An Analysis of the Productive Errors Made by Pure Apractic Speakers with Differing Loci of Lesions

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The verbal productive errors made by subjects demonstrating apraxia of speech plus aphasia have been well defined (Itoh, et al., 1979; Klich, et al., 1979; Deutsch, 1979; Itoh, et al., 1978; Freeman, et al., 1978; Sands, et al., 1978; DiSimoni and Darley, 1977; Trost and Canter, 1974; Martin and Rigrodsky, 1974a, 1974b; Deal and Darley, 1972; Johns and Darley, 1970; Shankweiler, et al., 1968; Shankweiler and Harris, 1966). Although it has been reported that apraxia of speech may occur in the absence of aphasia (Mazzochi and Vignolo, 1978; Mohr, et al., 1978) no systematic investigation of the speech symptomatology of pure apractic speakers has been reported to date. The purpose of the present investigation was to define both the articulatory and initiation/transitionalization patterns observed in the speech of pure apractic speakers.

METHOD

Subjects. Subjects were two male and two female adults. Ages ranged from 49 to 59 years. Years of education ranged from 11.5 to 19, and months post-onset ranged from 6 to 84. All were judged to demonstrate apraxia of speech based upon the results of administration of the Mayo Clinic Apraxia of Speech Battery and the clinical judgments of experienced speech pathologists. Absence of aphasia was confirmed by overall PICA scores which ranged from 14.29 to 14.83 and PICA modality score ranged as follow: verbal 14.23 - 14.85; gestural 14.50 - 14.96; and graphic 14.0 - 14.75. Overall Token Test error scores ranged from 0 to 3 and no subject erred on the modified Keenan and Brassell sentences although one subject self-corrected once. Forward digit spans ranged from six to nine and backward digit spans from four to six. CT scans were available for three subjects and an EEG report for the fourth. Left midparietal lesions were identified in two patients, a left frontoparietal lesion was confirmed in one patient, and a lesion of the basal ganglia, especially the caudate nucleus, and deep temporal area was identified in the fourth subject.

Procedure

One thousand forty-nine verbal responses to specific stimuli were obtained in the following categories:

(1) Oral repetition of stimuli following an auditory tape-recorded model

277 Nonsense monosyllables
304 Monosyllabic words
3 Bisyllabic words
48 Polysyllabic words

(2) Oral reading
305 Monosyllabic words
3 Bisyllabic words
48 Polysyllabic words

(3) Confrontation naming
58 Monosyllabic words
3 Bisyllabic words

All verbal and written responses were videotaped for further analysis. From the video tapes, all verbal utterances were broadly transcribed using IPA. Overall interjudge transcription reliability was .96, and overall intrajudge transcription reliability was .97.

All erroneous utterances were classified using the system outlined in Appendix A. This system allowed for the analysis of two classifications of errors--phonetic and initiation/transitionalization. For analysis of the phonetic aspects of production, confusion matrices were completed for each of the four subjects for initial, medial and final positions. Only the last utterance emitted by each subject was analyzed phonetically. All initiation attempts were classified as such but were not analyzed phonetically and were not counted as initial phonetic errors.

RESULTS

Results are summarized with regard to type of stimulus items, mode of stimulus input, and site of lesion for each patient.

Repetition of Monosyllabic Nonsense Syllables and Monosyllabic Words and Reading Monosyllabic Words. Pure apractic subjects demonstrated far more phonetic and I/T errors when asked to repeat nonsense monosyllables than when asked to repeat or read monosyllabic words. All subjects made slightly more phonetic errors when asked to repeat words than when asked to read them. However, more I/T errors occurred on the reading of monosyllables than on the repetition of the same stimuli. Except for nonsense material, more errors of distortion than substitution were committed by all subjects. Distortion errors were particularly evident in the speech of the subject with the subcortical lesion and involved VOT, velar control and tongue placement. Far more errors on vowels were recorded for the subjects of this study than have been reported previously for aphasic-apractic subjects.

Comparisons of Tasks which Required Repeating the Names of Common Nouns, Reading the Names and Naming the Objects. The most predominant phonetic error again was that of distortion and more phonetic errors occurred in the final position. There was a slight tendency for final errors to decrease when subjects were asked to name objects instead of repeat names. I/T errors, however, increased from repetition to reading to naming.

Cluster Production: Repeating Nonsense Monosyllables and Monosyllabic Words and Reading Monosyllabic Words Initiated by Clusters. Initial clusters, final consonants, and especially vowels were phonetically more deviant in the task which involved nonsense words than in the tasks which used real words. On the repetition task for real words, phonetic errors tended to predominate for both clusters and singleton elements. On the reading task, phonetic errors decreased while initiation and transitionalization errors increased.

Cluster Production: Repeating Nonsense Monosyllables and Monosyllabic Words and Reading Monosyllabic Words Terminated by Clusters. The predominant error observed in final cluster production for all subjects was phonetic in nature. For nonsense syllables, the predominant error to occur in the initial and medial positions was substitution. I/T errors were also frequently observed in these two positions. Final clusters were frequently in error with substitutions predominating. In repetition of real words, initial and medial positions were marked by fewer phonetic errors while I/T errors were slightly reduced for two subjects but markedly increased for the most severe subject compared to the nonsense stimuli. The most frequent error observed in final clusters was distortion.

On the reading task, substitutions increased in initial and medial positions and two subjects demonstrated a marked increase in I/T errors for these positions. Somewhat more clusters were produced correctly in the reading than in the repetition task, but overall errors for all subjects were not markedly different between the two tasks.

When cluster production was viewed in terms of increasing linguistic significance, i.e., those clusters which simply follow the phonological rules of English, those which in some instances are morphologically constraining, and those which are always morphologically constraining, no ranking of difficulty could be established. This disagrees with the findings of Martin, et al. (1975) in their investigation of aphasic individuals.

Repeating and Reading Polysyllabic Words. Few differences in occurrence of phonetic errors were seen on the two tasks. However, I/T errors were seen to increase dramatically on the reading task for all subjects but the least severe.

CONCLUSIONS

The results of this investigation lend themselves to three major conclusions: (1) Most deviant aspects of the speech production of pure apractic speakers are consistent with those symptoms reported for aphasic-apractic speakers. (2) Some speech symptoms of pure apractic subjects differ markedly from those which are characteristic of aphasic-apractic speakers. (3) Apractic speech symptomatology can result from differing loci of lesions and these differing loci of lesions may produce distinct apractic characteristics.

DISCUSSION

Commonalities Among the Motor Speech Production of Pure Apractic and Aphasic-Apractic Patients

Many of the findings of this investigation were in accordance with description of speech symptomatology previously reported for aphasic-apractic speakers. Nonsense stimuli were more difficult than words. Polysyllabic words were more difficult than monosyllabic words. Consonantal clusters were more frequently deviant than singleton consonants. Imitative accuracy was better than spontaneous accuracy for the production of monosyllabic nouns. Prosodic disturbances are an integral aspect of the disorder.

Differences Between the Motor Speech Production of Pure Apractic and Aphasic-Apractic Patients

With regard to the phonetic aspect of speech production, some speech symptoms of pure apractic speakers differ from those reported for

aphasic-apractic speakers. First, distortions were observed to be the predominant phonetic error in this study. It may be that substitutions predominate in the speech of aphasic-apractic speakers due to the summation effects of a motor speech disorder and a linguistic impairment. Alternately, the researchers of this and previous studies may have been classifying errors differently, especially those errors resulting from deviant VOT. In order to resolve the question of distortion vs. substitutive errors further acoustical studies are needed. Second, vowels were found to be quite deviant in the present investigation. Early studies of the speech production of aphasic-apractic speakers indicated that vowel production was adequate. Hence, many recent studies, especially those concerned with distinctive feature analyses, have omitted analyses of vowels. Several recent studies of aphasic-apractic speakers, however, have reported a high frequency of vowel distortions, as found in the present study.

The Effects of Site of Lesion

The four subjects in this study did not represent a homogeneous group with regard to the predominance of categories of production errors observed. Individualized patterns of phonetic production as well as initiation and transitionalization were observed and presumably were related to site of lesion as well as time post-onset. The two subjects with midparietal lesions demonstrated similar I/T errors (repetitions of phonemes, syllables and words, prolongations, struggles, both audible and inaudible, groping behavior and self-correction) which rendered their speech quite disfluent. The subject with the subcortical lesion demonstrated I/T errors which consisted predominantly of phonetic gropings and prolongations, especially of vowels, presumably to provide additional time to reach articulatory targets. The least severe and longest post-onset patient, the one diagnosed as having a frontoparietal lesion, demonstrated few I/T errors.

With regard to phonetic production, the two midparietal patients exhibited, for the most part, either frank consonantal substitutions or distortions of glides, fricatives and affricates. The patient with a subcortical lesion exhibited great difficulty in control of VOT, velar heightening and lowering, and tongue placement for vowels, causing her speech to sound "pseudo-foreign." In addition, this patient also exhibited frequent consonant distortions and substitutions. The frontoparietal patient predominantly demonstrated distortions of fricatives and affricates. However, few phonetic errors occurred in this patient's speech, presumably because this patient was seven years post-onset and had learned compensatory strategies for programming motor speech production.

Although the results we've reported here today are preliminary, we feel that they are significant in that they point to the need for us as clinicians to recognize the possible influences of types of stimulus inputs on apractic patients' output and also of the probable differential patterns of output by apractic speakers which may or may not be related to site of lesion and/or time post-onset.

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Classification System for Erroneous Productions
(Square, 1981)

Phonetic Errors

SUBSTITUTION: The replacement of the target phoneme by another English pho

DISTORTION: An incorrect attempt of the production of the target phoneme r sulting in faulty, indistinct production.

ADDITIONS: Inserted phonemes which are not present in the target. These w subcategorized as follows: a) inserted schwa, b) added vowel(s) or diphtho c) added consonant(s).

OMISSIONS: The absence or loss of a phoneme which should have been in the target.

Initiation/Transitionalization Errors

REPETITION: Consecutive productions of a phoneme, syllable, or word as observed in stuttering. The subcategories used included: a) phoneme repet tions, b) syllable repetitions, c) repetition of several syllables, d) word repetitions.

PROLONGATIONS: An extended duration of a continuous phoneme beyond normal limits. These were subdivided into: a) vowel prolongations and b) consona prolongations.

INAUDIBLE STRUGGLE: A silent period after the stimulus was presented which characterized by facial grimacing.

AUDIBLE STRUGGLE: A period in which a sound was produced which did not app to be phonemic in nature. This may or may not have been accompanied by fac grimacing.

PHONETIC GROPING: Attempts to produce a target phoneme through trial-and-error productions of other English phonemes.

PAUSE: A silent period after the stimulus is presented which is characteri by neither inaudible or audible struggle.

SELF-CORRECTION: Faulty production of a phoneme, syllable, or word immedia followed by correct production. These were sub-categorized as follows: a) phoneme self-correction, b) syllable self-correction. c) word self-corre

METATHESIS: An inversion in the order of phonemes, These were subclassif as follows: a) intra-metathesis: within a stimulus item, e.g., /tak/----/k b) inter-metathesis: over two stimulus items, e.g., /fak It/----/fet It/.

NEOLOGISM: An attempt at the production of a stimulus which bears no relationship to the item even when the above transformations are considered