Understanding of auditory discourse in older adults: the effect of syntax

Introduction

As people get older language processing ability changes. Some older adults may be less efficient in processing syntactically complex sentences in comparison to younger adults (Obler, Fein, Nicholas & Albert, 1991) though this is not a universal finding (Waters & Caplan, 2005). Age related changes have also been observed in understanding discourse (Cohen, 1979). However, there is little research of the effect of ageing on the *auditory* comprehension of complex discourse, i.e. consisting of syntactically complex sentences. Norman, Kemper, Kynette, Cheung and Anagnopoulos (1991) investigated the ability of young and old adults to recall syntactically complex discourse by writing down sentences they previously heard in the discourse samples. Comprehension of discourse was also tested. While there was an interaction between age and sentence recall, the authors do not report whether the syntactic complexity of the discourse influenced comprehension. The authors attributed the sentence recall ability to deficient working memory in older adults (measured with digit span tasks). The current study investigates the effect of discourse complexity and working memory in healthy older adults, using auditory discourse and digit span tasks. Investigating the effect of syntax on discourse comprehension in healthy ageing can help determine how normal and pathological ageing differ and can contribute towards the development of more sensitive and specific assessments of language that capture pathological language changes.

Method

Participants: thirty healthy adults (all with MMSE[1] scores of more than 24) participated in the study. Table 1 gives background information of the participants. All participants had normal hearing and no history of neurological conditions.

Story comprehension tasks: four stories from Caplan and Evans (1990) were adapted and used in the study. Two stories (A, B) consisted of simple (active) sentences and the other two (C, D) of complex (passive) sentences. All four stories had non-reversible sentences and could be understood on the basis of general knowledge. Stories A and C had the same topic (theft at a petrol station) and B and D had a different topic (police incident in a house). So, each story had a simple and a complex equivalent. The two simple stories (A, B) consisted of around 180 words and around 30 sentences each. The two complex stories (C, D) also consisted of around 180 words each and each was around 20 sentences long. In both groups, one half of participants listened to one simple (A) and one complex (D) story. Similarly, the other half of participants in each group listened to stories B and C, simple and complex respectively. Each story was followed by 18 true/false probes that tested comprehension. The maximum score a participant could achieve was 18 per story (if 100% correct).

Working memory tasks: the two digit span subtests (forward repetition and matching span judgement) of PALPA (Kay, Lesser & Coltheart, 1992) were used to measure working

[1] Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state. *Journal of Psychiatry Research, 12,* 189-198.

memory abilities. Following these two tasks, participants were asked to repeat the digit materials from the forward span task but this time backwards.

Results

Descriptive statistics from discourse comprehension and working memory tasks are in table 2. Bivariate Spearman correlations between the variables are in table 3. There was a moderate negative correlation ($\rho=-.530$, $p<.01$) between age and complex story condition and no correlation between age and simple story condition. Performance in the simple story condition did not correlate with any other variable. There was also a moderate positive correlation ($\rho=.472$, $p<.01$) between the complex story task and forward digit span but a weaker correlation ($\rho=.373$, $p< .05$) with the matching span task. There was no correlation between complex discourse and backward digit span, although there was a strong negative correlation between age and backward digit span ($\rho=-.755$, $p< .01$).

Discussion

There appear to be three patterns: a. memory abilities, b. complex discourse condition and memory, c. simple discourse condition. Unlike other studies (Cohen, 1979; Mackenzie, 2000), the story comprehension tasks did not correlate with the level of education of the participants, despite the lower level of education of the old group (table 1).

Limitations in auditory discourse comprehension in older adults have been attributed to limitations in working memory ability (Norman et al., 1991). Considering simple and complex discourse tasks together, it appears that, overall, working memory did not have much of an effect on discourse comprehension. Norman et al. found that forward digit span did not correlate with discourse comprehension but backward digit span did. They stated that working memory limitations impair processing of complex syntax, which hinder comprehension (p. 350). Considering the moderate correlation between the complex discourse condition and forward digit span, it seems that working memory plays some role in understanding complex discourse, but it is a different component of working memory from that reported by Norman and colleagues. Waters and Caplan (2005) argued that the working memory system for syntax is separate from that used in other aspects of language (e.g. serial recall in digit span tasks). Part of our findings could be interpreted as reflecting a language specific working memory system as Waters and Caplan (2005) suggest, which is influenced by the syntactic complexity of the discourse. The correlation between the complex discourse and forward span task ($\rho=.472$) could be indicative of that view. It may well be that there is a working memory subsystem responsible for complex sentence and complex discourse interpretation which is influenced by ageing. Our findings point towards a new avenue of research on discourse and ageing, with syntactic complexity as an important variable.

Table 1. Background information of participants

		young (n=10)	old (n=20)
age	mean *(sd)*	22 *(1.03)*	79.95 *(8.55)*
	range	20-23	70-93
education (years)	mean *(sd)*	16.5 *(1.20)*	11.93 *(2.98)*
	range	14-18	9-18
gender	M	7	14
	F	3	6

Table 2. Performance on discourse and memory tasks*

	discourse comprehension task		working memory tasks		
	simple	*complex*	*forward*	*backward*	*matching*
young	14.1 *(1.79)*	13.7 *(2.16)*	6.7 *(.68)*	4.9 *(.74)*	6.7 *(.48)*
old	13.25 *(1.45)*	12.4 *(2.01)*	5.7 *(.98)*	3.65 *(.59)*	6.15 *(.88)*

*mean *(sd)*

Table 3. Correlations among different variables

	age	simple	complex	forward span	backward span	matching span
simple	-.196					
complex	-.530*	-.017				
forward span	-.614*	-.072	.472*			
backward span	-.755*	.237	.291	.681*		
matching span	-.558*	-.082	.373**	.551*	.705*	
education	-.703*	.275	.143	.493*	.708*	.511*

* $p < .01$, ** $p < .05$, (two-tailed)

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