Stability and Decline of Narrative Abilities in Healthy Ageing

(Article begins on next page)

Stability and decline of narrative abilities in healthy ageing

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Introduction

Narrative skills require the interplay of micro-linguistic and macro-linguistic structures: the micro-linguistic level is responsible for lexical-semantic, morphological and morphosyntactic processes, while the macro-linguistic level ensures the pragmatic functionality of the text, through coherent and cohesive devices[1]. In particular, *coherence* defines the strategies used by the speaker to make the content accessible and relevant to the interlocutor, while *cohesion* represents the ways by which the components of the text are mutually connected within a sequence[2].

During ageing, individuals may exhibit changes in several domains of both micro- and macro-linguistic features[3]. At the micro-linguistic level, the occurrence of errors in the lexical retrieval of semantically appropriate words (i.e., semantic paraphasias) is often observed[4], as well as a decomplexified syntax and a reduced length of the utterances[4-6]. At the macro-linguistic level, relevant changes concern the increase of local coherence errors (e.g., referential errors and topic shifts)[4], global coherence abnormalities (e.g., tangential and off-topic utterances)[7], and cohesive inaccuracy (e.g., misuse of linking conjunctions and referential pronouns)[4,7,8,10]. A decrease of discourse informativeness is also reported, often defined by a lower density of words or propositions expressing a content that is relevant to the story[4,6,8-10]. Nonetheless, not all the studies detected a significant deterioration of narrative in ageing, not only at the micro-structural level, e.g., syntactic complexity[11], but also in the macro-structural organization of information[5,12].

Many previous studies investigated narrative skills considering only some specific features or involving young participants. Therefore, this study aims at providing a comprehensive

assessment of narrative abilities in a group of healthy individuals from young to late adulthood. We expect to find a progressive decline of micro- and macro-linguistic features, as a consequence of age-related changes in discourse production.

Methods

Participants

The sample included 60 Italian-speaking adults, organised in three groups, as follows: a) 20 young adults (YA: 10 females; education: M=14.2; SD=2.85) ranging in age from 20 to 40 years (M=27.6; SD=5.32); b) 20 old adults (OA: 9 females; education: M=10.6; SD=2.85) ranging in age from 65 to 75 years (M=70.0; SD=3.11); c) 20 senior-old adults (SOA: 14 females; education: M=10.2; SD=5.06) ranging in age from 76 to 86 years (M=80.1; SD=2.85). The groups were not matched for education (F=5.69; p=.006).

Exclusion criteria were: 1) severe cognitive or linguistic deficits, as assessed by the achievement of a cut-off score in the Montreal Cognitive Assessment[13], the Token Test[14], and the naming subtest of the Aachener Aphasie Test[15]; 2) current or past neurological or neuropsychological disorders; 3) substance or alcohol use disorder; 4) hearing and/or vision problems; 5) history of head injury; 6) taking mood stabilisers.

Materials and procedure

Narratives were elicited using four picture stimuli[1]: two single-picture scenes ("The Picnic"[16] and "Cookie Theft"[17]) and two picture sequences ("Flower Pot"[18] and "Quarrel"[19]).

Each participant was assessed individually and instructed to describe the situation depicted in the pictures, trying to avoid the use of ambiguous words since the administrator was not familiar with the stimuli. Pictures were administered using a laptop facing the participant to prevent memory limitations and referent sharing. Narratives were audio-recorded and transcribed verbatim[1,4].

Narrative analysis. First, we calculated the duration (in seconds) and the total number of units (i.e. words, non-words, false starts, etc.) and utterances in each story[1,20]. Therefore, we analysed each text taking into account both micro- and macro-linguistic features of narrative production, such as productivity measures (speech rate and mean length of utterances), lexical and grammatical processing, textual organization (coherence and cohesion), and informativeness[1,20]. The complete list of the variables considered is reported in *Table 1*, with a concise definition of each measure.

Data analysis

To investigate the presence of significant differences in the narrative profile of our groups, we performed a 4x3 repeated measures ANOVA on each narrative variable measured, with a within-subjects factor of Task (four levels: "The Picnic", "Cookie Theft", "Flower Pot", "Quarrel") and a between-subjects factor of Group (three levels: YA, OA, SOA). Moreover, we included Education as a covariate, in order to control its effect on participants' performance.

Table 1. Micro-/Macro-linguistic narrative features.

Micro-linguistic level	*Productivity*	a) Speech rate	Number of well-formed words produced in a minute: (words/time in seconds)*60.
		b) Mean length of utterances (MLU)	Number of well-formed words/total number of utterances.
	Lexical processing and grammatical organization	c) %Phonological errors	The percentage of phonological paraphasias (i.e. a word phonologically deviant), neologisms and false starts out of all uttered units: (phonological errors/units)*100.
		d) %Semantic paraphasias	The percentage of words that were classified as semantic paraphasia: (semantic paraphasias/words)*100.
		e) %Complete sentences	The percentage of sentences with all the arguments required by the verb, without paragrammatic errors, namely omissions or substitutions of bound morphemes or functional words: (complete sentences/utterances)*100
Macro-linguistic level	*Textual organization*	a) %Cohesion errors	The percentage of utterances with a cohesive errors, e.g. misuse of cohesive function words or abrupt interruptions of utterances: (cohesive errors/utterances)*100.
		b) %Local coherence errors	The percentage of utterances with a local coherence error, namely the use of words with unclear referents and topic shifts: (local coherence errors/utterances)*100.
		c) %Global coherence errors	The percentage of utterances with a global coherence error, namely utterances that may be tangential, conceptually incongruent with the story, propositional repetitions or fillers: global coherence errors/utterances)*100.
	Informative content	d) %Lexical informativeness (lexical information units)	The percentage of words lexically, grammatically and pragmatically accurate, i.e. words not scored as semantic or phonological paraphasias, not ambiguous, repeated or forming tangential utterances: (lexical information units/words)*100.

Results

The results of the assessment are reported in *Table 2*. The ANOVA showed a significant between-subjects effect of Group on participants' speech rate and MLU, and on the percentage of semantic paraphasias and local coherence errors ($5.38 < F < 7.48$; $.001 < p < .007$), whereas no effect was detected on the percentage of phonological errors, complete sentences, cohesion errors, global coherence errors and lexical informativeness ($.393 < F < 2.39$; $.101 < p < .677$). In addition, a between-subjects effect of Education was found on semantic paraphasias, local coherence errors and global coherence errors ($6.12 < F < 9.62$; $.003 < p < .016$).

Pairwise comparisons (Bonferroni-adjusted) between YA and OA revealed a decreasing of MLU ($p = .021$) and local coherence ($p = .01$) with age; by comparing YA and SOA, a significant difference emerged in all the variables considered, i.e., speech rate, MLU, semantic paraphasias and local coherence errors ($.005 < p < .028$). Finally, the comparison between OA and SOA showed a significant difference only in the percentage of semantic paraphasias ($p = .004$).

Table 2. Mean distributions, (standard deviations) and [ranges] for each group, and main ANOVA results (between-subjects effect of Group).

Measure	YA	OA	SOA	F	p
Speech rate	149.08 (25.6) [30-260]	134.24 (31.68) [56-260]	127.06 (24.02) [54.2-180]	5.712	.006
Mean length of utterances	7.95 (2.81) [3.9-24.5]	6.25 (1.91) [3.5-13.0]	5.94 (1.6) [2.8-13.0]	6.126	.004
%Phonological errors	.93 (1.2) [.0-4.8]	1.25 (1.6) [.0-5.6]	1.82 (2.27) [.0-12.5]	1.877	.163
%Semantic paraphasias	.76 (1.63) [.0-6.7]	1.24 (2.56) [.0-14.3]	2.66 (3.63) [.0-18.2]	7.48	.001
%Complete sentences	62.68 (20.43) [.0-75]	59.55 (24.25) [.0-100.0]	52.9 (20.72) [.0-100.0]	1.571	.217
%Cohesion errors	19.96 (13.88) [.0-63.6]	19.06 (14.41) [.0-60.0]	21.84 (15.9) [.0-66.7]	.393	.677
%Local coherence errors	15.09 (12.56) [.0-55.6]	27.7 (20.29) [.0-100.0]	26.95 (16.49) [.0-87.5]	5.38	.007
%Global coherence errors	8.21 (9.85) [.0-57.1]	12.21 (14.59) [.0-62.5]	13.08 (13.37) [.0-80.0]	.675	.513
%Lexical informativeness	85.78 (7.81) [50.0-98.3]	82.08 (12.13) [44.5-100.0]	79.69 (11.61) [31.4-100.0]	2.39	.101

Conclusion

Our results showed a decline in narrative abilities of old participants, both OA and SOA, compared to controls in both micro-linguistic and macro-linguistic features: SOA exhibited a worsening of productivity measures (speech rate and MLU), lexical-semantic processes and local coherence; on the other hand, only MLU and local coherence seemed to be significantly impaired in OA. This pattern is consistent with previous studies[4,5], in which a higher decrease of narrative abilities was detected in the oldest subjects, while the same abilities appeared mostly preserved in healthy adults under 70-75 years of age. In particular, our results revealed a sharp drop in the lexical-semantic appropriateness in SOA, expressed by the increase of semantic paraphasias in this group. This evidence strengthens the idea that lexical retrieval might be highly affected by age even in healthy individuals without cognitive or linguistic impairments.

We did not find a significant decrease of phonological and syntactic abilities, which seem to be preserved in ageing (as reported in other studies)[4,11]. Surprisingly, a decline was detected neither in global coherence, which appeared to be more influenced by education, nor in cohesion. Whereas other studies reported a preserved global coherence in healthy ageing[4,12], the apparently spared cohesion contrasts the majority of previous findings. Therefore, the extent of macro-linguistic decline in ageing deserves further investigations.

Despite the size of the groups, this study highlights the importance of narrative assessment in healthy ageing. Future research is hence required, in order to increase not only our understanding of discourse changing during the lifespan but also the chance of promoting narrative training to improve discourse production in the later stages of life.

References

Marini, A., Andreetta, S., del Tin, S., Carlomagno, S. (2011). A multi-level approach to the analysis of narrative language in aphasia. *Aphasiology* 25(11), 1372-1392.

De Beaugrande, R., Dressler, W.U. (1981). *Introduction to Text Linguistics*. London-New York: Longman.

Marini, A. (2018). Neuropsychological Aspects of Language in Older Adults. In S. Masiero, U. Carraro (eds.). *Rehabilitation for Medicine for Elderly Patients*. Cham: Springer.

Marini, A., Boewe, A., Caltagirone, C., Carlomagno, S. (2005). Age-related Differences in the Production of Textual Description. *J Psycholinguist R* 34(5), 439-463.

Kemper, S., Rash, S., Kynette, D., Norman, S. (1990). Telling stories: The structure of adults' narratives. *Eur J Cogn Psychol* 2(3), 205-228.

Kemper, S., Sumner, A. (2001). The Structure of Verbal Abilities in Young and Older Adults. *Psychol Aging* 16(2), 312-322.

Glosser, G., Deser, T. (1992). A Comparison of Changes in Macrolinguistic and Microlinguistic Aspects of Discourse Production in Normal Aging. *J Gerontol* 47(4), P266-P272.

Duong, A., Ska, B. (2001). Production of Narratives: Picture Sequence Facilitates Organizational but Not Conceptual Processing in Less Educated Subjects. *Brain Cognition* 46(1-2), 121-124.

Pistono, A., Pariente, J., Bézy, C., Pastor, J., Tran, T.M., Renard, A., Fossard, M., Nespoulous, J., Jucla, M. (2017). Inter-individual variability in discourse informativeness in elderly populations. *Clin Linguist Phonet* 31(5), 391-408.

Juncos-Rabadán, O. (1996). Narrative Speech in the Elderly: Effects of Age and Education on Telling Stories. *Int J Behav Dev* 19(3), 669-685.

Nippold, M.A., Cramon, P.M., Hayward-Mayhew, C. (2014). Spoken language production in adults: Examining age-related differences in syntactic complexity. *Clin Linguist Phonet* 28(3), 195-207.

Cooper, P.V. (1990). Discourse Production and Normal Aging: Performance on Oral Picture Description Tasks. *J Gerontol* 45(5), P210-P214.

Nasreddine, Z.S., Phillips, N.A., Bédirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J.L., Chertkow, H. (2005). The Montreal Cognitive Assessment, MoCA: A Brief Screening Tool For Mild Cognitive Impairment. *J Am Geriatr Soc* 53(4), 695-699.

De Renzi, A., Vignolo, L.A. (1962). Token test: A sensitive test to detect receptive disturbances in aphasics. *Brain* 85, 665-678.

Luzzatti, C., Willems, K., DeBleser, R. (1991). *Aachener Aphasie test* (Versione Italiana). Firenze: Organizzazioni Speciali.

Kertesz, A. (1982). *Western Aphasia Battery*. New York: Grune & Stratton.

Goodglass, H., Kaplan, E. (1972). *The Boston Diagnostic Aphasia Examination*. Philadelphia: Lea & Febiger.

Huber, W., Gleber, J. (1982). Linguistic and non-linguistic processing of narratives in aphasia. *Brain Lang* 16, 1-18.

Nicholas, L., Brookshire, R. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *J Speech Hear Res* 36(2), 338-350.

Marini, A., Carlomagno, S. (2004). *Analisi del discorso e patologia del linguaggio*. Milano: Springer.