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정상노인과 젊은 성인의 문맥을 이용한 문장처리와 교대주의력의 관계

Relationship between Alternating Attention and Context Use during Sentence Processing in Older and Younger Adults

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요약

노화로 인한 인지의 변화는 정상 노인들의 통사처리에 부정적 영향을 끼치는데 작업기억용량이 중요한 인지기능을 한다고 알려져 있다. 본 연구는 명사구 연결 전치사구의 이해에 도움이 되는 문맥을 제시할 때와 그렇지 않을 때 정상 노인과 젊은 성인이 어떻게 명사구 연결 전치사구를 처리하는지 단어별 자율조절읽기 방법을 통해 알아보았다. 또한, 이 때 어떤 인지기능이 문맥 이용을 통한 명사구 연결 전치사구의 처리능력과 관련이 있는지도 살펴보았다. 정상 노인은 읽기과제에서 문맥유무에 상관없이 젊은 성인보다 읽기속도가 느렸다. 그러나 두 그룹 모두 문맥이 존재할 때 명사구 연결 전치사구의 처리 속도가 빨랐다. 즉, 노인들의 노화로 인한 인지의 저하는 처리 속도만 느리게 했을 뿐 질적인 면에서 차이는 없었다. 문맥을 이용한 명사구 연결 전치사구 처리 시 관련된 인지기능은 교대주의력으로 나타났으며 본 연구에서는 작업기억용량의 역할은 발견되지 않았다. 이를 통해 노화가 통사처리에 끼치는 영향은 반드시 부정적인 것이 아니라 통사구조에 따라 다를 수 있으며, 통사 구문의 종류에 따라 관련된 인지기능이 다를 수 있음을 시사한다.

■ 중심어 : | 노인언어 | 읽기 | 통사적 애매성 | 문맥 | 인지 |

Abstract

Cognitive decline in aging is known to yield detrimental effects in syntactic processing and working memory capacity is the most crucial cognitive function in understanding older adults' sentence processing skills. This study examined how young and older adults utilize contextual information while resolving NP-attached Ps vis word-by-word self-paced reading paradigm. In addition, the study asked which cognitive functions play roles on the use of a NP-supporting context during processing of NP-attached PP. When NP-attached PP was presented in a supporting context, both age groups performed faster than in the null context condition. Among different cognitive functions, alternating attention skills were correlated with the ability utilizing context during syntactic ambiguity resolution and working memory capacity was not found to be crucial for this study. In conclusion, this study suggests that aging does not always affect older adults' syntactic processing negatively and relevant cognitive function may vary depending on the type of syntactic structure.

■ keyword : | Language in Aging | Reading | Syntactic Ambiguity | Context | Cognition |

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I. Introduction

People process a sentence incrementally as words are heard or read sequentially. When syntactically ambiguous sentences are presented, they immediately determine one of the multiple possible syntactic interpretations based on syntactic or semantic preferences. However, when the following words hold substantial information that conflicts with the initial interpretation, people may temporarily experience confusion. Then, they realize that their initial syntactic or semantic analysis was incorrect. At this time people revise their initial syntactic or semantic analysis and select an alternative interpretation, thus resolving the temporary syntactic ambiguity. This slows processing of the sentence, resulting in increased reading or listening times.

1. Syntactic ambiguity resolution in isolation

Consider following sentences from [1] in [Table 1].

Table 1. Examples of sentences with VP-attached and NP-attached PPs

PP type	Ambiguity	Sentence
VP-attached PP	No	(1) The historian had to study the map with the magnifying glass so as to value it.
NP-attached PP	No	(2) The historian had to study the map with the appalling tear so as to value it.

In sentences (1) and (2), a temporary syntactic ambiguity arises at the preposition "with", making it possible to attach the entire prepositional phrase (PP), "with the magnifying glass" or "with the appalling tear," to either the verb phrase(VP), to study, or to the noun phrase(NP), the map. When two syntactic analyses are possible at an ambiguous region, "with," people are initially biased toward interpreting the prepositional phrase as the instrument of the verb (described henceforth as "VP-attached PP")[2]. However, if people encounter a pragmatic implausibility (i.e., unexpectedness), as in (1), then a reanalysis of the syntactic structure based on semantics/plausibility occurs that requires considering the dispreferred structure. For example, upon hearing with the appalling tear, people realize that instead of modifying the VP, to study, and being interpreted as an instrument, the PP should modify the NP, the map, and be interpreted as a modification. Such temporarily ambiguous sentences are referred to as garden-path sentences, and this phenomenon is called the garden-path effect[3].

2. Syntactic resolution in context

However, when such syntactic ambiguity is presented within a context containing syntactically relevant information that supports the less preferred structure, the context information guides syntactic ambiguity resolution early in structure building; people are able to process a less preferred structure such as NP-attachment, which is relatively difficult to process and requires a longer processing time in null context, without any difficulty when it occurs in a supporting context.

Consider the case when one of two preambles from [1] in [Table 2] precedes our exemplar sentence (2) in [Table 1]. Based on referential theory a simple definite NP, the map, is preferred if there is a unique referent in the preceding context[1]. However, if two or more referents exist in an individual's internal interpretation of the context, a complex NP, the map with the appalling tear, is favored over the other interpretation because each referent needs to be distinguished uniquely from the other. Therefore, in the 2-Referent context, (4) in [Table 2], attachment of the PP to the NP is expected. In essence, this type of

referential context reverses the general syntactic preference for VP-attachment that is observed in the null context. The referential theory proposes that possible syntactic structures (e.g., NP-attachment and VP-attachment) are developed in parallel, but the immediate effects of referential context enable people to select an appropriate syntactic structure quickly and to override syntactic preferences.

Table 2. Examples of preambles supporting either NP- or VP-supporting context

Context type	Number of referent	Preamble
VP supporting context	1 map	(3) A historian was working in the British Museum holding a magnifying glass. He' d sat down to study a map. On his desk there was a map which had an appalling tear and a manuscript which seemed in perfect condition.
NP supporting context	2 maps	(4) A historian was working in the British Museum holding a magnifying glass. He' d sat down to study a map. On his desk there was a map which had an appalling tear and a map which seemed in perfect condition.

This nullification of the garden-path effect in the 2-referent discourse context was also confirmed experimentally. Altmann and Steedman[1] used similar preambles as in (3) and (4) [Table 2], which had either a 2-referent context supporting NP-attachment or a 1-referent context biasing VP-attachment preceding the target sentences. The target sentences, containing either VP-attachment or NP-attachment, as in (1) and (2), were presented phrase-by-phrase to a group of college students, who read them at their own reading pace.

The study showed that the context containing 2 referents was strong enough to make the young adults expect NP-attachment for the target sentence: when the 2-referent context was presented followed by the sentence containing NP-attachment, the reading time for the region containing the PP, for example, "with the appalling tear" in sentence (2) in [Table 1] was faster than for the VP-attached PP. such as "with the magnifying glass" in sentence (1) in [Table 2]. Thus, the results showed that the participants used the referential context to avoid the garden-path effect, which would have been observed if the target sentence containing the NP-attachment had been presented in isolation.

3. Roles of cognitive functions on syntactic ambiguity resolution in null and supporting context

While some researchers focused on syntactic resolution and benefit of preceding context, other researchers have extended their research interests to the underlying resources that operate multiple syntactic structures during syntactic ambiguity resolution. Past studies have reported that the operation of multiple interpretations is related to cognitive functions and that a decline in working memory capacity limits the simultaneous operation of multiple syntactic structures[4]. Therefore, individual differences in syntactic ambiguity resolution have been linked to working memory[5][6]. Along with working memory capacity, inhibition (also known as selective attention)[7] and shifting attention skills[8] are known to be required for efficient syntactic ambiguity resolution.

In the case of utilizing context during syntactic ambiguity resolution, positive relationship between working memory and efficiency of context use for resolving syntactic ambiguity was reported[9]. Besides working memory capacity, however, there has been no research on the roles of different cognitive functions when the context is used during syntactic ambiguity resolution in young adults.

4. Declined cognition in aging and its effect on syntactic ambiguity resolution in null and supporting context

Most syntactic processing studies focusing on older adults's performance are about syntactic complexity[10-12]. Very few studies have examined syntactic ambiguity resolution skills in older adults and those have been used reduced relative clauses (RRCs)[13][14]. These studies have reported older adults have performed less efficiently than young adults.

How context affects syntactic ambiguity resolution in young adults has been investigated intensively, and these studies have shown positive effects of context for young adults. However, little is known about the effects for older adults.

Most studies of context use by older adults have focused on the effects of context information on lexical ambiguity resolution. Although the study design and stimuli are similar, the results of these studies differed depending on whether the task involved on-line or off-line processing. Older adults were able to use the context as well as younger adults during off-line sentence processing[15-16]. When both off-line and on-line sentence processing skills were examined, older adults showed slower and less successful performance[17][18] or no use of context during on-line processing, although good use of context was observed during off-line sentence processing[19]. Therefore, it can be concluded that a somewhat different extent of context use is expected in older adults compared to younger adults, who are efficient at using context for lexical ambiguity during both off-line and on-line sentence processing.

To understand age-related differences during sentence processing, some researchers focus on age-related cognitive differences. Reduced working memory capacity, slowing of cognitive processing speed, declines of various cognitive functions such as inhibition, alternating attention, switching attention have been reported as possible factors resulting in differential processing of syntactic complexity between younger and older adults[20][21].

For syntactic ambiguity resolution in older adults, contribution of working memory capacity has been found: reduced working memory capacity in older adults have detrimental effect on syntactic ambiguity when compared with younger adults[5]. However, the role of cognitive functions on syntactic ambiguity resolution in context. has not been investigated.

Recently, how older and younger adults resolve syntactic ambiguity using NP- and VP-attached PPs in null context was investigated. In [22], older adults had cognitive disadvantage when compared with younger adults and they processed PP-attachment ambiguity resolution more slowly than young adults across the broad. However, the processing patterns, preference for VP-attachment and proportional processing time difference between NP-attachment and VP-attachment were not qualitatively different between age groups. In [22], no influence of working memory capacity on PP-attachment ambiguity resolution.

5. Research questions

Although researchers have intensively investigated temporary syntactic ambiguity resolution from various points of view, there are still unanswered issues to be examined. First, while processing a sentence with temporary syntactic ambiguity, it is unclear whether older adults use the preceding context, which is utilized by young adults. There is some evidence that older adults can overcome challenges in sentence processing, such as syntactic complexity or less sensitive sensory input, using a supportive context or internally stored

knowledge[15][23][24], but most research on how aging affects syntactic ambiguity resolution has not explored the effect of context on syntactic ambiguity resolution.

Second, among cognitive abilities, only working memory has been included when investigating age-related differences in syntactic ambiguity resolution. Along with working memory capacity, cognitive psychologists have postulated that other cognitive functions such as inhibition, set-switching, and alternating attention skills contribute to sentence processing skills in aging, too. Moreover, although various cognitive functions have been considered as possible predictors for sentence processing skills, manipulation of syntactic complexity has been the focus rather than ambiguity[20]. As cognitive functions change with aging and various syntactic types may be affected differentially by age-related cognitive differences, it is necessary to investigate whether various cognitive functions contribute to the processing of less complex syntactic structures, such as syntactic ambiguity.

In this study, I examined whether the ability to utilize supporting context during NP-attachment resolution changes with aging and which cognitive functions are related with ability using preceding contexts that support NP-attachment ambiguity resolution.

II. Methods

1. Participants

Twenty-four older adult (65-79 years, mean: 71.82) and thirty-three young adults (20-35 years, mean: 25.88) participated in this research. The participants, residing in New York City, were native speakers of American English and not fluent in any foreign languages. Exclusion criteria for this study were people who had cognitive impairments based on the results the Mini-Mental State Examination (MMSE)[25] (below 24), vision impairments that were not corrected by eyeglasses or contact lenses, a history of neurological disorders (e.g., stroke, dementia), a learning disability, and/or cognitive deficits. Only age distinguished the groups ($p < .0001$) and years of education and MMSE scores did not differ between the two age groups ($p > .05$)

2. Reading Experiment

The reading task had a 2x2 design, crossing context (null vs. preceding context) and age (young vs. older adults). Twelve target sentences without context and six target sentences with NP-supporting context were used. All the target sentences consisted of temporary syntactic ambiguity of NP-attached PP. See [Table 3] for examples of target items.

Along with the target items, structurally similar 54 filler items were used. To confirm the comprehension ability, after reading the target and filler sentence, one yes/no question per set was presented.

During the reading experiment, the participants' reading times were obtained using the moving window paradigm for self-paced word-by-word reading task[6]. The participants pressed the space bar to begin a trial. After pressing the space bar again, the dashes representing the first word were simultaneously replaced by the characters in the first word. The participants pressed the button again to read the next word and so on. In this case, the words were seen non-cumulatively.

Table 3. Examples of target items

Context	Syntactic structure of the target sentence	Examples
No	NP-attached PP	(5) The doctor examined the patient with a toothache but he couldn't determine what the problem was.
Yes (a safe with a new lock and a safe with an old lock)	NP-attached PP	(6) A burglar broke into a bank carrying some dynamite. He planned to blow open a safe. Once inside he saw that there was a safe which had a new lock and a safe which had an old lock. The burglar blew open the safe with the new lock and made off with the loot.

3. Measure of cognitive functions

To examine the contribution of age-related cognitive functions to context use during syntactic ambiguity resolution in aging, following cognitive functions were measured: working memory capacity was measured by the Digit and Word Ordering Span tasks[26], inhibition by the Stroop task[27], shifting attention based on the Wisconsin Card Sorting Test[28], and alternating attention and cognitive processing speed by the Trail Making Tests[29][Table 4].

Table 4. Cognitive functions and corresponding neuropsychological tests

Cognitive function	Test	Measure	Abbreviation
Working memory capacity	Month ordering task	Month span	WM_M
	Digit ordering task	Digit span	WM_D
Inhibition	Stroop task	Derived performance time difference between the word reading and color-labeling conditions	Stroop
Shifting attention	Wisconsin Card Sorting Test	Number of target responses	WCST_T
		Percentage of perseverative errors	WCST_P
		Number of completed categories	WCST_N
Alternating attention	Trail Making Test	Derived performance time difference between Part B and Part A	TMT
Cognitive processing speed	Trail Making Test: Part A	Performance time	TMT_A

4. Statistical analysis

4.1 Comprehension question accuracy

To assess off-line sentence processing skills, comprehension question accuracy of NP-attached PP with and without supporting context were analyzed. Two age groups were compared on total accuracy of comprehension questions and accuracy on two types of target items based on presence of context vial independent samples and paired samples t-test using SPSS(Statistical Packages for Social Science) v25.

4.2 Self-paced reading times

To investigate on-line sentence processing skills, the participants' reading time in milliseconds, (ms) from correctly answered items per word was used. Among all the words in the sentence, 5-7 words in the critical region, see underlined words in (5) and (6), were selected for statistical analysis.

To adjust for differences in individual reading speed and string length (number of characters) per word, a regression analysis using the raw reading times was conducted. Combining all the words from fillers and target items, a regression equation was derived that could predict reading times from string length for each participant[30]. For the regression equation, only words in the critical regions were calculated. For each critical region, the predicted value from the participant's regression equation was subtracted from the actual reading time for that item. For example, assume a word within the critical region consists of five characters, and a participant's regression equation predicts that the reading time for a word 5 characters in length would be 100 ms. If the actual reading time for this region turned out to be 170 ms, the differential value between the predicted and actual times would then be calculated (170 ms - 100 ms) to obtain a residual reading time (RRT) of 70 ms. After calculating the RRT for all the critical

regions for each participant, the group mean of each critical region was calculated. Raw reading time values that were more than three SD from the mean residual reading time for a region within a condition were excluded from the analysis.

After obtaining RRTs for the critical regions in young and older adults, I conducted a univariate General Linear Model (GLM) analysis, in which I simultaneously tested the main effects of age group (younger vs. older adults) and context (null vs. presence of context). RRT of the most crucial target word, which is the last word in the critical region such as "toothache" and "safe", was a fixed factor during the analysis.

4.3 Cognitive predictor for context use

To investigate which cognitive functions are related with ability utilizing supporting context during PP-attachment ambiguity resolution, correlation analyses were conducted using age groups' RRTs of the most crucial target word in supporting context, participants' ages, working memory capacity (WM_M, WM_D), inhibition (Stroop), shifting attention (WCST_T, WCST_P, WCST_C), alternating attention(TMT), and cognitive processing speed (TMT_A).

Ⅲ. Results

1. Comprehension question accuracy

Both age groups showed comparable total accuracy ($t(55) = -1.49$, $p > .05$). The benefit of context was not observed in comprehension accuracy when comparing NP-attached PP between the null and NP-supporting contexts. ($t(55) = .71$, $p > .05$); comprehension accuracy was comparable between two conditions. Regardless of whether the NP-supporting was present, comprehension accuracy between age groups (null context: $t(55) = -1.19$, $p > .05$, NP-supporting context: $t(55) = -.94$, $p > .05$) and within age groups (older adults: $t(32) = .51$, $p > .05$, young adults: $t(23) = .82$, $p > .05$) was not affected. See accuracy data in [Table 5].

Table 5. Comprehension accuracy

(1) Total accuracy and accuracy

Mean(*SD*)	Total accuracy	*t*(*df*)	*p*
Older adults	96.80(4.31)	−1.49(55)	.14
Young adults	97.99(3.75)		

(2) Accuracy between NP-attachment in null and in supporting context (based on presence of context)

Mean(*SD*)	accuracy	*t*(*df*)	*p*
Null context	95.87(4.71)	.71(55)	.48
NP-supporting	94.91(10.10)		

(3) Accuracy between age group and presence of context

Mean(SD)	Null context	Supporting context	*t* (*df*)	*p*
Older adults	95.46(4.70)	93.84(11.76)	.68(32)	.51
Young adults	96.88(4.12)	96.39(7.22)	.23(23)	.82
t(*df*)	−1.19(55)	−.94(55)		
p	.24	.06		

2. Self-paced reading times

Based on regression analyses, each participant's RRTs at critical regions were computed. See [Fig. 1] for RRT of the target word across age groups and presence of context.

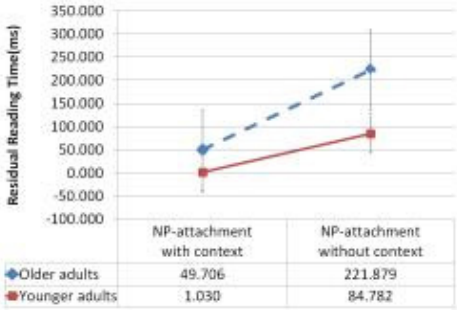

Fig. 1. RRT of target word

At the target word, main effects of age group (p < .01) and context presence (p < .01) were observed. Older adults required longer processing times than young adults, and both age groups were able to utilize context in overcoming the garden-path effect.

However, no interaction between age group and context presence was observed (p > .05); magnitude of the garden-path effect between NP-attachment in isolation and NP-attachment in NP-supporting 2-referent context was comparable for both age groups. A summary of the GLM analysis can be found in [Table 6].

Table 6. A 2 x 2 univariate GLM analysis

Source	*df*	SS	MS	F	*p*
Corrected Model	3	453788.47	151262.82	9.76	.001**
Intercept	1	395262.89	395262.89	25.49	.001**
Age	1	205950.30	205950.30	13.28	.001**
Context Presence	1	200085.79	200085.79	12.90	.001**
Age x Context Presence	1	39878.29	39878.29	2.57	.112
Error	92	1426541.52	15505.89		
Total	96	2300456.05			
Corrected Total	95	1880329.99			

Note. Significant results are bolded: ** for p 〈 .01

3. Contribution of cognitive functions during syntactic ambiguity resolution in supporting context

Except for digit span from the digit ordering task, the total number of correct responses from the WCST, and derived time difference between Part A and Part B from the TMT, the following measures showed a correlation with age: working memory capacity from the month ordering task (r(48) = .34, p < .05), inhibition from the Stroop task (r(48) = .59, p < .01), shifting attention represented by both percentage of perseverative errors (r(48) = .49, p < .01) and number of completed categories (r(48) = .42, p < .01) from the WCST, and cognitive processing speed from the TMT-A (r(48) = .36, p < .05). This indicates that significant declines in cognitive functions were observed in older adults compared to younger adults across four cognitive functions, but not for alternating attention based on the TMT. A main effect of age was replicated in the correlation analysis results: RRT of the target word in NP-supporting context was correlated with age (r(48) = .34, p < .05). Among cognitive functions, only alternating attention (measured by the derived performance time difference between Parts B and A

Table 7. Correlation among ability utilizing supporting context, cognitive functions and age

	RRT	WM_M	WM_D	Stroop	WCST_T	WCST_P	WCST_C	TMT	TMT_A	Age
RRT	–									
WM_M	−.19	–								
WM_D	−.07	.67**	–							
Stroop	.12	−.39*	−.22	–						
WCST_T	.01	.12	.22	.12	–					
WCST_P	.18	−.29*	−.22	.33*	−.06	–				
WCST_C	−.11	.29*	.16	−.39**	.13	−.74**	–			
TMT	.30*	−.12	−.15	.24	.05	.17	−.05	–		
TMT_A	.05	−.37**	−.16	.23	−.14	.47**	−.48**	−.32*	–	
AGE	.34*	−.34*	−.14	.59**	−.09	.49**	−.42**	.16	.36*	–

Note. ** for p 〈 .01, *for p 〈 .05
RRT = RRT of the most critical word in NP-supporting context

of the TMT) was correlated with RRT of the target word in NP-supporting context ($r(48) = .30$, $p < .05$).

This indicates that poor alternating attention skills are related to inefficient utilization of NP-supporting context during NP-attachment ambiguity resolution, represented by longer processing times at the target word. See [Table 7] for results of the correlation analysis.

Ⅳ. Discussion and conclusion

To examine whether the ability to use context during PP-attachment ambiguity resolution changes with aging, this study manipulated the presence or absence of context that preceded sentences containing PP modifying NP. Specifically, the study attempted to answer the question of whether the presence of context allowed participants to avoid a garden-path effect in both young and older adults.

At the point of temporary syntactic disambiguation, both age groups utilized supporting context, exhibiting faster processing times when context was present. The benefit of context was comparable for both age groups. However, the processing of older adults was slower than that of young adults, regardless of whether context was present.

In the null context condition, the verb within the sentence yielded a bias toward a VP-attachment interpretation that was reanalyzed into a NP-attachment due to pragmatic/ semantic knowledge. In contrast, when a context introducing 2 referents preceded sentences containing NP-attached PP, both age groups were able to take advantage of the supporting context, resulting in faster processing times in favor of the NP-attached PP.

Different processing time depending on the presence of context by presenting that readers prefer NP-attachment in NP-supporting context supports the referential theory. According to it, the preceding context, which introduces 2 referents, helps the reader to expect each referent to be distinguished through some type of modification. Therefore, although NP-attached PP was not preferred in null context, in the supporting context, it is preferred and processed faster.

In the literature, the ability to use context has been observed across a number of age groups, but the question of whether young and older adults are equally efficient at using context has remained controversial. The current study shows that older adults have the ability to use context as [17] reported. Moreover, older adults utilized context as efficiently as young adults, exhibiting faster processing times in the presence of context, compared with processing times in its absence during NP-attachment ambiguity resolution.

While no interaction between age groups and types of context (presence vs. absence) was observed in the current study, no direct comparisons within the literature are possible due to the absence of previous studies examining the effect of context presence and absence on syntactic processing. Based on reading time results, quantitative processing was different between age groups, while qualitative processing was not.

When examining which cognitive functions are related with the ability using supporting context during syntactic ambiguity resolution, alternating attention skills, measured in derived performance time difference between Parts B and A on the TMT, was found to be crucial: People who received greater benefit from context during NP-attachment ambiguity resolution would show faster RRTs and these people tend to have better alternating attention skills.

To date, the role of alternating attention skills in sentence processing has not been investigated intensively, but it has been shown that impaired processing of syntactic complexity in individuals with Parkinson's disease correlated with declines in alternative attention skills[31]. Previously, [20] also did not find the connection between alternating attention and the processing of syntactic complexity in healthy older adults. Besides these studies, the current investigation is one of the first to measure and examine the ability of alternating attention skills predicting the ability to use context for temporary syntactic ambiguity resolution in both younger and older adults.

The 2-referent context that supported NP-attachment preference was efficiently utilized by the readers in this study. However, it seems that although the probability of NP-attached PP would be greater than VP-attached PP, the readers might not revise the less probable interpretation, VP-attached PP, because the verb in the target sentence could facilitate the interpretation of VP-attached PP. Therefore, while maintaining two interpretations (both NP- and VP-attachment) simultaneously, the readers may need to decide on the most appropriate syntactic interpretation, which is NP-attached PP based on the context information. For this procedure, alternating attention skills seem to be the most appropriate ones. Again, this is the first study to examine alternating attention skill as a predictor for temporary syntactic ambiguity resolution in both age groups, so further investigation may be required to confirm this idea.

In this study, working memory capacity did not predict differential processing patterns for both age groups. There are several ways to explain why working memory did not predict ability utilizing context during NP-attachment ambiguity resolution. First, processing NP-attached PPs may not be complex enough to exceed the working memory capacity of the participants. As the capacity-constrained theory[5] postulates, language processing may be comparable between the two age groups when language tasks carry a small processing load, despite working memory capacity differences between younger and older adults. PP-attachment ambiguity and referential context may belong to this particular case. Also, [8] reported no relation between working memory capacity and transitivity verb ambiguity. Based on these findings, it seems that different types of temporary syntactic ambiguity may have a different degree of processing difficulty. Therefore, depending on the difficulty level, working memory capacity may or may not predict success or failure in sentence processing.

In summary, this study reveals the remarkable finding that older adults appear to be able to override their cognitive disadvantages when using context during NP-attachment ambiguity resolution, resulting in comparable abilities between both age groups. Moreover, alternating attention skills are key factors for exploiting supporting context during NP-attachment ambiguity resolution for both age groups.

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