

Desempenho de adultos brasileiros normais na prova semântica: efeito da escolaridade****

Performance of normal Brazilian adults in a semantic test: effect of literacy

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Abstract

Background: modern concepts on the neuropsychological bases of language consider that its network has a direct relation with the support systems such as attention and memory. Semantic memory constitutes the basis of knowledge, communication and learning. Semantic knowledge is consolidated with the exposure to information and the possibility to integrate information. Thus, aging and literacy can be associated to semantic knowledge. Aim: to analyze in normal Brazilian adults the interference of literacy through the performance in a semantic test. Method: 56 normal Brazilian adults, 20 males and 36 females, with ages between 20 and 56 years and literacy between 1 and 20 years. Participants were divided in two groups according to years of literacy: Group 1 (n = 31) with 1 to 8 years and Group 2 (n=25) with more than 8 years. The semantic test consisted on the presentation of questions related to 10 pictures. These questions involved: category, physical traces and function. After the questions, the naming of the pictures was requested. Results: the level of literacy had an influence on the performance of the participants. There were differences between the groups regarding the judgment of the semantic traces and in the naming task: Group 2 presented better scores in most of the tasks. Negative questions presented a higher number of errors. The qualitative analyses of the answers obtained in the naming task indicate that the animated figures presented a higher number of deviant answers, with a higher occurrence of substitutions by a coordinated answer. Conclusion: it was possible to observe that low literacy levels had a negative influence on the performance presented in tasks involving semantic knowledge, judgment of traces and naming, particularly when involving animated pictures.

Key Words: Cognition Disorders; Diagnosis; Semantics; Educational Status; Neuropsychological Tests.

Resumo

Tema: nas modernas visões sobre as bases neuropsicobiológicas da linguagem, aceita-se seu funcionamento em estreita relação com sistemas de suporte, como atenção e memória. A memória semântica constitui a base do conhecimento, comunicação e aprendizado. O conhecimento semântico se consolida com a exposição a informações e a possibilidade de integração dessas informações. Assim sendo, a idade e a escolaridade podem estar associadas ao conhecimento semântico. Objetivo: analisar a interferência do nível de escolaridade no desempenho, de adultos brasileiros normais, na prova semântica. Método: cinquenta e seis brasileiros normais, vinte do sexo masculino, trinta e seis do feminino, com faixa etária variando entre vinte e sessenta e cinco anos, e escolaridade entre um e vinte anos, foram divididos em dois grupos, de acordo com o nível de escolaridade. O Grupo 1 (N = 31) com um a oito anos de escolaridade; e o Grupo 2 (N = 25) com escolaridade acima de oito anos. A prova semântica consistiu em apresentar questões, em relação a dez figuras, sobre categoria, traço físico, e função, e após as questões solicitar a nomeação dessas figuras. Resultados: o nível de escolaridade influenciou o desempenho dos sujeitos. Houve diferença entre os Grupos em julgamento de traços semânticos e na nomeação, onde o Grupo 2 obteve os melhores escores na maioria das provas. As questões negativas foram as que apresentaram o maior número de erros. A partir da análise qualitativa das respostas na nomeação observou-se que as figuras de seres animados foram as que mais apresentaram respostas desviantes, com maior ocorrência de substituições por itens coordenados. Conclusão: foi possível observar que o menor nível de escolaridade influenciou o desempenho negativamente, em tarefas de conhecimento semântico, em ambos julgamento de traços e nomeação, particularmente na categoria animados.

Palavras-Chave: Transtornos Cognitivos; Diagnóstico; Semântica; Escolaridade; Testes Neuropsicológicos.

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Introduction

In modern conceptions about neural, psychological and biological bases of language, its functioning is accepted in a narrow relation with support systems. For oral language, the attention and memory are fundamental systems.

Memory is the process by which what we learn persists along time (Squire and Kandel, 2003). It consists in a set of the interrelated multiple systems (Hopper and Bayles, 2001). The long term memory includes a non declarative subsystem that is in charge of non verbal processing, as conditionings, abilities and habits; and a declarative subsystem, that includes the episodic and semantic memory (Squire and Kandel, 2003) and can be expressed in conscientious way (Budson and Price, 2005). The present investigation is about the semantic memory abilities.

This study is about the knowledge that we have on physical, social and mental worlds, on the meaning of the words, on geographic knowledge, on social customs, people and experiences, colors, smells and textures (Baddeley, 1998; Budson and Price, 2005). Its importance is immense because it constitutes the base of the knowledge, which allows the object use, food recognition, reaction to environment stimulations, decisions in world, communication and learning (Snowden, 2002).

The way that information is organized brought the development of theories and models about the semantic memory. The semantic net notion of Collins and Quillian (1969) foresees a hierarchically arranged representation, where the concepts are represented as knots and each knot is associated with a number of properties. From it, the idea of cognitive economy appears where a trace is applied to many items; and instead of being tied to each element, it will be related to a more general concept. Later, another revised net model appears and foresees a diffuse activation (Collins and Loftus). With the less rigid net, the concept of semantics distance appears, where concepts highly related are closer and the distance reflects the easiness with which the excitement could flow from a knot to the next one. When two concepts are stimulated in the net, the activation of each one is spread through the net until the two concepts find each other.

In contraposition to the bottom-up theory, Levelt et al. (1999) and the modern connections defend the idea that the activation of lexical representations occurs in net and not on a hierarchic way. Thus, the access to hyperonymous is not condition for the nomination.

Regarding the semantic memory organization, studies of Warrington and Shallice suggested its division in two great domains: animate and inanimate beings (Baddeley, 1998). Beyond these, other categories are suggested, as parts of the body and musical instruments.

Problems of nomination of different categories, presented by aphasic individuals, led to believe that different areas of the brain are related, in a more intense way, in different dimensions of perceptual entrances and different associative and exit characteristics. The standard of semantic deficits can reflect the standard of sensorial dimensions that contribute to the identification of items from different classes.

Then, it is possible to establish correlations between the nature of memory disorders and cortical or sub cortical affections related the determined illnesses. The neurological disorders that can be associated more frequently to semantic memory deficits include degenerative processes, as Alzheimer and semantic dementia; herpetic encephalitis; epilepsy of temporal lobe; encephalic trauma; and Global aphasia (Snowden, 2002).

When the system is damaged, the capacity to access the lower and more detailed knots of the semantic system is reduced; however the subjects can still be capable to access the highest levels. This way, selective loss of specific information and preservation of generic attributes tends to occur (Gainotti et al., 1996). Certain types of semantic errors reflect more serious disorders; for example, super commanded errors are more frequent in patients with dementia than in normal seniors (Nicholas et al., 1996).

The semantic knowledge is consolidated with exposition to information and the integration possibility of this information (Rüegg, 2004). Thus, the age and the educational status can be associated to a greater and more consistent semantic knowledge. On the other hand, seniors are more susceptible to semantic memory alterations for presenting access deficits to the knowledge without damage of the recognition. The age still brings the risk to develop neurological illnesses that attend a course with these deficits.

Nyberg et al. (2003) compared the performance of three groups where only age varied (35-80 years), in tasks of access, recognition, fluency and semantic knowledge. For semantic memory, there was an addition in the groups of medium age and young seniors, and later a decrease. In general, the results support the vision that the episodic memory is more sensible to the age factors than the semantic memory.

The educational status has been associated to a good performance in cognitive tasks (Wiederholf et al., 1993). This association was also proven by studies with speakers of the Brazilian Portuguese with nomination tests (Mansur et al., 2006), and fluency for semantic categories studies (Brucki and Rocha, 2004)

For Rüegg (2004), the effect of age seemed to be annulled, when the educational status was high, in nomination, verbal fluency, and definition of categories tests, what proves the interference of the educational status in semantic knowledge of the subjects in this sample. In the study carried through by Tallberg (2005) the results had shown that high educational status, good performance in global cognitive abilities test (FSIQ), in verbal fluency, and in other lexical tests presented a significant positive correlation with good performance in the Boston Nomination test, while genre and age presented a smaller influence.

Some instruments can be used in evaluation of semantic memory, among them is the semantics test, of the Boston Diagnosis Test of Aphasia (BDTA) (Goodglass et al., 2001), that allows to verify the integrity of the conceptual representation of drawn objects, by means of questions on traces and properties, and by the nomination of the item after answering the questions.

The aim of this study was to analyze the interference of the educational status in the performance, of normal Brazilian adults, in the semantics test of the BDTA.

Method

All participants signed the Term of Free and Clarified Assent (CAPEPesq 788-02), before being submitted to the test.

Subjects

Fifty six normal Brazilians, twenty male and thirty six female participated in this study. The age range was between twenty and sixty five years old ($M = 43,88$; $dp = 12,981$), and educational status was between one and twenty years ($M = 9,14$; $dp = 4,875$). The participants were divided into two groups, according to the educational status. Group 1 (G1) was consisted by thirty one subjects presenting one to eight years of education; and Group 2 (G2) was consisted by twenty five subjects presenting more than eight years of education (Table 1).

In previous studies about application of the BDTA in Brazilian population, as Radanovic et al. (2004), significant differences in the performance of the subjects were found on the sample with educational period below and above 8 years. Based on this study, it was established this range of education years for the constitution of the groups.

Presence of previous or current neurological or psychiatric illnesses; alcoholism, use of drugs, learning disabilities and carriers of non controlled systemic illness was used as exclusion criteria. For citizens with age above 55 years the criterion of normality MOANS was used (Smith and Ivnik, 2003).

Test

Figures: the semantic test was consisted by 10 figures, drawn in black and white, pertaining to five different semantic categories, two of the domain of living beings (five animal items: turkey, pelican, spider, camel and whale; one food item: anise), and three of non living (two tools items: hand saw and wooden rake; one clothes item: glove; one transportation item: ambulance).

Questions: there were three types of questions regarding the figures: about category (c), physical trace (pt), and function (f). Two questions of each type were made, totalizing six questions for each presented figure. The questions were followed by the signals + or -, indicating a positive or negative question, respectively. The positive question demanded an answer yes, and the refusal an answer no. The distribution of positive and negative questions was random in the questions. The examiner showed the figures to the subjects and asked the questions in the listed order. For each question answered correctly a specific score was attributed, being sixty the maximum possible score.

Nomination: after the presentation of the six questions, the examiner requested from subject to name the figure. For each correct nomination a score was attributed, being the possible maximum score ten points. The deviated answers were classified in: synonymous (S); co-ordinated (C); circumlocution (Cir); semantics association (Sa); visual (V); others (O); I do not know (Idk).

Results

When dividing the sample in two groups, the non-parametric statistical test Mann-Whitney was used to compare the Groups in relation to the

variables: age, educational level, c+, c-, pt+, pt-, f+, f-, total in questions, and total in nomination. (Table 2)

In the variable age, the p value founded was 0,837 suggesting that the answers distribution of the subjects, when this parameter was considered, was equivalent on the two groups, that is, there was not interference in the performance in the carried through test.

The educational status influenced in a significant way the performance of the subjects. We can observe that c+ presented statistically significant difference between the groups in the performance in questions c+ (p=0,025), c- (p=0,003), pt+ (p=0,009), pt- (p=0,005), f- (p<0,001), in total questions (p<0,001), and in total nomination (p<0,001), being that G2 presented better scores, except in the questions f+ where the performance of the two groups was similar (p=0,915).

The non parametric correlation test of Spearman was also applied, and as result it was possible to observe that a positive correlation between age and the performance of the subjects in questions type c+ occurred. This means that in these questions, as greater the age of the subjects, greater was the number of correct answers.

It can be observed in table 3 (total number of errors in each type of question), that the negative questions were the ones that presented the greatest number of errors, independently of the type of question.

From the qualitative analysis of the answers in the nomination test it was observed that the figures of living beings (wooden rake, grass-candy, pelican, turkey and whale) were the ones that presented more deviant answers. Table 4 shows the classification of these answers and the frequency with which they occurred, beyond the total of errors in the nomination in each figure. This table also shows that the coordinate (C) answer was the most frequent.

Discussion

This study showed that subjects that present high educational status presented better general performance than the ones with low educational status.

This result gives consistency to the necessity of taking into consideration cultural characteristics as access to formal instruction, when language tests are applied.

A limitation of this study is the fact of not having been studied seniors with age above 75 years. Our sample included individuals in bordering

TABLE 1. Social and demographic distribution of the subjects.

	Group	N	Mean (M)	Standard deviation (dp)
Age	G1	31	44,45	11,977
	G2	25	43,16	14,349
Educational Status	G1	31	5,42	2,262
	G2	25	13,76	2,818

TABLE 2. Comparison between the groups G1 and G2, in relation to the variables: age, educational status, c+, c-, pt+, pt-, f+, f-, total in questions, and total in nomination

	Group	Mean (M)	Standard deviation (dp)	P
Age	G1	44,45	11,977	0,837
	G2	43,16	14,349	
Educational status	G1	5,42	2,262	< 0,001
	G2	13,76	2,818	
c+	G1	9,16	0,820	0,025
	G2	9,60	0,764	
c-	G1	8,84	1,344	0,003
	G2	9,72	0,458	
pt+	G1	9,16	0,934	0,009
	G2	9,72	0,614	
pt-	G1	8,42	1,205	0,005
	G2	9,28	0,678	
f+	G1	9,52	0,769	0,915
	G2	9,44	0,961	
f-	G1	8,00	1,438	<0,001
	G2	9,32	0,852	
Total question	G1	53,10	4,728	< 0,001
	G2	57,24	2,728	
Total Nomination	G1	5,94	1,063	< 0,001
	G2	7,2	0,957	

c+=positive category; c-= negative category; pt+=physical trace positive; pt-=physical trace negative; f+=positive function; f-=negative function.

TABLE 3. Number of errors in each type of question, for each figure.

Figure	c+	c-	pt+	pt-	f+	f-	Total
Turkey	10	11	3	1	10	10	45
Pelican	0	2	1	4	6	19	32
Camel	3	10	4	4	3	4	28
Whale	0	2	15	3	0	26	46
Hand saw	0	1	2	3	1	2	9
Wooden rake	2	1	6	1	0	0	10
anise	11	2	1	5	6	11	36
Spider	2	2	0	1	0	12	17
Glove	7	1	3	4	2	3	20
Ambulance	0	12	0	35	1	0	48
Total	35	44	35	61	29	87	291

c+=positive category; c-= negative category; pt+=physical trace positive; pt-=physical trace negative; f+=positive function; f-=negative function

band, in which the cited effect of age in literature is not observed.

The semantic test had not been applied, until the moment, to healthy Brazilian individuals. It was

Table 4: Classification of deviant answers and the frequency with which they occurred in each figure.

Figure	S	C	Cir	Sa	O	Idk	V	Total
Turkey		2			2	1	16	22
Pelican		36				7		43
Camel								0
Whale		12		3				15
Hand saw		1						1
Wooden rake		20	9		8	10	7	54
Anise	1	37		3	5	8		54
Spider		1						1
Glove				4				4
Ambulance		1						1
Total	1	110	9	10	15	26	24	195
	(0,51%)	(56,41%)	(4,62%)	(5,12%)	(7,7%)	(13,33%)	(12,31%)	(100%)

S=synonym; C=coordinated; Cir=circumlocution; Sa=semantic association; O=other; Idk=I do not know; V=visual

verified that the results line up with the ones of studies of Mansur et al. (2006), Brucki and Rocha (2004), Rüegg (2004), carried through in Brazil and with the ones of Tallberg (2005), Wiederholf et al. (1993), carried through in other countries, in which intense effect of the educational status in the performance in language tests is noticed.

The discussion is relevant on some specific aspects of the test.

The first discussion is about what the test really evaluates. As justification of the authors, the judgment of semantic traces and the figures nomination are indicatives of semantic knowledge. Our results strengthen the idea that they represent instances of diverse nature of this knowledge. To nominate the figure correctly did not estimate necessarily the correctly answer of all the questions, the fact points to the discussion on the semantic knowledge storage for implicit or explicit processes. For Koenig et al. (2005) sediment acquisitions in the course of life, as to nominate, reflect acquisition processes priority implicit, while to Squire and Kandel (2003) and to Budson and Price (2005) the semantic memory is declarative memory system.

On the other hand, such to judge semantic traces as to nominate, they are eminently metalinguistics activities, which are supposed to be sensible to the educational status effect and not necessarily reflect the repertoire of the language speaker. To know an object or a living being does not depend essentially on the conscience of the adding of functional or sensorial properties related to the category to which they belong. This way, it is possible that metalinguistic inabilities mask the experience and knowledge of the subject on the item, constituting error source.

It is still interesting to observe other possible sources of errors, related to visual and lexical characteristics. Among the visual characteristics, the complexity and the visual agreement (Silveri et al., 2002) have been pointed as relevant to the nomination. Among the lexical characteristics, the age of acquisition, the effect of frequency and the agreement of nomination are significant variables in Barbarotto et al. (2001). For Silveri et al. (2002), the effect of frequency of an item would be related to the age of acquisition (the most frequent would be acquired in more precocious age) and to the familiarity, in such way that the most frequent items would be less vulnerable to the loss or damage, since they would be more consolidated in the semantic system. These variables present important influence in the preservation of semantic knowledge, being possible to justify the bad performance of healthy subjects in specific tasks or intense losses in illnesses as Alzheimer's disease (AD), in which, general, frequent and family facts are the most preserved.

The familiarity effect reflected on worse performance of nomination for category of living beings. This fact can represent the fragility of codification of the category, which is usually more affected in patients with AD. As the living beings tend to be less familiar than the inanimate ones, their nomination requires more efficient strategies of search, being also more susceptible to error in most varied semantic-lexical tasks. The deficit in the nomination in normal subjects suggests, thus, that the source of the error is a deficit in levels of lexical retaken, in an unbroken semantic system.

Regarding the general performance in the judgment of semantic traces, it was obtained greater number of errors in questions (-), that demanded the answer "no". Considering the idea of a net organizer of the semantic knowledge, it can be said that more time is taken to analyze a negative instance and to arrive at a negative answer, because this one simply does not depend on the presence or absence of a link; positive or negative evidence is taken into account, and depending on the set of criteria, an answer "yes" or "no" is evoked (Baddeley, 1998). The necessary analysis to the negative questions is more complex, intervening negatively on the performance of the two Groups.

When analyzing the deviant answers in the nomination, it was observed that coordinate answers occurred in greater number. In other words, the error was presented by substitution of the target item by co-hyponym. This type of error does

not represent semantic deficit or loss of sets of concepts, as it occurs in pathological situations.

Several studies can be glimpsed from the present inquiry. The analysis of the visual variables (visual agreement and complexity) and lexical-concept (familiarity) is the next step to complement the understanding of factors that contribute for good or bad performance of the subjects. In this same direction, the observation of the errors of more aged and sick individuals would assist the identification of the deficit degree in both the perceptual and semantic aspects (Nicholas et al., 1996).

Studies with reaction time would bring more precise data about the latency in the judgment of negative or positive traces.

Another interesting possibility would be the analysis of the effect of overlapping information by the semantic pre-activation. Reduction in the time of identification or judgment, on a stimulus,

can occur when it is immediately preceded by a word or figure semantically related to it (Wible et al., 2006). The verification of the facilitation effect by the pre-activation, in subjects with lexical access difficulty, would be a positive contribution to the performance of the subjects (Avila et al., 2001).

Conclusion

The study on judgment of semantic traces, combined to the nomination, brought the discussion interesting aspects about the organization of the semantic knowledge. Its evaluation allowed the observation of the effect of social and cultural variables evidenced by the educational status, in language tasks. It disclosed items that generate difficulties for the visual and lexical analysis, pointing to possible adaptations, mainly visual, in a way to reach greater sensitivity of the instrument, when applied to diagnosis.

References

- AVILA, C.; RALPH, M. A. L.; PARCET, M. A.; et al. Implicit word cues facilitate impaired naming performance: evidence from a case of anomia. *Brain Lang.*, Orlando, v. 79, n. 2, p. 185-200, nov. 2001.
- BADDELEY, A. Knowledge. In: BADDELEY, A. *Human memory: theory and practice*. Mariland: Allyn & Bacon, 1998. cap. 13, p. 319-355.
- BARBAROTTO, R.; CAPITANI, E.; LAICONA, M. Living musical instruments and inanimate body parts? *Neuropsychol.*, Orlando, v. 39, n. 4, p. 406-414, jan. 2001.
- BRUCKI, S. M. D.; ROCHA, M. S. G. Category fluency test: effects of age, gender and education on total scores, clustering and switching in Brazilian Portuguese - speaking subjects. *Braz. J. Med. Biolog. Res.*, Ribeirão Preto, v. 37, n. 12, p. 1771-1777, dez. 2004.
- BUDSON, A. E.; PRICE, B. H. Memory dysfunction. *New England J. Med.*, v. 352, n. 7, p. 692-699, 2005.
- GAINOTTI, G.; DI BETTA, A. M.; SILVERI, M. C. The production of specific and generic associates of living and nonliving, high- and low-familiarity stimuli in Alzheimer's disease. *Brain Lang.*, Orlando, v. 54, n. 2, p. 262-274, ago. 1996.
- GOODGLASS, H.; KAPLAN, E.; BARRESI, B. *The assessment of Aphasia and related disorders*. Philadelphia: Lippincott Williams & Wilkins, 2001.
- HOPPER, T.; BAYLES, K. A. Management of neurogenic communication disorders associated with dementia. In: CHAPPEY, R. (Ed.). *Language intervention strategies in Aphasia and related neurogenic communication disorders*. 4. ed. Philadelphia: Lippincott Williams & Wilkins, 2001. cap. 35, p. 829-846.
- KOENIG, P.; SMITH, E. E.; ANTANI, S.; et al. Can Alzheimer's disease patients learn a novel semantic category by implicit means? *Brain Lang.*, Orlando, v. 95, n. 1, p. 16-17, out. 2005.
- LEVELT, W. J. M.; ROELOFS, A.; MEYER, A. S. A theory of lexical access in speech production. *Behav. Brain Sci.*, Cambridge, v. 22, n. 1, p. 1-38, 1999.
- MANSUR, L. L.; RADANOVIC, M.; ARAÚJO, G. C.; TAQUEMORI, L. Y.; GRECO, L. L. Teste de nomeação de Boston: desempenho de uma população de São Paulo. *Pró-Fono R. Atual. Cient.*, Barueri, v. 18, n. 1, p. 13-20, jan.-abr. 2006.
- NICHOLAS, M.; OBLER, L. K.; AU, R.; ALBERT, M. L. On the nature of naming errors in aging and dementia: a study of semantic relatedness. *Brain Lang.*, Orlando, v. 54, n. 2, p. 184-195, ago. 1996.
- NYBERG, L.; MAITLANDS, S. B.; RÖNNLUND, M.; et al. Selective adult age differences in an age-invariant multifactor model of declarative memory. *Psychol. Aging*, Washington, v. 18, n. 1, p. 149-160, mar. 2003.
- RADANOVIC, M.; MANSUR, L. L.; SCAFF, M. Normative data for the Brazilian population in the Boston diagnostic aphasia examination: influence of schooling. *Braz. J. Med. Biol. Res.*, Ribeirão Preto, v. 37, n. 11, p. 1731-1738, nov. 2004.

RÜEGG, D. *Análise da influência de variáveis demográficas: escolaridade e idade no conhecimento de categorias semânticas em indivíduos normais*. 2004. 114 f. Dissertação (Mestrado em Ciências da saúde - área de Fisiopatologia Experimental) - Faculdade de Medicina, Universidade de São Paulo, São Paulo.

SILVERI, M. C.; CAPPÀ, A.; MARIOTTI, P.; PUOPOLO, M. Naming in patients with Alzheimer's Disease: influence of age of acquisition and categorical effects. *J. Clin. Exper. Neuropsychol.*, London, v. 24, n. 6, p. 755-764, set. 2002.

SMITH, G. E.; IVNIK, R. J. Normative neuropsychology. In: PETERSEN, R. C. *Mild cognitive impairment*. New York: Oxford, 2003. p. 63-88.

SNOWDEN, J. Disorders of semantic memory. In: BADDELEY, A. D.; KOPELMAN, M. D.; WILSON, B. A. (Eds.). *The handbook of memory disorders*. 2. ed. England: John Wiley & Sons, 2002. cap. 14, p. 293-314.

SQUIRE, L. R.; KANDEL, E. R. *Memória: da mente às moléculas*. Trad. Dalmaç e Quillfeldt. Porto Alegre: Artmed, 2003.

TALLBERG, I. M. The Boston naming test in Swedish: normative data. *Brain Lang.*, Orlando, v. 94, n. 1, p. 19-31, jul. 2005.

WIBLE, C. G.; DUKE HAN, S.; SPENCER, M. H.; et al. Connectivity among semantic associates: an fMRI study of semantic priming. *Brain Lang.*, Orlando, v. 97, n. 3, p. 294-305, jun. 2006.

WIEDERHOLF, W. O.; CAHN, D.; BUTTERS, N. M.; et al. Effects of age, gender and education on selected neuropsychological tests in an elderly community cohort. *J. Am. Geriatr. Soc.*, Oxford, v. 41, p. 639-647, 1993.