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Pragmatic assessment in healthy aging: a cognitive approach

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Introduction

The ability to communicate effectively in a social context may decrease as a consequence of the normal aging process. This may also depend on physiological and neurological changes as well as changes in the personal environment, such as a reduction in the number of social contacts and a transformation of the social role, as in the case of retirement, which usually characterize old age. Older adults frequently show a generalized cognitive decline[1], caused by a reduction in the cortical connectivity of the frontal lobe[2]; this primarily affects high-order cognitive abilities such as executive functions (EFs), i.e. planning, working memory and inhibition, and is accompanied by an alteration in hearing and speech processes. These changes may affect the ability to use language, resulting in difficulty retrieving and recalling names, circumlocution, reduced syntactic complexity, and prosodic alterations, which may be accompanied by defective emotion recognition[3].
However, few studies in the literature have provided a complete assessment of communicative-pragmatic performance in old age; moreover, little attention has been paid to evaluating the role played by the decline in cognitive abilities such as Theory of Mind (ToM), the ability to attribute mental states to oneself and to others[4] and EFs, in explaining this decline.

Methods

Sample: The following three age groups participated in the study: *i.)* 20 healthy Old Adults (OA, 10 males, 10 females) ranging in age from 65 to 75 years (M = 69.3; SD = 3.2, with a mean of 12.1 years of education (SD = 3.7); *ii.)* 20 healthy Senior-Old Adults (SOA: 7 males, 13 females) ranging in age from 76 to 86 years, (M = 79.9 years; SD = 2.9) with a mean of 11.0 years of education (SD = 5.1); *iii.)* 20 healthy controls (Control Group, CG, 11 males, 9 females), ranging in age from 20 to 40 years, and with a mean of 13.9 years of education (SD = 4.4); no significant differences between groups were found on an educational level (F = 2.66; p = .079). Exclusion criteria were: 1) the presence of severe cognitive or linguistic deficits 2) evidence of current or past neurological disorder (e.g., epilepsy) 3) substance or alcohol use disorder 4) anamnesis of major neurological or neuropsychological disease 5) hearing or vision problems 6) history of head injury 7) taking mood stabilizers. All the participants were Italian native speakers.
Finally, only subjects with sufficient cognitive and communication skills, as resulting from the achievement of a cut-off score in the Montreal Cognitive Assessment (MoCA)[4] and the Token Test[5] were included in the sample.

Material. We used the Assessment Battery for Communication (ABaCo)[6,7,8,9] to evaluate communicative-pragmatic ability. The ABaCo is a validated clinical tool for investigating all the

main pragmatic aspects involved in communication and different communicative modalities and it provides a broad assessment of participants' pragmatic performance. It is characterized by five scales: linguistic, extralinguistic, paralinguistic, contextual and conversational. With the sole exception of the conversational one, each scale of the ABaCo is divided into two subscales: comprehension and production.
Furthermore, we evaluated: Executive functions (EFs) - working memory (Digit and Listening Span tests, Prose memory test), inhibition (Stroop test), cognitive flexibility (Nelson's test) and Theory of Mind (ToM) - describing the emotional and mental state (Reading the Mind in the Eyes test), first-order ToM (Strange stories tasks: mentalistic and physical) and second-order ToM tasks.

Data analysis
To investigate the presence of significant differences in communicative-pragmatic performance, we performed a 2x3 repeated measures ANOVA with a within-subjects factor of Scale (two levels: comprehension vs. production sub-scales) and a between-subjects factor of Group (three levels: Senior-Old Adults, Old Adults and Controls). We performed a correlation analysis (Pearson's r) to evaluate the correlation between communicative-pragmatic ability (evaluated using the ABaCo) and Age, EFs and ToM, and applied a regression analysis to the cognitive factors that significantly correlated with pragmatic performance.

Results

The ANOVA revealed a main effect of Group ($F = 11.44$; $p < .001$; $\eta 2p = .286$, three levels: CG, OA and SOA) on pragmatic performance evaluated using the ABaCo and a main effect of subscale ($F = 7.86$; $p = .007$; $\eta 2p = .12$) (comprehension vs. production). The interaction effect was non-significant, Group x Scale ($F = .94$; $p = .40$; $\eta 2p = .03$). A Bonferroni-corrected paired contrast revealed that OA ($p < .001$) and SOA ($p = .001$) performed worse than CG, while no difference was found between the two groups of elderly subjects ($p = 1.0$).

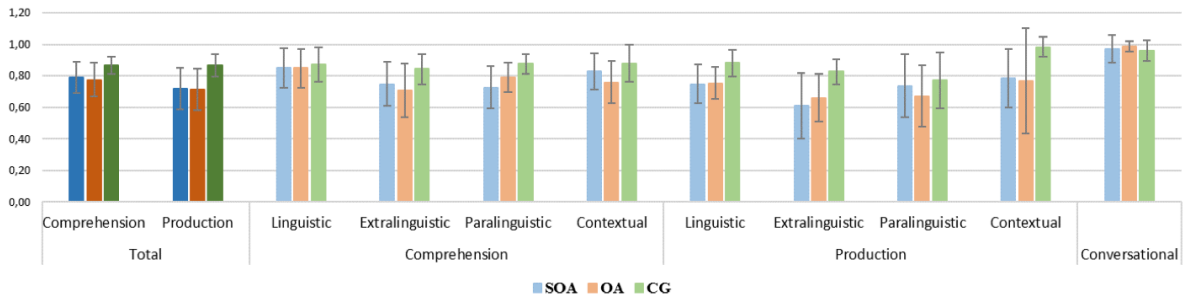

Figure 1. Participants' mean scores on the ABaCo

Table 1 shows the results of the cognitive tests. The ANOVAs revealed a main effect of Group ($3.42 < F < 19.84$; $.0001 < p < .04$) on performance in all the cognitive and ToM tests, with the only exceptions being the Prose memory test ($F = 1.57$; $p = .022$), Stroop test ($F = .040$; $p = .96$) and ToM Strange Stories ($F = 1.17$; $p = .21$). Performance on the ABaCo was correlated with Age ($r = -.55$; $p < .001$), EFs (Listening Span test ($r = .49$; $p < .001$), Forward Digit Span test ($r = .28$; $p < .05$), Nelson's test ($r = .43$; $p = .001$), ToM REM test ($r = .58$; $p < .001$) and ToM second-order stories task ($r = .32$; $p = .011$). By contrast, performance on the ABaCo did not

correlate with the Prose memory test (r = .18; p = .18), Backward Digit Span test (r = .18; p = .16), Stroop Test (r= -.03; p = .82) or first-order ToM Strange Stories (mentalistic: r = .17; p = .15 and physical r = .18; p = .17).
A Stepwise regression analysis (Model fit: R2 = .33; R2 adj = .32; Std. err. = .08) showed that only the Reading the Mind in the Eyes test (β = .58; t = 5.06; p < .001) was a significant predictor of participants' communicative-pragmatic performance on the ABaCo (see Table 1).

	Test	Group	Mean	SD
Executive functions	Forward Digital Span	SOA	5,47	1,98
		OA	6,37	1,92
		CG	7,29	2,05
	Backward Digital Span	SOA	4,95	2,63
		OA	5,65	1,95
		CG	6,95	2,70
	Listening Span	SOA	16,35	5,35
		OA	18,00	6,00
		CG	26,56	5,10
	Prose memory	SOA	10,60	3,42
		OA	10,38	2,89
		CG	11,79	1,37
	Nelson's test	SOA	3,40	2,11
		OA	5,25	2,17
		CG	6,10	1,12
	Stroop	SOA	20,22	5,21
		OA	19,96	7,43
		CG	20,57	7,49
Theory of Mind	Strange Stories M.	SOA	4,85	1,18
		OA	4,90	1,17
		CG	5,40	0,82
	Strange Stories Ph.	SOA	5,05	2,43
		OA	5,35	1,87
		CG	5,74	1,66
	ToM II order	SOA	0,85	0,67
		OA	1,30	0,73
		CG	1,85	0,37
	RME	SOA	17,25	3,35
		OA	18,63	2,71
		CG	22,70	3,29

Table 2. Mean value distributions and standard deviations of tests evaluating EFs and ToM.

Conclusion

The results indicate a generalized decline in communicative-pragmatic ability in both elderly age groups (OA and SOA), compared to the control group (CG). This result confirms the hypothesis that communicative-pragmatic ability decreases in the aging process, in line with other studies[7]. Moreover, all the participant groups performed better in comprehension tasks than in those on the production scale.

The regression analysis showed that only ToM, specifically the ability to ascribe emotional and mental states (measured by the RME test), was identified as a significant predictor of communicative-pragmatic ability. By contrast, the other cognitive functions, EFs - working memory, inhibition and cognitive flexibility - in addition to performance on first and second-order ToM tasks, were not found to have a specific role as predictors in explaining participants' pragmatic performance.

Despite the limit of including a small number of participants who were not balanced by gender, the present study shows that elderly people may have a specific communicative-pragmatic impairment and highlights the importance of promoting training specifically focused on improving such ability[10,11].

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