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Repetition in Aphasia

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ABSTRACT

Forty-one Spanish-speaking left hemisphere-damaged patients were taken and divided into seven groups (transcortical motor, Broca aphasia, conduction aphasia, Wernicke aphasia, anomic aphasia, alexia without agraphia, and global aphasia). Three repetition tests (words, high-probability and low-probability sentences) taken from the Boston Diagnostic Aphasia Examination Spanish version (Goodglass and Kaplan, *Evaluaciòn de las afasias y de transtomos similares*, 1979) were given. Repetition errors were specially associated with perisylvian aphasias (Broca, conduction, and Wernicke). However, in all aphasic groups some repetition errors were observed. They were not only quantitative but also qualitatively different. Depending on the specific repetition task, errors may be evident or unnoticed in a particular aphasic group. Different mechanisms underlying repetition deficits are proposed: limitation of the auditory–verbal short-term memory, difficulties at the level of the phonological production, defects in phoneme recognition, and deficits in semantic and syntactic comprehension.

Repetition has become perhaps the most important language feature in aphasia classification (Benson and Geschwind 1977; Alexander and Benson 1992). Aphasia groups can be distinguished according to the ability to repeat: in transcortical aphasias repetition is spared. Broca's, Wernicke's and especially conduction aphasics present deficits in their ability to repeat spoken language (Benson 1979; Alexander and Benson 1992; Berndt 1988). However, the ability to repeat depends upon a series of variables such as phonological composition, lexical status, length, syntactic form, predictability, and grammatical class (Albert *et al.*). This holds true in normal people as well as in aphasic patients (Berndt 1988).

As isolated repetition deficit has been considered as the crucial clinical sign in conduction aphasia. Conduction aphasia has usually been defined as an aphasia

characterized by relatively fluent spontaneous language, good comprehension, and poor repetition with the presence of literal paraphasias (e.g. Benson 1979; Benson *et al.* 1973; Kertesz 1979, 1985).

The possibility of several mechanisms, each of which are capable of given rise to deficient repetition has led to the postulation of different forms of conduction aphasia: efferent/afferent (Kertesz 1979, 1985), or reproduction/repetition (e.g. Shallice and Warrington 1977; Caplan *et al.* 1986). The efferent–reproduction type involves the phonemic organization and representation of words and correlates with parietal and insular lobe damage, while the afferent–repetition involves short-term memory, affects the repetition of large stretches of material and arises from temporal damage (e.g., Caramazza *et al.* 1981). Luria (1976) considers that what has been referred to as conduction aphasia corresponds to two different types of linguistic defect. He uses the term afferent motor aphasia to refer to the efferent–reproduction parietal type mentioned above. Luria considers this to involve an inability to analyze, manipulate, or otherwise appreciate the featural composition of movements required to produce language sounds (Luria's *articulemes*). He observes this as a type of kinesthesic apraxia of speech. The second type of conduction aphasia (afferent–repetition) is associated with short-term verbal memory deficits, and included in Luria's acoustic–amnesic aphasia.

Despite the great importance of repetition in aphasia, only a few studies have been specially devoted to repetition defects analysis in aphasia (e.g. Gardner and Winner 1978). Repetition cannot be considered a simple phenomenon. Goldstein (1948) argued that repetition implies sensory perception, motor speech capacity, 'inner speech', understanding of the material to be repeated, the attitude and educational level of the subject, and the context in which repetition occurs. According to Luria (1966, 1976) repetition requires a process of auditory (phonemic) analysis, control of speech articulation, and adequate audioverbal memory. Luria underlines that repetition of different types of materials may require the involvement of distinct neuroanatomical substrates.

Gardner and Winner (1978) analyzed repetition defects in a group of 44 aphasic patients, divided into eight groups (anomic, transcortical sensory, transcortical motor, isolation, Broca, Wernicke, conduction, and mixed anterior), and used a test consisting of 11 types of items, and two conditions (immediate and delayed repetition). In the immediate condition, mixed anterior group presented the highest number of errors (about 50%), followed by Broca (about 35%), conduction (about 32%), Wernicke (about 30%), transcortical motor (about 20%), transcortical sensory and isolation (about 10%), and anomic patients (about 3%). Performance was observed to be a product of the length and the meaningfulness of the stimulus items; the delayed condition although aided Broca aphasics, impeded anomic aphasics. Unfortunately, in this study only short elements (from one to eight syllables) were included.

The purpose of the current research was to analyze the frequency of repetition errors in an unselected sample of aphasic patients.

METHOD

Subjects

Forty-one right-handed, monolingual Spanish-speaking aphasic patients with left hemisphere damage were studied (17 women, 24 men; average age 41.48, age range 20–65). These subjects presented various etiologies (vascular = 29; tumoral = 9; traumatic = 3). The cerebral damage had evolved over a period varying from 1 to 4 months. Patients had no background of previous neurological or psychiatrical illness. Average schooling was 8.32 years (range 4–16). All lesions were corroborated by mean of computarized axial tomography.

Procedure

Besides the general neurological and neuropsychological exams, the following tests were given to each patient: (1) the Boston Diagnostic Aphasia Examination—Spanish version (Goodglass and Kaplan 1979), and (2) the Token Test—shortened version (De Renzi and Faglioni 1978).

Patients were divided into seven groups, and the following criteria were jointly considered: results on the Boston Diagnostic Aphasia Examination, the Token Test, and the general neurological and neuropsychological examination. The following groups were formed: (1) transcortical motor aphasia (left prefrontal damage) (six patients), (2) Broca's aphasia (five patients), (3) conduction aphasia (six patients), (4) Wernicke's aphasia (13 patients), (5) anomic or amnesic aphasia (four patients), (6) alexia without agraphia (left occipital damage not associated with an evident spoken language deficit) (three patients) and (7) global aphasia (four patients). Table 1 presents the general characteristics of the sample.

Repetition Scores

The three subtests (words, high-probability, and low-probability sentences) of the Repetition section of the Boston Diagnostic Aphasia Examination were analyzed and compared with normative scores obtained in an equivalent in age and educational level group (Rosselli *et al.* 1990). This test was selected because: (1) it includes different types of repetition, and (2) it is one of the most extensively used in aphasia assessment.

TABLE 1
General characteristics of the sample

Patient	Sex	Age	Years of education	Etiology	Category	BDAE Auditory comprehension	BDAE naming	BDAE repetition	Token
1	M	55	6	vascular	TMA	+0.75	+1.00	+0.50	30
2	M	20	11	vascular	TMA	+1.00	+1.00	+1.50	27
3	F	47	5	tumor	TMA	+1.00	+1.00	+1.00	33
4	F	56	16	tumor	TMA	+0.50	+0.75	+1.00	26
5	M	45	4	vascular	TMA	+0.50	+1.00	+1.50	24
6	F	23	11	tumor	TMA	+1.00	+1.00	+1.50	26
7	M	26	16	vascular	Broca	+0.50	+1.00	−0.25	26
8	M	36	16	vascular	Broca	+0.50	+0.75	−0.25	30
9	F	25	5	vascular	Broca	0.00	−1.00	−1.00	18
10	F	46	5	vascular	Broca	−0.25	−1.00	−1.00	12
11	F	22	5	vascular	Broca	−0.75	+0.25	−0.75	14
12	M	35	5	tumor	Conduction	+0.50	+1.00	−0.25	26
13	F	61	8	vascular	Conduction	+0.75	−1.25	−1.25	22
14	F	39	5	vascular	Conduction	+0.75	+0.50	−1.00	31
15	M	33	8	vascular	Conduction	+1.00	+0.50	−0.25	32
16	F	43	5	tumor	Conduction	+1.00	+1.50	−0.25	31
17	F	26	11	vascular	Conduction	+1.00	+1.50	−0.50	27
18	M	63	6	vascular	Wernicke	−0.50	0.00	−1.00	17
19	M	34	11	tumor	Wernicke	−0.25	0.00	+0.25	18
20	M	31	8	vascular	Wernicke	−1.00	0.00	−0.50	14
21	F	48	5	vascular	Wernicke	−1.00	−0.50	−1.00	18

Continued

Table 1 Continued

Patient	Sex	Age	Years of education	Etiology	Category	BDAE Auditory comprehension	BDAE naming	BDAE repetition	Token
22	M	18	9	trauma	Wernicke	−1.00	−1.00	−1.00	15
23	F	53	4	vascular	Wernicke	−1.50	−1.00	−1.50	5
24	M	28	5	trauma	Wernicke	−1.00	−0.50	+0.25	22
25	M	63	9	vascular	Wernicke	−1.00	−0.50	−0.25	14
26	M	60	11	vascular	Wernicke	−1.00	−1.00	−0.50	10
27	M	46	16	tumor	Wernicke	−1.00	−0.50	0.00	8
28	M	28	5	trauma	Wernicke	−0.75	−0.25	−1.50	18
29	F	37	16	vascular	Wernicke	−1.50	0.00	−1.50	4
30	M	46	4	vascular	Wernicke	−0.25	+0.50	+0.25	24
31	F	43	7	tumor	Anomic	+1.00	−0.25	+0.25	30
32	M	36	5	tumor	Anomic	−0.50	0.00	−0.50	17
33	M	65	11	vascular	Anomic	+0.50	0.00	+1.50	28
34	M	30	11	vascular	Anomic	0.00	−0.50	+0.75	24
35	M	54	5	vascular	Alx w/o agr	+1.00	+1.00	+1.25	27
36	M	47	5	vascular	Alx w/o agr	+0.75	+1.00	+1.25	30
37	M	65	16	vascular	Alx w/o agr	+1.00	+1.00	+1.25	30
38	F	25	5	vascular	Global	−0.75	−1.00	−1.00	8
39	M	31	5	vascular	Global	−1.00	−1.25	−1.50	11
40	F	46	5	vascular	Global	−1.00	−1.50	−1.25	11
41	F	22	5	vascular	Global	−1.50	−1.00	−1.25	13

RESULTS

Table 2 presents the general scores obtained in the different groups. It is observed that some repetition errors are encountered even in normal subjects. Excepting anomic and alexia without agraphia groups, the rest of the patients presented some errors when repeating words. Lowest scores were found in global and Broca groups. Repetition of low-probability sentences appeared as the most sensitive task, and even normal subjects eventually failed.

TABLE 2
Repetition scores on the Boston Diagnostic Aphasia Examination in different aphasic groups

	Words			High-probability			Low-probability		
	M	SD	Range	M	SD	Range	M	SD	Range
Normal Group	10.0	0.0	10–10	7.9	0.4	6–8	7.7	0.8	4–8
Transc. Motor	9.8	0.4	9–10	7.6	0.8	6–8	5.4	2.8	1–8
Broca	4.6	3.8	0–8	4.0	3.9	0–7	3.6	3.0	0–7
Conduction	6.3	3.0	1–10	4.3	2.9	0–8	1.7	1.8	0–5
Wernicke	5.8	3.2	0–9	2.7	2.7	0–8	1.4	1.9	0–6
Anomic	10.0	0.0	10–10	5.7	1.6	3–7	4.2	1.1	3–6
Alex w/o Agr	10.0	0.0	10–10	8.0	0.0	8–8	7.8	0.6	6–8
Global	2.7	2.0	1–6	0.0	0.0	0–0	0.0	0.0	0–0

In transcortical motor aphasia associated with prefrontal damage errors resulted from verbal paraphasias and changes in word-order in sentences (e.g., */el abaniko tshino tenìa una esmeralda ekstraordinaria/* (fifth low-probability sentence) → */el abaniko tshino tenìa una esmeralda eksterior/*;*Siga adelante i àgalo si es posible/*(fifth high-probability sentence) → */i siga si es posible/*); in long sentences, these patients often omitted some elements (e.g.*/el fantasma se ṫemontò a trabès del matoṙal en la niebla/*(eighth low-probability sentence) → */el fantasma se ṫemontò en la niebla/*). These errors were particularly evident in low probability sentences. In a certain sense, the sentences were changed to make them more normal and more simpler. Only one patient presented a verbal paraphasia in the word repetition test (1776 → 1976).

Errors in Broca aphasia were due to literal paraphasias (anticipation, substitutions, and deletions) in word repetition, and word-omissions in sentence repetition (e.g., */kinse/* (fifteen) → */kinke/*; */el argumento final del abogado lo konbensiò* (seventh low-probability sentence) → */dogumento pantun abobado komensiò/*). Sentence repetition

was agrammatical, with evident omission of grammatical connectors. It is noteworthy that not only was the mean number of errors very high for the three tests, but so were the standard deviations. Variability in performance was evident. This was the only group in which no differences were disclosed among the three repetition tasks.

In conduction aphasia literal errors, self-correction and approximations to the target word were evident (e.g., */sija/* (chair) → */sida, siga/*;*/el goriòn del granero kapturò un gusano gordo/* (sixth low-probability sentence) → */el koriòn del kradero kasturò un gusano gordo/*; */el fantasma se remontò a trabès del matoral en la niebla/* (eighth low-probability sentence) → */el fankasma, fantansa remoniò a trabès del batoral en la niebla/*). There was a very notable difference between high-probability and low-probability sentence repetition scores. While scores in word and high-probability conditions were better than in Broca patients, scores in the low-probability condition were only half of Broca patients' scores.

In Wernicke's aphasia group, two patients presented a total inability to understand spoken language (pure word-deafness), and consequently they failed to repeat any word or sentence. These two patients had a virtually identical lesion at the level of the posterior insula. If these two patients, are not included, repetition scores would increase in Wernicke's aphasia group (7.4, 3.6, and 1.8 in average respectively for words, low-probability, and high-probability sentences), becoming higher than conduction's and Broca's words repetition scores, but equivalent to conduction's low-probability sentence scores. Literal paraphasias were evident in the repetition of words (e.g., */enfatisar/* (to emphasize) → */elifinar/*) and sentences (e.g., */la tina gotea/* (first low-probability sentence) → */la tija kotea/*; */el goriòn del granero kapturò un gusano gordo/* (sixth low-probability sentence) → */el redor del bramero kapturò un lusero gordo/*). Table 3 presents the percentage of correct repetitions for the different patient groups; for Wernicke's group, pure word-deafness patients were not included.

TABLE 3

Percentage correct repetition for each patient group in the three repetition tests

	Anomic	Transcort	Wernicke	Conduction	Broca	Global
Words	100.0	98.0	74.0	63.0	46.0	27.0
High-prob.	71.2	95.0	45.0	53.7	50.0	0.0
Low-prob.	52.5	67.5	22.5	21.2	45.0	0.0

In anomic or amnesic aphasia errors were disclosed only in sentence repetition, particularly in long-sentences repetition. Errors were due to word-omission and verbal paraphasias (e.g., */el gorion del granero kapturò un gusano gordo/* (sixth low-probability sentence) → */el goriòn de la finca logrò un gusano/*; */siga adelante i àgalo*

si es posible/ (fifth high-probability sentence) → */siga adelante i aga lo posible/*).

Alexia without agraphia patients presented a normal performance in repetition tests, while global aphasics totally failed in sentence repetition, and only could occasionally repeat individual words.

CONCLUSIONS

Repetition deficits are strongly associated with perisylvian aphasias (Broca, Wernicke and conduction). The most severe defect for word repetition is observed in Broca aphasia followed by conduction and Wernicke (if excluding pure word-deafness patients), although the differences among these three groups are very low. Errors in the anomic group are virtually non-existent. These results agree with Gardner and Winner's study (1978). Pure word-deafness patients totally failed all repetition tasks, as has been usually observed (Hecaen and Albert 1978).

Sentence repetition involves some short-term memory. As expected, anomic aphasics presented some errors when repeating sentences. This affirms the assumption that word repetition and sentence repetition are based in different cognitive abilities and "neuroanatomical subtrates" (Luria 1976).

In conduction aphasia repetition errors were particularly evident when repeating low-probability sentences. It has been observed that difficulties in repetition are specially evident in conduction aphasia patients when repeating not only unusual sentences, but also non-sense material (logotomes) (Ardila and Rosselli 1990). When meaningful words or sentences are presented, their performance in repetition tests is very close to that of Broca and Wernicke patients.

As it has been generally underlined, Wernicke's aphasia represents an heterogenous group (e.g., Kertesz 1985). With regard to repetition tasks it was observed a huge variability: some patients were totally unable to repeat any spoken word (associated with pure word-deafness); while other patients presented scores very close to normal scores. However, in our current sample all the patients presented at least some repetition errors, so in word repetition as in sentence repetition.

Left prefrontal damage associated with transcortical motor aphasia correlates with low-probability sentence repetition errors: the patient introduces changes in the sentence in order to make it a more usual and simpler sentence. Sometimes, word omissions in long sentences were observed, probably due to memory and/or attention deficits. Performance in word repetition and high-probability sentences was very close to the performance observed in normal subjects, and only in low-probability sentences, were decreased scores disclosed. This tendency of transcortical aphasics to correct anomalous sentences has been previously reported by Davis *et al.* (1978) and had been mentioned by Luria (1966, 1976) in prefrontal dynamic aphasia patients. Geschwind *et al.* (1968) observed in a mixed transcortical aphasic the ability to supply

conventional completions to stereotyped sayings, and deleting the imperative verb in repetition instructions, indicating that even these patients are not simply performing an acoustic–articulatory translation. Whitaker (1976) reported a severely demented patient able to correct syntactic and phonemic errors when repeating.

Anomic or amnesic patients presented a normal word repetition, but failed in repeating long sentences, probably associated with a verbal memory defect. This memory deficit was observed in Gardner and Winner's study. Alexia without agraphia patients with left occipital damage, presented a normal performance in all repetition tests.

In summary, in all aphasic groups some repetition errors are observed. However, they are not only quantitative but also qualitative different. Depending on the specific repetition task, errors will be evident or unnoticed in a particular aphasic group. Some patients have difficulty repeating because of a pathological limitation of the auditory–verbal short-term memory (in anomic aphasia); other patients can present difficulties at the level of the phonological production (in Broca's and conduction aphasia); some other patients can present defects in phoneme recognition (in Wernicke's aphasia); and even some patients can have deficits in grammatical comprehension (in Broca's aphasia) and complex syntax usage (in transcortical motor aphasia).

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