

Prosody and the Hemispheres

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ABSTRACT

A test was designed in order to assess the ability of brain-damaged subjects to process prosodic information. The test was administered to three groups of subjects; patients who had suffered left or right hemisphere stroke and patients who have had a transitory ischemic attack. The results of the test did not show any significant difference in the performance of the three groups. The purpose of this note is to discuss the test and suggest possible improvements.

1. INTRODUCTION

The role of the right hemisphere in language and communication remains obscure. A widely spread opinion is that the right hemisphere normally has no part in language processing, the exception being persons with reversed or mixed laterality. Some authors claim that the right hemisphere does contribute to language and communication although to a lesser extent than the left (Zaidel 1978, Bradshaw and Nettleton 1981). During the last decade an increasing interest has focused on potential language and communication functions of the right hemisphere. It has been suggested that it plays an important role in the interpretation and handling of paralinguistic aspects of verbal communication, e.g. grasping the abstract content of common words, interpreting figures of speech, solving verbal syllogisms and remembering the general theme of stories (Gardner and Denes 1973, Winner and Gardner 1977, Caramazza, Gordon, Zurif and DeLuca 1976, and Wapner, Hamby and Gardner 1981). Some authors report on disturbances of the ability to evaluate everyday situations and to appreciate humorous material

(Wechsler 1973, Gardner, Ling, Flaum and Silverman 1975, Heilman, Schwartz and Watson 1978).

Several studies have reported the right hemisphere to be involved in the processing of emotional and non-verbal information (Tucker, Watson and Heilman 1977, Ross and Mesulam 1979, Ross 1981). It has also been suggested that the right hemisphere is dominant for the processing of prosodic information (Blumstein and Cooper 1974, Ross and Mesulam 1979, Heilman, Scholes and Watson 1975) but there are authors who reject this hypothesis (Zurif 1972, Schlanger, Schlanger and Gerstman 1976). There are several reports on disturbances of prosodic functions in aphasic subjects (Danly and Shapiro 1982, Danly, Cooper and Shapiro 1983, Ryalls 1982). On the other hand it has been suggested that the cerebral representation of prosodic functions in the right hemisphere mirrors the representation of language in the left hemisphere and that there are clinically distinct syndromes of aprosodia analogous to the syndromes of aphasia (Ross 1981). The author is concerned only with prosody expressing attitudes or emotions.

These results taken together suggest that prosodic functions in speech are affected differently by right and left hemisphere lesions. Right hemisphere lesions might give rise to difficulties in producing and comprehending affectively toned stimuli, whereas left hemisphere lesions might give rise to difficulties in tonal contrasts.

2. PROCEDURE

A test was designed to investigate comprehension, repetition and production of prosodic functions. The test consists of two parts; one exploring verbal contrasts, the other emotional expressions. The linguistic material includes the following contrasts:

- accent 1 versus accent 2

Six minimal word accents pairs were selected. The distinction between members of a pair is mainly marked by pitch variations.

- accent location

Four pairs of words were selected in which the location of accent (stress) is the distinctive feature. The distinction is

marked by pitch variation, accentuation (stress pattern) and vowel quality.

- compound noun versus noun-phrase

Four compound nouns were contrasted with four noun phrases, e.g. blå klocka 'hare-bell' and blå klocka 'blue bell'. The distinctions between the members of a pair is carried by variation in pitch and accent pattern.

All target words and phrases were illustrated and recorded by an actress. The targets were printed on cards in phrases with the exception of the compound words and the noun phrases which were printed in isolation.

The emotional stimulus material consisted of six semantically neutral sentences and four sentences verbally expressing different modes. The modes were: happiness, anger, astonishment and sadness. All sentences were recorded by an actress expressing these modes. The sentences were written down on cards, together with a note on the mode of expression in brackets. Five non-verbal, emotional sounds were recorded. The sounds were: crying, laughter, groaning, moaning and screaming. The outline of the test is schematically displayed in table 1.

To investigate the capacity of the test nine patients with right hemisphere lesions, four with left hemisphere lesions and four patients with the diagnosis transitory ischemic attack (TIA) were tested. All were native speakers of Swedish and right-handed. Patients with severe hearing loss, signs of dementia and age over 70 had been excluded. All brain-damaged patients had suffered ischemic stroke. The patients with left hemisphere lesion all had a history of aphasia but by the time of testing the symptoms were very mild or could not be demonstrated. Yet some patients reported having trouble now and then. The patients were given the test in one or two sessions depending on the endurance of each person. Each testitem was presented once. Since there were many examples of each category this was considered to be sufficient.

3. RESULTS

The test performances were analyzed and the number of errors were tabulated. The average number of errors for each test-

group and each task is displayed in table 2, with the exception for the naming of emotionally toned sentences which are displayed in table 3.

Table 2: The average number of errors per test task.

The answers in the naming task were classified into four categories:

- a) target: the answer is as intended.
- b) synonymous: the answer is synonymous with the intended one.
- c) unrelated: the answer has no obvious relation to the intended one.
- d) reversed: the answer is reversed to the intended one.

Table 3: The average number of answers in the non-target categories.

GROUP	ERRORS		
	RELATED	UNRELATED	REVERSED
RIGHT (N:9)	1.1	1.0	1.2
LEFT (N:4)	0.75	1.0	0.75
TIA (N:4)	2.25	1.25	0.25

The performance on the repetition and production of emotionally toned utterances were extremely varied and were not subject for analysis. Identification of non-verbal emotional sounds was performed without mistakes.

Tabel 1. Schematical display of test items and test tasks.

Test items	Number of stimuli	Test tasks			production
		discrimination	comprehension/identification	repetition	
word accents	12		matched to pictures	repeat auditory stimuli	read aloud from card
word stress	8		-"-	-"-	-"-
noun versus noun phrase	8		-"-	-"-	-"-
emotionally toned utterances	6	tell whether auditory stimuli are expressed the same way or differently	name auditory stimuli	-"-	
a) semantically neutral					
b) semantically loaded	4	-"-		-"-	-"-
non-verbal emotional sounds	5		-"-		

GROUP	VERBAL ASPECTS								NON-VERBAL ASPECT			
	COMPREHENSION			REPETITION			PRODUCTION			DISCRIMINATION		
	ACCENT 1-2	ACCENT LOC	COMP NP	ACCENT 1-2	ACCENT LOC	COMP NP	ACCENT 1-2	ACCENT LOC	COMP NP			
RIGHT N:9	1.7	0.1	1.2	1.7	0	1.3	0.2	0	1.2	0.25		
LEFT N:4	1.0	0.25	0.25	1.25	0	0.25	0	0	0.25	0.25		
TIA N:4	0.5	0.25	0.25	0.25	0	0	0	0	0.25	0.44		

4. DISCUSSION

No conclusion about the nature of prosodic disturbances can be drawn from this material. But on the basis of the results the tasks can be classified into three groups:

Group I: Tasks that were too easy; i.e. all subjects performed them easily and with few mistakes. This group includes accent location and naming of nonverbal emotional sounds.

Group II: Tasks that had so varied results that the tasks themselves must be regarded as inadequate. This group includes repetition and production of emotionally toned utterances.

Group III: Tasks that were hard enough to create difficulties for some of the subjects. In this group belong contrasts between accent 1 and 2, contrasts between compound nouns and noun-phrases and discrimination and naming of emotionally toned sentences.

It should be pointed out that when the repetition tasks are successful in the linguistic part of the test, comprehension and repetition scores are very similar.

The results of the three groups do not show any difference in performance. However, I cannot avoid the suspicion that this might be due to the small number of subjects. The test will be tried on a larger sample of subjects. For the continuation of this study, tasks classified into group I and II will be eliminated as well as the repetition tasks mentioned above.

A new, more comprehensive test will be developed. The following prosodic functions will be explored in the new test:

- syntactic structure
- syllabic structure
- speech acts
- focusing

An additional requirement is that the new test must be less boring than the present one.

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