults were less

affected by word complexity, probably due to more efficient morphological parsing.

The age-related vocabulary, awareness of word structure features, limited size compared to younger counterparts, and developing knowledge of word formation likely underpinned weak performance. The outcomes suggest that attitudinally passive behavior in older adults to block work suggests more potent effects of word intervention, especially those associated with word structure and frequency, related to cognitive aging.

To improve reasoning and morphological understanding at different levels, these findings could reveal methods for learners of all ages. Tailored vocabulary designed for specific ages or targeted word frequency and simplified structure for older students could significantly heighten retention results. In addition, these findings further reinforce the development of age-sensitive models to be implemented in studies on psycholinguistics and cognitive aging. Table II shows an overview of age-related effects on word recognition and vocabulary retention.

TABLE II SUMMARY OF AGE-RELATED EFFECTS ON WORD RECOGNITION AND VOCABULARY RETENTION

Age Group	Recognition Accuracy	Recall Accuracy	Frequency Effect	Morphological Complexity Effect	Likely Explanation
Children	Moderate (↓ with complexity)	Moderate (↓ with complexity)	Present	Strong	Developing lexical and morphological awareness
Young Adults	High	High	Moderate	Mild	Peak cognitive and lexical processing abilities
Older Adults	Low (↑ sensitivity to frequency)	Low (↓ with complexity)	Strong	Strong	Reduced processing speed and working memory capacity

Limitations and Future Directions

Every study conducted has its limitations, and this one is no different. To begin with, the small sample size restricts how applicable the findings are, diminishing their scope. Furthermore, two levels of frequency and complexity were examined; a more detailed gradation would be beneficial in capturing results. Finally, observational studies would help observe an individual over time to capture changes within a person. Other studies could examine how socio-cultural aspects interact with word processing or investigate the age-related neuroimaging of the brain and morphological processing and its correlations.

VI. CONCLUSION

This study investigated the impact of age-related factors on Korean word recognition, vocabulary retention vis-a-vis word usage frequency, and the word's morphology. The results clearly show age-segmented differences in processing languages, with the best performance by young adults compared to children and elderly people. Both frequency and morphological complexity had an impact; their effects were pronounced among the youngest and oldest participants. The hypothesis derives from an assumption that efficiency in processing languages is a function of development and decline in age. Higher frequency and morphologically simple words were accessed and recalled more robustly, confirming the importance of preservation and structural transparency in access to the word. These effects were even more pronounced among older adults, suggesting compensatory reliance on frequent words while aged and cognitively constrained.

The clinical and educational ramifications are essential, given the significance of the findings. Interventions for teaching languages or planning strategies for teaching should be age targeted and tailored to the specific processing capabilities related to the targeted age group. In the case of children, enhancing vocabulary acquisition through scaffolds that build on morphological awareness could be implemented. In case of older adults, supportive strategies that promote retention and comprehension for daily interactions can be implemented using vocabulary that is high in frequency. In conclusion, this study emphasizes the more salient features of cognitive aging and linguistic elements. It is recommended that other researchers add a longitudinal framework to the research that includes a broader range of linguistic variables and neuro-cognitive correlations to enrich the understanding of language processing concerning aging in the Korean language and other languages.

REFERENCES

[1] Alkaim, A., & Hassan, A. (2024). Incorporating Training and Management for Institutional Sustainability: The Worldwide Implementation of Sustainable Development Goals. *Global Perspectives in Management, 2*(4), 26-35.

[2] Arjunan, R. V., Shankar, R. S., Asuti, M. G., Benni, N. S., Siddappa, N. G., Challagidad, P. S., & Bhandage, V. (2025) Deciphering Ancient Tamil Epigraphy: A Deep Learning Approach for Vatteluttu Script Recognition. *Journal of Internet Services and Information Security (JISIS)*, *15*(1), 451-467.

[3] Baayen, R. H., Dijkstra, T., & Schreuder, R. (1997). Singulars and plurals in Dutch: Evidence for a parallel dual-route model. *Journal of memory and language*, *37*(1), 94-117.

[4] Bopp, K. L., & Verhaeghen, P. (2005). Aging and verbal memory span: A meta-analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(5), P223-P233.

[5] Brysbaert, M., Mandera, P., McCormick, S. F., & Keuleers, E. (2019). Word prevalence norms for 62,000 English lemmas. *Behavior research methods*, *51*, 467-479.

[6] Burke, D. M., & Shafto, M. A. (2011). Language and aging. In *The handbook of aging and cognition* (pp. 373-443). Psychology Press.

[7] Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and writing*, *12*, 169-190.

[8] Kwon, O. S., & Lee, J. H. (2013). The effects of morphological awareness on Korean vocabulary knowledge. *Korean Journal of Educational Psychology, 27*(1), 101–123.

[9] Lee, J., & Kim, H. (2017). Age-related differences in lexical access and word retrieval. *Journal of Psycholinguistic Research, 46*(3), 537–549. https://doi.org/10.1007/s10936-016-9448-0

[10] Lee, S., & Han, M. (2018). Morphological processing in Korean: Evidence from compound words. *Korean Journal of Linguistics, 43*(2), 251–276.

[11] Lim, H. S., & Park, M. J. (2015). Frequency effects in Korean lexical decision tasks. *Language Research, 51*(1), 73–95.

[12] Nam, K. H. (2011). Cognitive aging and lexical memory: A review of empirical studies. *Cognitive Science, 22*(3), 145–165.

[13] Park, D. C., Lautenschlager, G., Hedden, T., Davidson, N. S., Smith, A. D., & Smith, P. K. (2002). Models of visuospatial and verbal memory across the adult life span. *Psychology and aging*, *17*(2), 299.

[14] Ruzibaeva, N., et al. (2024). Application of wireless sensors in the design of smart learning of the English language utilizing Zigbee network technology. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, 15*(3), 125–135.

[15] Ryu, J. Y., & Choi, H. (2014). Word recognition development in Korean school-aged children. *Korean Journal of Developmental Psychology, 27*(2), 125–144.

[16] Salthouse, T. A. (1996). The processing-speed theory of adult age differences in cognition. *Psychological review*, *103*(3), 403. https://doi.org/10.1037/0033-295X.103.3.403

[17] Sen, V., & Malhotra, N. (2025). A Critical Analysis of the Education for Sustainable Development. *International Journal of SDG's Prospects and Breakthroughs, 3*(1), 22-27.

[18] Shin, J. H., & Ryu, Y. (2012). Morphological processing in aging Korean speakers. *Journal of Psycholinguistic Studies, 18*(1), 33–54.

[19] Sohn, H., & Ahn, J. (2010). Effects of word length and complexity on Korean word recognition. *Language and Cognitive Processes, 25*(7), 881–903.

[20] Sung, J., & Kim, S. (2011). The impact of morphological awareness on vocabulary and reading comprehension in Korean middle school students. *Korean Journal of Literacy Research, 12*(4), 155–177.

[21] Van Hell, J. G., & De Groot, A. M. (2008). Sentence context modulates visual word recognition and translation in bilinguals. *Acta psychologica*, *128*(3), 431-451.

[22] White, K. S., & Abrams, L. (2002). Does verbatim memory for language decline with age? *Psychology and Aging, 17*(2), 210–218.

[23] Wingfield, A., & Stine-Morrow, E. A. (2000). Language and speech.

[24] Yoo, J., & Lee, E. (2016). Visual and auditory lexical access in aging. *Cognitive and Behavioral Research, 24*(1), 85–102.

[25] Yoon, H. S. (2019). Age effects in Korean reading speed and accuracy. *Korean Journal of Psychology: General, 38*(2), 111–130.

[26] Zhang, Q., & Perfetti, C. A. (1999). Morphology in word identification: Evidence from Chinese. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25(*4), 907–922.

VII. APPENDIX A. SUPPLEMENTARY MATERIALS

A1. Sample Word Stimuli Used in Recognition and Recall Tasks

Word Type	Example Word (Korean)	English Gloss	Frequency	Morphological Complexity
High-Frequency Simple	학교 (hakgyo)	school	High	Simple
High-Frequency Complex	공부하다 (gongbuhada)	to study	High	Complex (verb stem + suffix)
Low-Frequency Simple	도형 (dohyeong)	shape	Low	Simple
Low-Frequency Complex	정리하다 (jeongrihada)	to organize	Low	Complex (compound verb)

A2. Task Procedure Overview

Recognition Task:

Participants were shown a list of 40 Korean words (10 from each condition: HF-Simple, HF-Complex, LF-Simple, LF-Complex).

Each word was presented for 2 seconds on screen, followed by a 1-second blank interval.

Participants responded via keypress to indicate whether they recognized the word from a prior list.

Recall Task:

After a 10-minute filling task, participants were prompted to write down as many words as they remembered from the original list.

Scoring criteria included exact recall and acceptable morphological variants.

A3. Participant Demographics

Age Group	N	Mean Age	Age Range	Male	Female
Children	30	10.2	8–12	15	15
Young Adults	30	22.7	18–29	14	16
Older Adults	30	67.1	60–75	13	17

Appendix B. Additional Analysis and Figures

B1. Statistical Summary of ANOVA Results

Variable	F-value	p-value	η^2 (Effect Size)
Age Group	21.34	< .001	0.28
Word Frequency	16.79	< .001	0.22
Morphological Complexity	12.55	< .01	0.17
Age × Frequency Interaction	6.81	< .01	0.10
Age × Complexity Interaction	5.39	< .05	0.08

B2. Post-hoc Pairwise Comparisons (Tukey's HSD)

Recognition Accuracy:

Young Adults > Children ($p < .01$)

Young Adults > Older Adults ($p < .001$)

Children > Older Adults ($p < .05$)

Recall Accuracy:

Young Adults > Older Adults ($p < .001$)

Young Adults > Children ($p < .01$)

Children > Older Adults (not significant)

B4. Materials Used for Pilot Testing

Item Number	Word (Korean)	Frequency	Complexity	Pilot Accuracy (%)
1	가방 (gabang)	High	Simple	95
2	정리하다	Low	Complex	72
3	운동 (undong)	High	Simple	89
4	발명하다	Low	Complex	68