Perception of English Contrastive Stress by Brain-damaged Adults

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1. Introduction

Like segmental features of language, prosody can be investigated in terms of both production and perception. With respect to the former, the literature is rather rich, consisting of a variety of research studies as well as clinical and other observations of both children and adults, and from a number of different languages. From such studies we gain the impression that prosodic features are early acquired by children and relatively resistant to loss in adults who have suffered brain damage, including people with fairly severe aphasia.

The literature on the perception of prosody is considerably smaller, particularly with reference to aphasia. There are only six studies in which the ability of aphasic subjects to comprehend prosodic information has been investigated - one of phonemic pitch accent in Japanese (Sasanuma et al. 1976), one of lexical tone in Thai (Gandour and Dardarananda 1983), one of correct vs. incorrect placement of syllabic stress in Rumanian (Mihăilescu et al. 1970), and four in English, including Blumstein and Goodglass' 1972 study of the perception of syllabic stress as a means of making syntactic distinctions between noun-verb pairs like *'transport* and *trans'port*, and semantic-syntactic distinctions between noun-noun phrase pairs like *'yellowjacket* and *yellow' jacket*. More recently Baum and her colleagues (1982) found that compared to normal subjects, Broca's aphasics were unable to make distinctions between phonemically similar sentences on the basis of either sentential stress or juncture, or to profit from increased stress on functors in sentences.

The prosodic feature investigated in the current study is English contrastive stress. What contrastive stress is has been a vexed question (Schmerling, 1976); it is used here to mean those variations in pitch, loudness and length that have the effect of highlighting or emphasizing differences in meaning between phrases or sentences.

2. Materials and Methods

2.1. Stimuli

The stimuli for this study were two series of commands based on those found

in the *Token Test* (De Renzi and Vignolo 1962), a widely used test of auditory comprehension in aphasia that holds extralinguistic or contextual cues to a minimum. The test uses a limited repertoire of five colors (blue, green, yellow, white and red), two shapes (circle and square), and two sizes (large and small). There are five parts to the test; in the current study, only Parts I and IV were chosen as models for the stimuli, Part I because it presents items of a level of complexity that would allow subjects with even severe impairments of auditory processing to perform at least some items correctly, and Part IV because it is challenging enough to be likely to elicit errors from subjects with relatively mild impairments.

The stimuli based on Part I of the *Token Test* had the following form:

I-1. Touch the red circle.
I-2. Touch the red *square.*
I-3. Touch the *blue* square.
I-4. Touch the *yellow circle.*
I-5. Touch the *green square.*

These commands were presented to subjects verbally in separate sets with two distinct readings. One of the readings used contrastive stress, emphasizing the differences in content between each succeeding sentence, as suggested by the italics in the examples above. There were 16 of these stimuli in this part of the study (the first command, because it contrasts with nothing, was a dummy item and was unscored). Precisely the same set of 16 stimuli was used for the other condition; with this reading (the Control condition), a uniform rising intonation was used at the end of each command, ignoring the inherent contrasts between commands.

The commands based on Part IV of the *Token Test* had the following shape:

IV-1. Touch the small yellow circle
and the small *blue* circle.
IV-2. Touch the large blue square
and the *small red* square.
IV-3. Touch the small red circle
and the *large white square.*

When each of the 15 items in this part of the study was presented in the Contrastive Stress condition, the first object noun phrase in each sentence was read with the same uniform rising intonation used at the end of the Control condition reading of the Part I-type stimuli. In the second NP, the words that contrast with words occupying the same syntactic position in the first NP were read with contrastive stress, as suggested by the italics in the examples above. Thus the domain of contrastive stress in the Part IV-type stimuli was the command itself (the second NP with reference to the first),

whereas with the Part I-type stimuli it was the immediately preceding stimulus. When presented in the Control condition, the Part IV-type stimuli were read with a uniform rising intonation at the end of each object NP.

All the commands were presented by tape recording, including a screening test to determine whether the subject's auditory comprehension and visual and motor abilities were sufficient to identify separately each of the nine target words (the colors, shapes and sizes) used in the test and to perform the task in general; this also served the function of finding a comfortable listening level for each subject. Half of the subjects heard the sets of stimuli with the Contrastive Stress condition first (first the 16 Part I-, then the 15 Part IV-type stimuli); then they heard the identical stimuli read in the Control condition. The other half of the subjects heard them in the order Control, then Contrastive Stress.

2.2. Subjects

There were 42 subjects in the study, all of whom had had a single cerebrovascular accident of either the left or the right hemisphere. All of the subjects with left hemisphere lesions had received an independent diagnosis of aphasia, usually from a speech-language pathologist. Subjects with right hemisphere lesions were determined to be not aphasic, on the basis of their performance on the *Boston Diagnostic Aphasia Examination* (Goodglass and Kaplan 1972), which was part of the testing protocol for this study. None of the subjects had a history of alcohol abuse, mental retardation, senile or presenile dementia, psychiatric problems or significant hearing loss. All were right-handed, and all were native speakers of American English. There were 15 subjects with single lesions of the right hemisphere and 27 with single lesions of the left hemisphere. All subjects were neurologically stable at the time of testing, and all were a minimum of one month post-onset. Additional information on time post-onset, as well as other demographic information, is presented in Table I.

Table I. Demographic information

		Aphasics (lefts)	Non-aphasics (rights)
Number:		27	15
Sex:	Male:	18	9
	Female:	9	6
Age	Mean:	57.7	55.3
in years:	Range:	38–75	32–72
Education:	Mean:	13.2	12.9
in years:	Range:	8–20	9.5–19
Months post-onset:	Mean:	39.1	37.9
	Range:	1–217	6–120

3. Results and Discussion

Contrastive stress appears to make a difference in the ability of aphasic patients to comprehend relatively short verbal commands, such as those in Part I of the *Token Test*. In this study the 27 left hemisphere damaged (i.e. aphasic) subjects demonstrated a statistically significant difference in performance with the Part I-type stimuli (as measured by a system of weighted scoring devised for the study and expressed in Table II in terms of percent correct); this difference favored the Contrastive Stress condition over the Control condition ($p < .05$). The right hemisphere damaged (i.e. non-aphasic) subjects performed the Part I-type stimuli perfectly (or nearly so) in both conditions.

For the longer, Part IV-type stimuli, there were no significant differences in performance between the Contrastive Stress and Control conditions for either of the subject groups. The right hemisphere damaged subjects again performed essentially like normal subjects, making very few mistakes, randomly scattered. The aphasic subjects also performed with virtually the same level of correctness in the two conditions, but with more errors than the non-aphasic subjects.

One reason for this outcome may be that this task in itself (i.e. in terms of the information content of the segmental phonemes alone) was too difficult for the aphasic subjects to allow the difference in prosodic styles evident and significant with the Part I-type stimuli, to emerge. Evidence for this may be found in their lower mean level of correctness in both testing conditions for the longer vs. the shorter stimuli; both of these differences (84.8% vs. 89.8% for the Control condition, and 84.7% vs. 92.5% for the Contrastive Stress condition) were statistically significant.

Table II. Results: Weighted scores (percent correct)

		Aphasics (lefts)		Non-aphasics (rights)	
Stimulus type	Condition	Mean	S.D.	Mean	S.D.
Part I	Control	89.8	16.1	100	0.0
		**		NS	
	Stress*	92.5	12.0	99.8	1.0
Part IV	Control	84.8	15.3	99.6	0.8
		NS		NS	
	Stress*	84.7	14.6	99.7	1.0

* Contrastive stress.
** $p = .037$.

4. Conclusions

The implications of these findings seem to be that when given an auditory language processing task that is manageable, such as stimuli like those in Part I of the *Token Test*, aphasic individuals perform that task significantly better in the presence of contrastive linguistic stress than with a neutral reading of the same material. When the task is more difficult, as in Part IV of the *Token Test*, the advantage conferred by contrastive stress disappears; in fact, if the listener's processing capacities are already overburdened by segmental information, the addition of suprasegmental information may result in poorer rather than better performance.

Darley and his colleagues (1975:6) have defined prosody generally as 'all the variations in time, pitch, and loudness that accomplish emphasis, lend interest to speech, and characterize individual and dialectal modes of expression.' This definition suggests a peripheral role to prosody, implying that if prosodic features were not present in a message, there would be little or no effect (in English, at least) on the understanding of its semantic content. The findings of this study, on the other hand, suggest that prosodic features such as contrastive stress convey not only a speaker's affect and attitude but also part of the 'core' of this message, and that aphasic individuals (even when severely impaired) retain the ability to comprehend the linguistic as well as the paralinguistic information that prosody conveys.

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