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Effects of Aging and Alzheimer Disease on Lexical-semantics: A Semantic Priming Study

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Abstract This study aims to clarify the influences of aging and AD on lexical-semantics by assigning a semantic priming paradigm. The following participants are included in the study: 30 young students, 22 early elderly, 19 late elderly, and 14 AD patients. The participants are asked to perform lexical decision tasks. Targets are high-frequency concrete words or nonwords. The primes are controlled with regard to their semantic relevance to the targets as follows: Association (e.g., *king - lion*), Superordination (*beast - lion*), Coordination (*tiger - lion*), Shared feature (*eyes - lion*), Distinctive feature (*mane - lion*), or Neutral (*XXXX – lion*). The participants have to decide whether the stimulus is a real word or not as correctly and as quickly as possible when the targets appeared on a monitor. As the Results, the mean reaction times (RTs) of the elderly groups are significantly longer than those of the young group, and the RTs of the AD group are even longer than those of the elderly groups. In the young and the elderly groups, the RTs for all the related-prime conditions are significantly shorter than those for the neutral-prime conditions (priming effects). The priming effects appears to be greater in the elderly groups. However, when the RTs are taken into consideration (priming rates), the gains are equivalent among young and elderly groups. In the AD group, priming effects are not observed, and noticeable individual differences in the priming rate are seen. The above findings suggest that lexical-semantics are generally preserved from aging. We also discusses that lexical-semantics are impaired in AD, and the diversity of the impairments may be the essence of AD.

Keywords：Aging, Alzheimer disease, Lexical-semantics, Priming

Ⅰ. INTRODUCTION

An experimental paradigm of semantic priming is an effective method for investigating lexical-semantics in both healthy people and brain-damaged patients. Semantic priming means a preceding stimulus (prime), which is semantically related to a succeeding stimulus (target), and facilitates (or inhibits) the processing of the target. For example, if “*jungle*” or “*lion*” are presented prior to “*tiger*”, “*tiger*” will be recognized more correctly and quickly than when “*pencil*” or “*XXXX*” are presented as a prime. Semantic priming effects are generally explained by spreading activation theory.[4)] The theory assumes that exposure to a prime word activates not only its concept, but also related concepts via semantic networks. Therefore, the subject is able to respond to the semantically related target words more correctly and quickly. The spread of such activations is regarded as automatic processing. Many researchers have attempted to evaluate a subject’s lexical-semantic representations and networks by manipulating prime-target relationships.

Several semantic priming studies have been conducted in elderly subjects or patients with early-stage Alzheimer disease (AD); however, these studies yielded contradictory results. In AD patients, some studies reported normal (equivalent to healthy controls) priming effects,[17,20)] suggesting the preservation of lexical-semantics. On the other hand, some studies reported that the priming effects were reduced or absent.[10,12,19,23,24)] In addition, Chertkow et al.[3] reported that the priming effects were increased, compared with healthy controls. They named this phenomenon “hyperpriming,” and hyperpriming in AD has been followed by other researchers.[6,22)] These reduced, increased, or absent priming effects suggest partial or whole deficits of lexical-semantics in AD. In elderly people, most studies have reported almost normal priming effects, suggesting that lexical-semantics remain robust with aging. However, some studies have reported hyperpriming in the elderly.[13,14)]

We hypothesized that the various results of priming effects in elderly people and AD patients depended mainly on differences in the prime-target relationships among studies. In the present study, we controlled the semantic relationships between the primes and targets and compared the priming effects for different prime conditions. The aim of this study was to improve our understanding of the possible deterioration in lexical-semantics with aging or AD by assigning a semantic priming paradigm.

Ⅱ. METHODS

1. Participants

This study was approved by the ethics committee of the Faculty of Health and Welfare, Prefectural University of Hiroshima. The participants provided written informed consent before taking part in the study.

The following four groups were created: a young group, composed of 30 undergraduate

Table 1. Data of Participants

	Young	Early Elderly	Late Elderly	AD
Age	20.5(1.0)	66.0(1.8)	73.9(2.0)	78.6(6.7)
Sex (M/F)	12/18	8/14	10/9	6/8
MMSE	29.7(0.5)	28.8(1.1)	29.0(0.9)	22.3(1.7)
WPM	98.8(2.9)	98.3(4.8)	98.1(2.9)	92.0(9.3)
Naming	99.6(1.5)	98.9(2.4)	97.2(4.6)	89.0(12.5)

Means (and standard deviations)
Note: AD = Alzheimer disease, MMSE=Mini-Mental State Examination,
WPM = word-picture matching

students; an early elderly group, composed of 22 healthy volunteers in their 60s; a late elderly group composed of 19 healthy volunteers in their 70s; and 14 AD patients who had been diagnosed as having probable AD dementia according to the NIA/AA criteria[15] (Table 1). Except for the AD patients, all the subjects scored over 27 points out of 30 on the Mini-Mental State Examination (MMSE), indicating that no signs of pathological cognitive dysfunction were present.[11]

2. Materials

Sixteen high-frequency concrete words (four animals: e.g., *lion*, *dog*; five artifacts: e.g., *station*, *cup*; seven plants: e.g., *sunflower*, *rose*) were selected as the targets.

The primes were controlled with regard to their semantic relevance to the targets as follows: Association, Superordination, Coordination, Shared features, Distinctive features, and Neutral. To prepare the prime words, 21 students were recruited. The students were presented with each target word and asked to write the first three words that came to their minds representing association, shared features, and distinctive features with the targets. Shared features meant features that the target item and related items generally had (e.g. “eyes” in zebra), and Distinctive features meant features that the target item had specifically (e.g. “stripes” in zebra). The words appearing with the highest frequency for each target were chosen as the primes. Superordination and Coordination were decided in accordance with the Japanese thesaurus of lexical structure.[9] For example, for the target “*lion*”, “*king*” was regarded as Association, “*beast*” was regarded as Superordination, “*tiger*” was regarded as Coordination, “*eyes*” was regarded as Shared features, and “*mane*” was regarded as Distinctive features. “*XXXX*” was used as Neutral (Table 2).

The prime and target words were presented with the most plausible orthography (kanji, hiragana, or katakana) in Japanese based on the NTT Japanese Psycholinguistics Database.[2] The same number of target nonwords was also prepared by rearranging the characters of the target words. Therefore, the stimulus-set contained 192 prime-target pairs, consisting of 80 word-word pairs, 16 XXXX-word pairs, 80 word-nonword pairs, and 16 XXXX-nonword pairs.

The participants also underwent a spoken-word to picture matching (WPM) and a picture-naming test using the target words (Table 1). An ANOVA revealed significant differences in the accuracy rate among groups for the WPM ($F(3, 81) = 6.68$, $P < 0.001$) and the picture-naming test ($F(3, 81) = 12.28$, $P < 0.001$). A multiple comparisons analysis revealed that only the AD group scored significantly lower than the other groups on both tests.

3. Procedure

The experiment was conducted using the SuperLab 5 (Cedrus Corporation). The stimuli

Table 2. Examples of Stimuli

Target	Prime					
	Association	Super-ordination	Co-ordination	Shared feature	Distinctive feature	Neutral
Lion	king	beast	tiger	eyes	mane	XXXX
Station	train	public	hospital	congestion	ticket	XXXX
Sunflower	summer	flower	dandelion	petal	yellow	XXXX

were presented at the center of the monitor in 72-point font. Other procedures were performed as described by Giffard et al.[6)]

The participants were asked to perform a lexical decision task for the second (target) stimulus. S/he had to press, as correctly and as quickly as possible, the "YES" button with the dominant hand if s/he recognized the stimulus as a real word or the "No" button with the non-dominant hand if he/she recognized the stimulus as a non-real word. Following the presentation of a fixation point for 500 ms, a prime appeared for 200 ms. This was followed by an empty screen for 50 ms (SOA: 250 ms), and finally the target was presented and left in place until a response was made. The target was simultaneously removed when the response was made, and the next trial was started after a 1500 ms interval. The above 192 prime-target pairs were presented in a random order. Twenty practice sessions were completed before the trials. Additional practice sessions were performed if the participants did not appear to have a clear understanding of the experimental task. Subjects who had a remarkably low correct answer rate were excluded.

4. Analyses

The statistical analyses were performed using SPSS 23.0 for Windows, and the accuracy and the reaction times (RTs) were analyzed. In the RT analyses, the error responses and responses exceeding the mean ± two standard deviations of each condition in each participant were excluded as outliers. The accuracy and the RTs were

Table 3. Results of Accuracy, Reaction Times, and Priming Rate

		Association	Super-ordination	Co-ordination	Shared feature	Distinctive feature	Neutral
Acc (%)	Young	98.6(2.6)	96.8(4.4)	97.6(4.3)	98.4(3.1)	97.8(4.0)	96.4(4.9)
	Early	98.1(3.4)	97.0(5.3)	97.3(3.6)	97.8(3.9)	98.4(2.7)	98.6(2.6)
	Late	99.1(2.2)	99.7(1.4)	99.4(1.9)	99.7(1.4)	99.1(2.2)	99.7(1.4)
	AD	98.3(2.8)	98.7(2.6)	97.9(3.0)	96.6(4.5)	95.7(4.4)	97.0(4.6)
RTs (ms)	Young	495(53)	494(56)	497(61)	498(54)	498(55)	529(64)
	Early	734(124)	739(123)	720(118)	721(114)	741(134)	805(165)
	Late	785(168)	750(134)	754(153)	779(143)	761(159)	833(182)
	AD	1270(365)	1575(759)	1450(503)	1416(508)	1302(422)	1292(397)
PR (%)	Young	-4.0 (5.8)	-4.4(6.6)	-4.2(7.2)	-3.9 (6.6)	-4.1(6.1)	-
	Early	-4.2(8.7)	-2.4(7.4)	-6.1(8.3)	-5.8(6.2)	-2.8(8.4)	-
	Late	-2.3(9.9)	-6.3(8.6)	-5.9(8.4)	-2.7(8.7)	-6.0(9.3)	-
	AD	6.8(18.5)	20.6(29.3)	18.0(15.7)	16.0(21.6)	7.9(12.3)	-

Means (and standard deviations)
Note: Acc = accuracy, RTs = reaction times, PR=priming rate, Early = early elderly, Late = late elderly,
AD = Alzheimer disease

examined using a two-way ANOVA with Group treated as a between-subject factor and Prime as a within-subject factor. Post-hoc comparisons were made according to Dunnett's many-one test.

Ⅲ. RESULTS

Table 3 shows the results for accuracy, mean RTs, and mean priming rate (see below) of each group for each prime condition.

1. Accuracy

The ANOVA revealed a significant main effect of Group (F (3, 81) = 2.92, P = 0.039). However, there are no main effects of Prime (F (5, 405) = 0.67, P = 0.650). There was also a significant Group × Prime interaction (F (15, 405) = 1.90, P = 0.022). The simple main effects of Group were significant for two conditions (Distinctive feature: F (3, 81) = 2.73, P = 0.049; Neutral: F (3, 81) = 3.58, P = 0.017). A multiple comparisons analysis revealed differences between the late elderly and the AD group for the distinctive feature condition and between the young and the late elderly group for the neutral condition. None of the groups showed any simple main effects of Prime.

2. Reaction times

The ANOVA revealed a significant main effect of Group (F (3, 81) = 56.99, P < 0.001) and Prime (F (2.0, 162.4) = 4.71, P = 0.010). The Group × Prime interaction was also significant (F (6.0, 162.4) = 6.43, P < 0.001). Significant simple main effects of Group were observed for all prime conditions (Association: F (3, 81) = 58.92, P < 0.001; Superordination: F (3, 81) = 37.27, P < 0.001; Coordination: F (3, 81) = 57.63, P < 0.001; Shared feature: F (3, 81) = 53.82, P < 0.001; Distinctive feature: F (3, 81) = 51.42, P < 0.001; Neutral: F (3, 81) = 45.48, P < 0.001). A multiple comparisons analysis revealed that, for any prime condition, the RTs of the young group were shorter than those of the other three groups and the RTs of the AD group were longer than those of the other three groups. Simple main effects of Prime were also significant in the healthy young and both elderly groups (young: F (5, 145) = 7.66, P < 0.001; early elderly: F (2.5, 51.9) = 8.89, P < 0.001; late elderly: F (3.5, 62.3) = 6.14, P < 0.001). A multiple comparisons analysis revealed that, in those groups, the RTs for every related-prime condition were shorter than those for the neutral condition. In the AD group, however, the simple main effects of Prime were nonsignificant.

3. Priming rate

In general, the overall RTs in elderly and brain-damaged subjects tend to be slow. Some researchers[5,16] have claimed that the greater priming effects observed in these subjects merely arise from prolonged RTs. To compare the magnitude of the priming effects purely, we used the “priming rate” that were obtained using the following equation[16] :

Priming rate = (RTs (related-prime) - RTs (neutral prime)) / RTs (neutral prime) × 100

A two-way ANOVA was conducted using the priming rate as a dependent variable. The ANOVA revealed that the main effect of Group was significant (F (3, 81) = 18.26, P < 0.001), but the main effect of Prime was not significant (F (2.8, 226.8) = 2.41, P = 0.073). A Group × Prime interaction was also significant (F (8.4, 226.8) = 3.67, P < 0.001). Significant simple main effects of Group were observed for all the prime conditions (Association: F (3, 81) = 4.05, P = 0.010; Superordination: F (3, 81) = 13.47, P < 0.001; Coordination: F (3, 81) = 23.27, P < 0.001; Shared feature: F (3, 81) = 13.75, P < 0.001; Distinctive feature: F (3, 81) = 8.12, P < 0.001). A multiple comparisons analysis revealed that significant differences were present between the AD group and the three other groups; that is, the AD group had poorer priming rates. In addition, the standard deviation of the priming rates for the AD group was much larger than those of the other groups (see Table 3), indicating considerable individual differences in the AD group. The simple main effects of Prime were nonsignificant in the young and in the AD group (young: F (4, 116) = 0.06, P =

0.993; AD: F (2.0, 25.7) = 2.41, P = 0.110) but were significant in the elderly groups (early elderly: F (4, 84) = 2.71, P = 0.035; late elderly: F (4, 72) = 2.66, P = 0.040). However, multiple comparisons using the Bonferroni's test revealed that there were no significant differences between any of the combinations. The minimum and maximum values (range) of the priming rates were -21.3% to 15.2% in the young group, -30.1% to 14.3% in the early elderly group, -27.2% to 13.6% in the later elderly group, and -20.6% to 106.1% in the AD group. The range of the priming rates was similar in the three healthy groups but was very wide in the AD group.

Ⅳ. DISCUSSION

The accuracy of the lexical decision tasks was very high for every group, and no clear differences among the groups were seen (ceiling effects). Therefore, we used the RTs as an index for the priming effects.

1. Influence of aging on lexical-semantics

The early and late elderly groups had significantly longer RTs for the lexical decision tasks than the young group. However, the RTs for the related-prime conditions were significantly shorter than those for the neutral-prime condition in all the groups. That is, priming effects were observed despite aging.

The priming effects appeared to be greater in the elderly groups than in the young group. However, the overall RTs of young and elderly people are generally different, with the RTs of elderly people tending to be longer because of slower cognitive and motor processing. We agree with Giffard et al.[5] and Merck et al.[16] and think that the overall RTs should be considered to compare the magnitudes of the priming effects appropriately. We therefore calculated the "priming rate", which took the mean RTs of the neutral-prime condition into consideration. As a result, no significant differences in the priming rates were observed among the three groups. In other words, the magnitudes of the priming effects were not affected by aging. These findings are consistent with those of Giffard at al.[5] and suggest that lexical-semantics generally remain robust with aging.

However, in our analyses of the priming rates using an ANOVA, simple main effects of the prime-conditions were observed in both elderly groups, suggesting that the priming effects were reduced or increased for certain prime-target relationships. Consequently, mild or partial deficits of lexical-semantics with aging might exist. Further investigations that include older participants are required.

2. Influence of AD on lexical-semantics

The AD group had poorer performances on the language tests (WPM and picture naming) than the other groups. However, AD patients generally have impairments not only in language domains, but also in other cognitive domains, such as attention and executive function. Therefore, it is difficult to interpret their poor performances on the language tests as indicating a deficit in lexical-semantics. A semantic priming paradigm may be useful for assessing lexical-semantics in AD patients, since it may minimize the influences of other cognitive impairments.

Table 4 shows previous studies of semantic priming in AD patients. Some studies have demonstrated that AD patients exhibit normal priming effects, but other studies have reported the opposite findings, with priming effects being reduced[23,24] or absent[10,19] even during the early stage of AD. In the latter studies, the priming effects were observed only for some prime-target conditions or the size of the effects (similar to the priming rates in this study) was smaller than that observed in healthy controls. In addition, some studies reported "hyperpriming". Hyperpriming is also considered to be a partial deficit of lexical-semantics.[6, 7] For example, for the prime-target pair of tiger-lion, if a patient loses knowledge that "a tiger has stripes," the semantic distance between lion and tiger becomes closer and the priming effect of lion becomes larger. Overall, semantic priming studies in patients with AD have yielded controversial results.

In our study, priming effects were not observed in the AD group. This result may not be due to our patients having severer dementia, since their MMSE scores were almost equivalent to those of subjects in preceding studies and all the patients executed the experimental task with high accuracy rates and almost equal mean RTs, compared with the results of previous studies (about 1000 - 1500 ms). Nevertheless, the standard deviation and range of the priming rates for the AD group were much larger than those for the other groups. This finding suggests that the individual differences among AD patients are quite large. We think that a wide variety of lexical-semantics disorders may exist among early AD patients. Lexical-semantics may be preserved in some patients but not in others, or some concepts, but not others, may be preserved. The diversity of impairments in lexical-semantics may be the essence of AD.

This study hypothesized that the contradictory results of the priming effects in the AD subjects depended mainly on differences in the prime-target relationships among the studies. This study prepared various prime conditions and tried to compare the priming effects for different prime-target relationships. However, no significant differences in the priming effects were found among the prime conditions. Various experimental factors, such as the SOA, might influence the priming effects. Further investigations are required to clarify the priming effects in AD.

Table 4　Semantic Priming Studies Examining Alzheimer Disease Patients Using Lexical-decision Tasks

Studies	*N*	*MMSE*	*Prime*	*Priming Effects*	*Priming Size*
Ober et al.[19]	9	NR	Coordination	No	-
Chertkow et al.[3]	6	17.5	Association Coordination	Yes	AD > HC
Albert et al.[1]	10	NR	Association	Yes in 6 patients No in 4 patients	AD = HC
Nebes et al.[18]	16	20.0	Association	Yes	AD > HC
Ober et al.[20]	20	19.3	Association	Yes	AD = HC
Silveri et al.[24]	8	NR	Coordination Features	Yes	AD < HC
Ito et al.[10]	12	20.8	Association	No	-
Nakamura et al.[17]	4	19.0	Coordination	Yes	AD = HC
Giffard et al.[6]	53	22.0	Coordination Features	Yes	AD > HC for Coordination AD = HC for Features
Giffard et al.[7]	24	22.5	Coordination Features	Yes (but No in late stage)	AD > HC for Coordination AD = HC for Features
Perri et al.[21]	21	21.1	Coordination Features	Yes	AD = HC
Rogers et al.[23]	11	21.5	Association Superordination Coordination Features	Yes for Association, Superordination, and Coordination No for Features	AD = HC for Association and Superordination AD < HC for Coordination
Hernández et al.[8]	36	24.0 (mild) 22.0 (moderate)	Coordination	Yes in mild patients No in moderate patients	AD = HC
Perri et al.[22]	20	25.0 (mild) 19.8 (moderate)	Coordination	No in mild patients Yes in moderate patients	AD > HC
Laisney et al.[12]	16	25.4	Coordination Features	Yes for Coordination No for Feature	AD = HC

Note: MMSE = Mini-Mental State Examination, NR = not reported, AD = Alzheimer disease, HC = healthy controls

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REFERENCES

1) Albert M, Milberg W (1989). Semantic processing in patients with Alzheimer's disease. Brain Lang, 37: 163-171.
2) Amano S, Kondo T (1999). NTT Japanese Psycholinguistic Database. Sanseido, Tokyo (in Japanese).
3) Chertkow H, Bub D, Seidenberg M (1989). Priming and semantic memory loss in Alzheimer's disease. Brain Lang, 36: 420-446.
4) Collins A M, Loftus E F (1975). A spreading activation theory of semantic processing. Psychol Rev, 82: 407-428.
5) Giffard B, Desgranges B, Kerrouche N, et al (2003). The hyperpriming phenomenon in normal aging: a consequence of cognitive Slowing? Neuropsychology, 17: 594-601.
6) Giffard B, Desgranges B, Nore-Mary F, et al (2001). The nature of semantic memory deficits in Alzheimer's disease: new insights from hyperpriming effects. Brain, 124: 1522-1532.
7) Giffard B, Desgranges B, Nore-Mary F, et al (2002). The dynamic time course of semantic memory impairment in Alzheimer's disease: clues from hyperpriming and hypopriming effects. Brain, 125: 2044-2057.
8) Hernández M, Costa A, Juncadella M, et al (2008). Category-specific semantic deficits in Alzheimer's disease: a semantic priming study. Neuropsychologia, 46: 935-946.
9) Ikehara S, Miyazaki M, Shirai S, et al (1999). Goi-Taikei: A Japanese Lexicon. Iwanami-shoten, Tokyo (in Japanese).
10) Ito J, Koyama S, Nageishi Y (1999). N400 component of event-related potentials in patients with Parkinson's disease and those with dementia of the Alzheimer's type. Rinshou Nouha, 41: 94-98 (in Japanese).
11) Kukull W A, Larson E B, Teri L, et al (1994). The Mini-Mental State Examination score and the clinical diagnosis of dementia. J Clin Epidemiol, 47: 1061-1067.
12) Laisney M, Giffard B, Belliard S, et al (2011). When the zebra loses its stripes: semantic priming in early Alzheimer's disease and semantic dementia. Cortex, 47: 35-46.
13) Laver G D (2000). A speed-accuracy analysis of word recognition in young and older adults. Psychol Aging, 15: 705-709.
14) Laver G D, Burke D M (1993). Why do semantic priming effects increase in old age? -A meta-analysis. Psychol Aging, 8: 34-43.
15) McKhann G M, Knopman D S, Chertkow H, et al (2011). The diagnosis of dementia due to Alzheimer's disease: recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. Alzheimers Dement, 7: 263-269.
16) Merck C, Jonin P Y, Laisney M, et al (2014). When the zebra loses its stripes but is still in the savannah: results from a semantic priming paradigm in semantic dementia. Neuropsychologia, 53: 221-232.
17) Nakamura H, Nakanishi M, Hamanaka T, et al (2000). Semantic priming in patients with Alzheimer and semantic dementia. Cortex, 36: 151-162.
18) Nebes R D, Brady C B, Huff F J (1989). Automatic and attentional mechanisms of semantic priming in Alzheimer's disease. J Clin Exp Neuropsychol, 11: 219-230.
19) Ober B A, Shenaut G K (1988). Lexical decision and priming in Alzheimer's disease. Neuropsychologia, 26: 273-286.
20) Ober B A, Shenaut G K, Jagust W J, et al (1991). Automatic semantic priming with various category relations in Alzheimer's disease and normal aging. Psychol Aging, 6: 647-660.
21) Perri R, Carlesimo G A, Zannino G D, et al (2003). Intentional and automatic measures of specific-category effect in the semantic impairment of patients with Alzheimer's disease.

Neuropsychologia, 41: 1509-1522.
22) Perri R, Zannino G D, Caltagirone C, et al (2011). Semantic priming for coordinate distant concepts in Alzheimer's disease patients. Neuropsychologia, 49: 839-847.
23) Rogers S L, Friedman R B (2008). The underlying mechanisms of semantic memory loss in Alzheimer's disease and semantic dementia. Neuropsychologia, 46: 12-21.
24) Silveri M C, Monteleone D, Burani C, et al (1996). Automatic semantic facilitation in Alzheimer's disease. J Clin Exp Neuropsychol, 18: 371-382.

加齢またはアルツハイマー病が語彙・意味機能に及ぼす影響
—意味的プライミング法による検討—

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