

PHONOLOGICALLY BASED ASSESSMENT AND INTERVENTION IN SPASTIC CEREBRAL PALSY: A CASE ANALYSIS

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SUMMARY

The articulation errors of one adult subject demonstrating a spastic variety of congenital cerebral palsy were evaluated via a phonological process analysis. This analysis indicated that a stopping process (replacement of fricatives with homorganic stops) was the most detrimental to the subject's intelligibility. Subsequent to this analysis a phonemic contrasting programme was initiated toward the goal of minimizing the influence of the stopping process. Results of spontaneous speech sample analyses indicated that this approach was successful in increasing the percentage of correctly produced fricative patterns. Success in this case suggests the applicability of a linguistically based intervention approach in structural/functional disturbances of speech articulation.

OPSOMMING

Die artikulasiefoute van 'n volwassene proefpersoon met 'n verskeidenheid spastiese simptome van kongenitale serebrale verlamming, is met behulp van 'n fonologiese proses-analise geëvalueer. Die analise het aangetoon dat 'n afsluitingsproses (vervanging van frikatieve met homorganiese afsluitingsklanke) die proefpersoon se spraakverstaanbaarheid, hoofsaaklik beïnvloed het. 'n Fonemiese kontrasprogram is hieropvolgend geïnisieer met die doel om die invloed van die afsluitingsproses te verminder. Die resultate van 'n spontane spraakmonsteranalise het aangedui dat hierdie benadering suksesvol was wat betref die verhoging van korrek geproduseerde frikatiefpatrone. Die sukses behaal suggereer die toepasbaarheid van 'n linguisties gebaseerde benadering by strukturele funksionele artikulasieafwykings.

Assessment and intervention of articulatory disorders has traditionally focused on individual sound errors that detract from a client's intelligibility. This approach has been employed commonly for both functional and organic disorders of speech articulation. Though this approach has been successful to some degree, it often fails to bring about clinically significant improvement in those individuals demonstrating multiple articulation errors.

The past decade has yielded an emphasis on the identification of "patterns of errors" in those cases where multiple sound errors are observed. A recent development related to this pattern approach of assessment is the identification of general phonological processes in the

defective speech pattern. A phonological process is considered to be a type of “mental operation” which simplifies a production by removing certain difficult properties from that production (Oller⁶; Stampe⁸). In his *Dissertation on Natural Phonology*, David Stampe⁸ points out that *although a phonological substitution is a mental operation, it is clearly motivated by the physical character of speech — its neurophysiological, morphological, mechanical, temporal, and acoustic properties* (p. 6). Given this description, it is surprising that relatively little attention has been focused on the identification and elimination of phonological processes in organically based articulation disorders. Ingram⁵ reviews literature which identified error patterns in the speech of hard-of-hearing, cleft palate, and mentally retarded subjects. Paskowitz and Bond⁷ have also used the phonological process approach to identify error patterns in the speech of hearing impaired children. Crary and Hunt³ (in preparation) have demonstrated the clinical effectiveness of a pattern approach in the identification and subsequent elimination of phonological processes in the speech of one child with a repaired palatal cleft. In a recent didactic article, Crary and Fokes² have argued that this approach may be clinically efficient in the identification and elimination of defective articulatory patterns in the speech of neurologically impaired adults.

The present study reflects an attempt to: (1) identify phonological processes in the speech of a neurologically impaired adult, (2) quantify the influence of those processes on intelligibility, and (3) reduce the influence of the processes determined to be the most detrimental to perceived intelligibility.

METHODOLOGY

SUBJECT:

The subject was a twenty-five-year-old female with congenital cerebral palsy of the spastic variety. She was enrolled in a public school special class and received one hour of speech therapy per week. Her therapist judged her to be “fairly intelligible” with multiple sound errors evident in her speech pattern. Therapy for the preceding eight months had focused on facilitating correct fricative production at the sound level. Although the subject could produce some fricatives in isolation, there was no reported or observed carryover to the syllable or word level.

ASSESSMENT: PROCESS IDENTIFICATION

In an attempt to identify phonological processes in the speech pattern of our subject two procedures were employed: (1) the *Phonological Process Analysis* (Weiner⁹), and (2) analysis of a spontaneous speech sample using procedures outlined by Crary.¹

Table I presents the results of Weiner’s analysis procedure. It can be seen that cluster reduction and stopping were the “strongest” (i.e., most frequent) processes, occurring in 100% and 88% of the test items

respectively. Cluster reduction was also observed in 75% of the applicable non-test items, while stopping was observed in 89% of the applicable non-test items. In addition, the stopping process was observed in 92% of those clusters involving fricatives. Other processes noted include deletion of final consonants and prevocalic voicing.

TABLE I: Results of *Phonological Process Analysis* (Weiner⁹)

Process	% Occurrence in Test Items	% Occurrence in Non-Test Items
Deletion Final Consonants	25% (4/16)	39%
Cluster Reduction	100% (28/28)	75%
Prevocalic Voicing	38% (6/16)	27%
Stopping	88% (14/16)	89%

Table II presents the results of the spontaneous speech analysis. To comprehend these data a brief discussion of the analysis procedures is required. The column marked "RS" indicates the "Relative Strength" of each process. This is determined by dividing the number of actual occurrences of a process by the number of potential occurrences. "RA" indicates "Relative Appearance" of those phonological patterns simplified by processes. This is determined by dividing the potential occurrence of each process by the total number of words in the sample. "RIU" indicates the "Relative Influence on Unintelligibility". This is calculated by multiplying RS and RA. The higher the RIU value, the greater the detrimental influence on intelligibility.

TABLE II: Spontaneous Speech Analysis: Pre-Therapy

Process	RS	RA	RIU
Deletion Final Con.	.24	.85	.20
Cluster Reduction	1.00	.25	.25
Prevocalic Voicing	.47	.25	.12
Stopping	.92	.37	.34

As shown in this table, the stopping process had the greatest influence on our subject's speech (highest RIU value) followed by cluster reduction, deletion of final consonants, and prevocalic voicing. In considering the rank orderings of processes in each assessment procedure it can be seen that there is excellent agreement between the two procedures. They both suggest that our subject was simplifying her productive patterns by reducing cluster complexity, replacing fricatives with homorganic stops, deleting final consonants, and voicing prevocalic voiceless stops. Because of the high RIU values for stopping in the speech sample analysis and the frequent occurrence of this process in

both test and non-test items in the Weiner procedure, the stopping process was chosen as our intervention target.

THERAPY PROGRAMME

In an attempt to reduce the influence of the stopping process on our subject's speech, a phonemic contrasting programme was developed which focused on the feature contrast \pm continuant. Following the general outline for phonemic contrasting prepared by Fokes⁴ a six-step programme was developed (two carryover steps were added to the basic programme to facilitate correct production beyond the word level). Briefly, the steps consisted of presenting words individually or in a minimal pair and emphasizing: (1) the perceptual qualities of the target features, (2) the differences in physical production patterns for the contrasted feature, and (3) imitation of the word pairs combined with perceptual identification of the feature contrast. The final training step involves spontaneous production attempts by the client. A copy of this programme is provided in Table V.

RESULTS OF THERAPY

Figure 1 presents the charted results of the therapy programme. The subject attended twenty half-hour sessions. Data presented in this figure indicate that the subject acquired improved continuant production from a pretest performance of 50% to a post-test performance of 80%. Note that step 5 appears to be the "critical step" in the programme for our subject. In this step the subject had to first correctly identify the feature contrast and then imitate a target word. It is apparent from the data on step 5 that our subject was more successful on the imitative task than the perception task (imitation scores noted by ()). Even over repeated trials and sessions no improvement was noted in the ability to correctly identify the presented feature. This was confusing to us since our subject had performed the same perceptual task at the 80% level or above for three sessions prior to step 5. The final comment to be made on these data regards the abrupt termination of the programme.

This was not a planned feature. Rather, it was necessitated by the end of our subject's academic semester. Note that the post-test did reach the preset criteria even though criteria was not demonstrated in step 6.

POST-THERAPY SPEECH ANALYSIS

At the end of the therapy programme a second speech sample was collected and analysed to assess changes in the spontaneous production of fricative patterns. The analysis performed on this sample was identical to that performed on the pre-therapy sample.

The results of this analysis are presented in Table III. Several changes

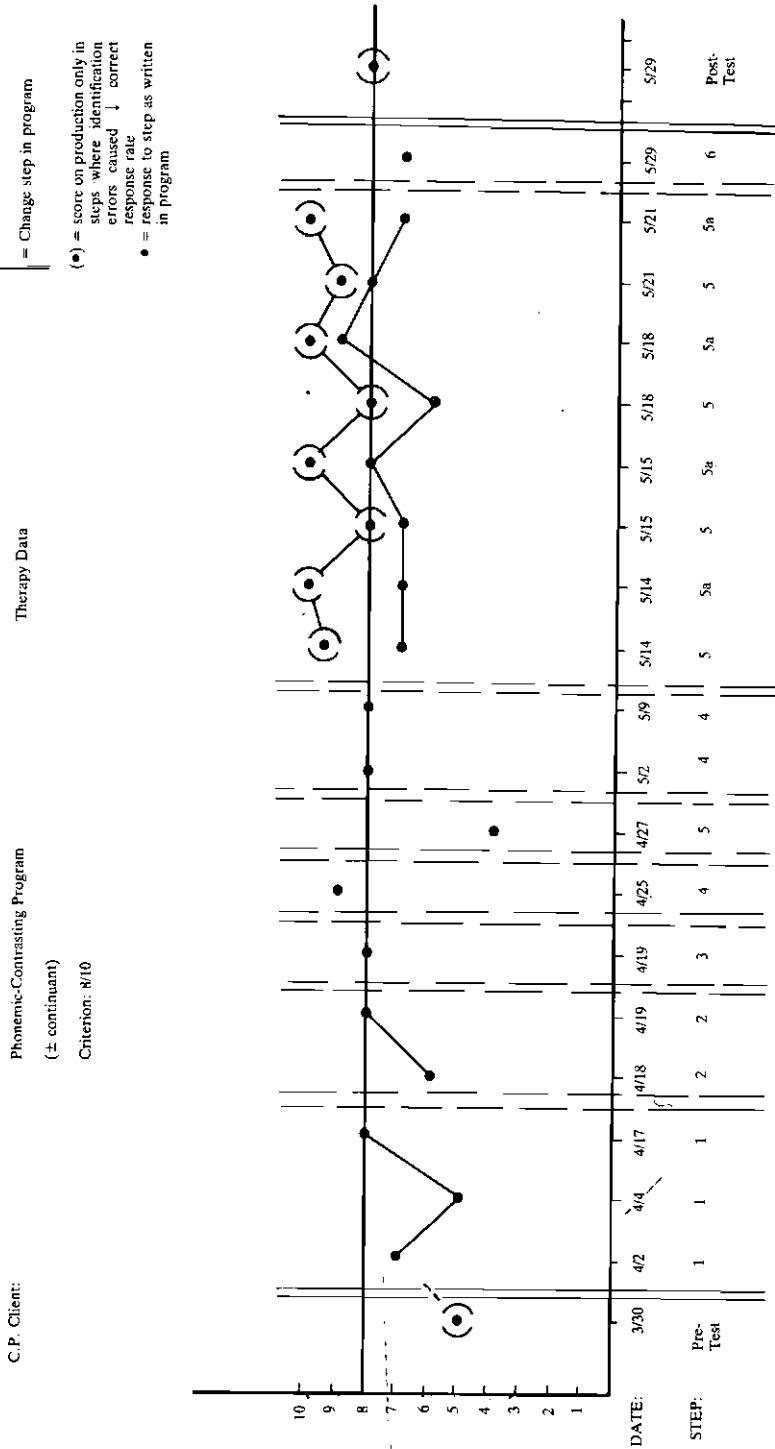


Figure 1 Therapy Programme Results

in the RS and RIU values can be seen. The relative strength of the stopping process decreased from 92% in the pre-therapy sample to 48% in this sample. In the post-therapy sample decreases were also noted in RS for Deletion of Final Consonants and for Cluster Reduction.

The final table (Table IV) summarizes RIU changes from the pre-therapy sample to the post-therapy sample. Improvement is noted for the stopping process (RIU .34 to .21), deletion of final consonants (RIU .20 to .13), and cluster reduction (RIU .25 to .14).

TABLE III: Spontaneous Speech Analysis: Post-Therapy

Process	RS	RA	RIU
Deletion Final Con.	.18	.74	.13
Cluster Reduction	.80	.17	.14
Prevocalic Voicing	.52	.28	.14
Stopping	.48	.44	.21

TABLE IV: Spontaneous Speech Analysis: RIU Comparisons

Process	Pre-Therapy	Post-Therapy
Deletion Final Con.	.20	.13
Cluster Reduction	.25	.14
Prevocalic Voicing	.12	.14
Stopping	.34	.21

CONCLUSION

The present case study attempted to demonstrate that patterns of articulatory errors could be identified in the speech of a neurologically impaired adult via a phonological process analysis. A second consideration of this study was to attempt to reduce the influence of observed patterns via a phonemic contrasting approach to therapy. Pretherapy speech samples revealed a strong and influential stopping process indicating a systematic replacement of fricatives with homorganic stops. The results of a therapy programme aimed at reduction of the stopping process indicated an increase in correct fricative production at the word level. Results of a post-therapy speech sample analysis indicated a reduction in the frequency and influence of the stopping process which reflects an increase in correct fricative production in spontaneous speech.

The results of this case study indicate the clinical effectiveness of using a pattern approach in the assessment and intervention of organically based articulatory disorders. Future clinical research in this area should

REFERENCES

1. Crary, M. A. (1979), *Procedures for Sampling Prominent Phonological Processes*. Unpublished manuscript.
2. Crary, M. A. and Fokes, J. (1980), Phonological processes in apraxia of speech: A systematic simplification of articulatory performance. *Aphasia, Apraxia, Agnosia*. 11: 1-13.
3. Crary, M. A. and Hunt, T. L. (in preparation), *Phonological intervention with a cleft palate child*.
4. Fokes, J. (1976), *Working with sound systems of children with multiple articulation problems: Phonemic contrasting*. Unpublished manuscript; Ohio University, Athens.
5. Ingram, D. (1976), *Phonological Disability in Children*. New York: Elsevier, North-Holland.
6. Oller, D. K. (1974), Simplification as the goal of phonological processes in child speech. *Language Learning*, 24, 229-303.
7. Paskowitz, P. and Bond, Z. S. (1980), Phonological structure of the speech of hearing impaired children. *Ohio Speech and Hearing Journal* (in press).
8. Stampe, D. (1973), *A dissertation on natural phonology*. Unpublished Ph.D. dissertation, University of Chicago.
9. Weiner, F. (1979), *Phonological Process Analysis*. Baltimore: University Park Press.