

# MASS GENERALISED LEARNING APPLIED TO THE PROBLEM OF CARRY-OVER IN ARTICULATION THERAPY

AVRIL KLAFF, B.A. (Sp. & H. Therapy) (WITWATERSRAND)

*Department Speech Pathology and Audiology,  
University of the Witwatersrand, Johannesburg.*

## SUMMARY

This study was designed to investigate Morehead and Johnson's hypothesis that mass generalised learning experience in therapy will eliminate carryover problems. Four subjects who consistently misarticulated the /S/ phoneme participated in an intensive six week therapy programme. Two experimental subjects were trained in the production of the entire category of sounds of which the target phoneme is a member. Two matched control subjects received traditional articulation therapy. Pre- and post-therapy measures included an articulation test, competence tests and spectrographic analysis. Sound production tasks and carry-over tasks were administered at regular intervals during therapy to assess generalisation to untrained contexts. Complete carry-over was evidenced by one experimental subject at the end of the sentence phase of therapy. The remaining three subjects demonstrated inconsistent carry-over at the conclusion of the therapy programme. It is suggested that a mass generalised learning procedure may offer an efficient approach to articulation therapy.

## OPSOMMING

Hierdie studie ondersoek Morehead en Johnson se hipotese dat 'n veralgemeende leerproses in terapie oordrag vergemaklik. Vier proefpersone wat die /S/-foneem konsekwent foutief geartikuleer het, is in 'n intensiewe terapieprogram van ses weke betrek. Twee eksperimentele proefpersone is opgelei om die volledige groep foneme in die kategorie van klanke waarvan die foutiewe foneem 'n deel is, te produseer. Twee proefpersone het as kontrole tradisionele artikulasie- en bevoegdheidstoetses sowel as spektrografiese analises is deur die proefpersone voor en na terapie ondergaan. Klankproduksie- en oordragtake is met gereelde tussenposes gedurende terapie onderneem om oordrag in 'n onopgeleide verband te beoordeel. Volledige oordrag is deur een eksperimentele proefpersoon aan die einde van die sinfase van terapie behaal. Die ander drie proefpersone het wisselvallige oordrag aan die einde van die terapieprogram getoon. Daar word voorgestel dat 'n veralgemeende leerproses moontlik 'n doeltreffende benadering tot artikulasie terapie bied.

Articulatory disorders have long been recognised as the most prevalent of all speech disorders.<sup>2,12,30</sup> Thus the need to devise efficient and effective procedures for the remediation of these problems is strongly indicated. The ultimate goal of an articulation therapy programme is to bring the individual to a point where he can communicate normally regardless of the speech context and the environment in which he finds himself.<sup>1,2,7,35</sup> However, the problems involved in accomplishing this goal require no introduction to the speech therapist.

The terms generalisation, transfer of training and carry-over have been used interchangeably in the literature to refer to this aspect of therapy. The approach-

es that have traditionally been advocated for facilitating this phase of therapy suggest that most speech therapists have viewed carry-over as the extension of correct articulation from the clinical setting to other situational settings. Inherent in these procedures is the assumption that carry-over is an event which occurs only in the final stages of therapy. Their ineffectiveness is reflected in a statement made by Mowrer.<sup>21</sup> 'Carry-over remains one of the most perplexing problems speech clinicians have to face in attempting to modify articulation.'

Since the problems of carry-over continue to plague speech therapists it is fitting that research be directed towards scrutinising the efficacy of traditional therapy procedures and to designing alternative procedures with the sole purpose of eliminating carry-over difficulties.<sup>4</sup> It is to this aim that the present study was directed.

Recently Morehead and Johnson<sup>20</sup> made observations that have shed a new light on the carry-over controversy. They attribute the unstable changes that occur in therapy to the learning theory framework in which most speech therapy programmes take place. Raymore<sup>25</sup> notes that most speech therapists use the basic "stimulus method" of therapy to teach correct production. This technique has its origin in the early work of Travis (1931) but the procedure formulated by Van Riper in 1939 is frequently referred to as the "traditional approach" to articulation therapy. In most cases the therapist presents a model of the correct sound and the child is asked to repeat it. Reinforcement is provided for each successful attempt on approximation to success. Morehead and Johnson<sup>20</sup> note that this pairing of a stimulus and response constitutes a specific training experience, the consequences of which are unstable changes in the newly learned behaviour.

In contrast

*Piagetian-based programmes . . . assume that mass generalised experience is crucial to learning and these should provide more stable changes in behaviour.*<sup>20</sup>

Many enthusiasts in different fields have adapted Piaget's viewpoint to suit their specific needs. Since no further references to this method of teaching could be found which is specifically applied to speech therapy, the writer interpreted this principle in a way that was thought best suited to articulation learning.

Impetus for change in the nature of articulation therapy has also resulted from the application of linguistic theory to normal and defective articulation. Recent research has resulted in the proposal that articulation problems be considered in the framework of the phonological system.<sup>3,4,14,19,22,23,31</sup>

As a number of phonemes share features in common it has been thought that it is the omission or misuse of a feature that accounts for the misarticulation errors of the child. The implication is that correction of articulation must be directed at locating and correcting the feature which is common to a number of misarticulations.<sup>18,19,23</sup> Thus traditional therapy procedures of teaching sounds in isolation are being substituted for by procedures in which an entire category of sounds is worked on.<sup>13,31</sup>

It is proposed that these recent developments in the remediation of multiple articulation defects can be utilised to translate the principle of mass generalised

learning experience into a practical therapy procedure for dealing with a group of children having difficulty with only one phoneme. It was hypothesized that emphasis on the entire category of sounds of which the target phoneme is a member will provide the child with more generalised learning experience than the teaching of a single, isolated sound. This in turn will result in more stable changes in articulatory ability, hence eliminating carry-over difficulties.

## METHOD

### AIM

It was the aim of the present study to employ the principle of mass generalised learning experience in articulation therapy and to observe its effects on the entire therapeutic process.

### SUBJECTS:

Four subjects (Ss) were divided into two groups of two Ss each. The experimental Ss were trained according to the principle of mass generalised learning. The control Ss received traditional articulation therapy.

All Ss were selected according to the following criteria:

1. Chronological age of 8 years or more in order to eliminate developmental articulation errors.
2. Presence of an interdental lisp.
3. Hearing within normal limits.

Since great difficulty was experienced in obtaining Ss who conformed to these criteria, those available had to be matched as closely as possible according to the following variables:

Subject	C.A.	SEX	Articulation Error	Etiological Factors	Previous Therapy
E1	7,6 yrs.	F	$\theta/s$ $\partial/z$ l/r	None Observable	None
C1	9,6 yrs.	M	$\theta/s$ $\partial/z$ f/θ    v/θ $\xi^t \zeta^t$ $t\xi^t$ $d\xi^t$	None Observable	None
E2	8,0 yrs.	M	$\theta/s$ $\partial/z$	Tongue thrust Emotional problems. Learning problems.	None
C2	9,6 yrs.	F	$\theta/s$ $\partial/z$	Tongue thrust Emotional problems. Learning problems.	A few sessions at 4 yrs.

TABLE 1. Criteria according to which subjects were matched.

*Age* – since the ages of Ss ranged from 7,6 years to 9,6 years, the experimenter (E) felt that group therapy would be enhanced by placing children of the same age in the same group. Therefore, experimental and control Ss were not matched according to this variable.

*Sex* – one male and one female was placed in each group although this variable is not considered crucial.<sup>34</sup>

*Articulation error* – E1 (Experimental S 1) and C1 (Control S 1) had additional errors. (See Table 1)

*Etiological factors* – E2 (Experimental S 2) and C2 (Control S2) were matched for the presence of a tongue thrust swallow pattern and suspected emotional difficulties both of which may be related to articulation disorders.<sup>16,34</sup>

*Intelligence* – Ss were not matched according to I.Q. since this is not felt to be causally related to articulation disorders.<sup>34</sup> However Ss were matched according to an informal assessment of learning ability.

**PROCEDURE**

**TESTS FOR THE EFFECTS OF THERAPY:**

Figure 1 shows the sequence of therapy with the relative position of the testing sequence indicated. The tests were administrated on a before and after therapy basis as well as at specific intervals during therapy.

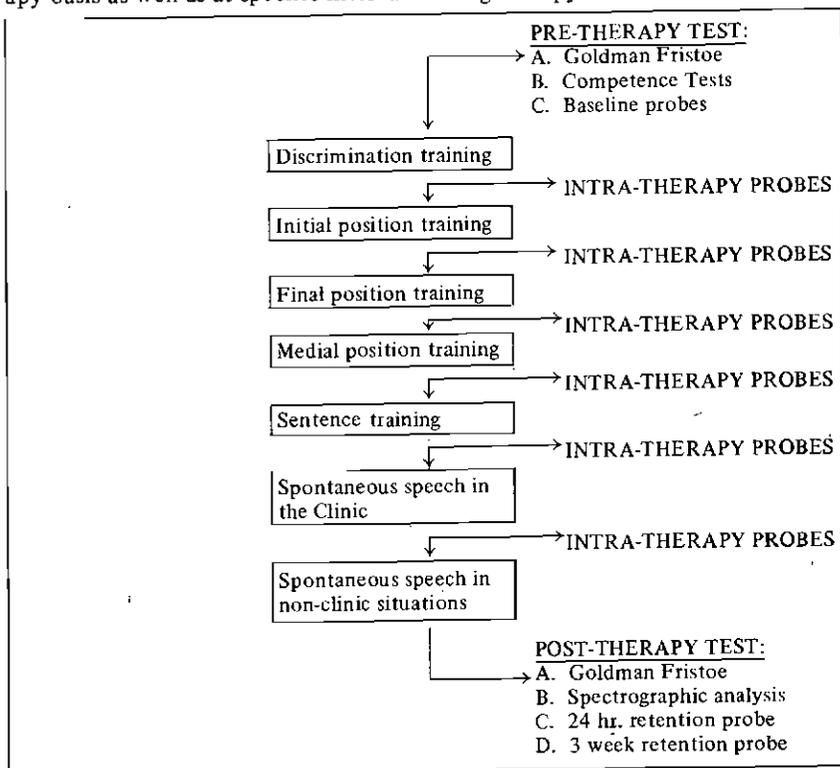


Figure 1. The Sequence of Therapy with the Relative Position of the Testing Sequence Indicated.

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#### PRE-THERAPY TESTS

These were administered to determine the level of performance for each S prior to the commencement of therapy. These included the Goldman Fristoe Test of Articulation<sup>8</sup> and two competence tests devised by the E to determine if Ss were able to make the phonological and phonetic distinctions between the target and error sound. Thus Ss were required to discriminate between minimal pairs containing [ + strident ] sounds and [ - strident ] sounds as well as minimal pairs containing slit and grooved phonemes. In addition the acoustic spectrograph was used to analyse the Ss renditions of the /s/ phoneme in an attempt to characterise more accurately the acoustic properties of the pre-therapy and post-therapy articulations.

#### INTRA-THERAPY PROBE TESTS

The probe tests used in the present study were based on those used by Elbert, Shelton and Arndt,<sup>5</sup> Shelton, Elbert and Arndt<sup>27</sup> and Wright, Shelton and Arndt.<sup>35</sup> The tests can be divided into two categories.

##### A. *Sound Production Tasks (SPTs)*

A 40 item SPT was divided into 20 items for the /s/ phoneme and 20 items for the /z/ phoneme. Both phonemes were sampled in initial, medial final positions and in clusters.

##### B. *Carry-Over Tasks*

Generalisation of correct production to spontaneous speech was measured in four ways:

1. Subjects were asked to read aloud until 20 instances of the /s/ and /z/ phonemes had been sampled.
2. Spontaneous speech was tape recorded in the therapy setting.
3. Spontaneous speech was recorded in an extra-therapy setting, namely the grounds of the University.
4. Parents were given some understanding of how to observe the child's speech in different situations and were asked to report carry-over progress to the E.

All the intra-therapy probes were administered prior to therapy in order to establish baseline performance levels for each S. The sequence of administration of these probes during therapy was not uniform for all Ss since they all progressed at difference rates. Probe tests were administered when a S obtained a score of 18/20 at the end of each phase of therapy. If scores indicated that generalisation had taken place to the next level of production then that phase of therapy was omitted.

#### POST-THERAPY TESTS

1. The Goldman-Fristoe Test of Articulation<sup>8</sup> was re-administered 24 hours after the termination of therapy.
2. Both SPTs and carry-over tasks were re-administered 24 hours and again 3 weeks following the termination of therapy.
3. Spectrographic analyses were made of each Ss pre-therapy and post-therapy renditions of 7 /s/ and /z/ words from the Goldman-Fristoe Test of Articulation.<sup>8</sup>

## RELIABILITY

Random samples of recordings of probe tests were played to two experienced speech therapists. The E rated the probes at the time of recording and on playback.

## THERAPY PROCEDURES

Each group was seen for approximately 30 minutes, five days a week. Therapy was terminated when complete carry-over had been achieved or when the maximum number of 20 sessions had been reached.

*Discrimination Training* – The initial stages of the experimental therapy procedure were aimed at establishing the distinction between the two groups of contrasting sounds. Thus all the [ + strident] or grooved sounds (/s/, /z/, /s̺/, /z̺/, /t̺s̺/ and /d̺z̺/ according to Halle<sup>10</sup> were said to belong to “the man with the tall hat”. The [ – strident] or slit sounds (/f/, /v/, /θ/ and (/ð/ according to Halle<sup>10</sup> were identified with the “man with the short hat”. Discrimination exercises were carried out in which the children were required to associate minimal pair words with the relevant “men”. In contrast, control therapy was concerned with identifying the error and the target sound (/θ/ and /s/) and training the children to discriminate between these two sounds.<sup>30</sup>

*The Acquisition Phase* – The experimental Ss were taught production of *all* the [ + strident] sounds. Production of /s/ and /z/ was taught by emphasizing the auditory and visual similarities between these sounds and other [ + strident] sounds. The Ss were asked to consciously contrast [ + strident] and [ – strident] sounds in their own speech so that the differences could be emphasized. The correct production of *all* [ + strident] sounds was stressed at all levels of the acquisition phase. This differs markedly from the traditional procedures in which the child’s attention is focused solely on correct production of the phoneme /s/.

*The Carry-Over Phase* – This phase was provided for Ss who failed to demonstrate carry-over following the acquisition phase of therapy. *Figure 1* indicates that this phase was divided into two stages. Experimental and control procedures differed in that experimental Ss were encouraged to use *all* [ + strident] sounds while the attention of the control Ss was focused *only* on the consistent use of /s/.

## RESULTS AND DISCUSSION

The small number of Ss used in the study did not justify a statistical analysis of the results and data are therefore presented in terms of individual performances.

### COMPARISON OF PRE-THERAPY AND POST-THERAPY TEST RESULTS

- A. *Competence Tests* – Results indicated that all Ss were able to discriminate on both a phonetic and phonological level, therefore all had competence for correct production.
- B. *The Goldman-Fristoe Test of Articulation* – All Ss were found to consistently misarticulate the /s/ and /z/ phonemes prior to therapy. All were consistent in correct production of these two phonemes on the

post-therapy test seemingly indicative of the fact that all Ss had achieved the same level of performance. However, results of the carry-over tasks administered at the conclusion of therapy showed that only one S (E1) had attained consistent use of /s/ and /z/ in all spontaneous speech situations while the remaining three Ss demonstrated inconsistent carry-over.

C. *Spectrographic Analysis* – The spectrograms were analysed with the aid of a phonetician. A systematic variation between pre-therapy and post-therapy renditions was observed.

1. The lowest frequency at which peaks of energy occur shifted from 2000Hz to 3500Hz.
2. Weighting of energy shifted from the mid-frequencies to the higher frequencies.
3. Peaks of energy extended to 16 000Hz.

The acoustic patterns of the pre-therapy articulations do not conform to those reported to be characteristic of any other English fricatives. Thus the misarticulation does not appear to be one of substitution of /θ/ for /s/ but could be more adequately described as an “articulatory displacement”.<sup>9</sup> However, the post-therapy patterns correspond closely to the patterns apparent in the E’s spectrogram confirming that the Ss had achieved acceptable production as a result of therapy.

#### INTRA-THERAPY PROBE TEST RESULTS

The results presented in this section document the changes that occurred in articulation generalisation as each S progressed through the programme.

##### A. *Sound Production Tasks*

Table II shows the total number of correct responses on the word and sentence task for each S.

The following trends can be extracted from Table II.

1. Discrimination training minimally improved production. A number of researchers have questioned the excessive reliance of therapy programmes on discrimination training.<sup>6,15,17,24,26,32</sup>
2. The scores on the /s/SPT exceeded scores obtained on the /z/SPT for all Ss during word training. Thus the benefits of training the experimental Ss in correct production of /s/ and /z/ simultaneously was not evident. However, while all four Ss obtained maximum scores on the /s/SPT, only the experimental Ss scored maximally on the /z/SPT. (See Table II). The E postulates that the effects of mass generalised learning experience may have begun to manifest itself in the ease with which the experimental Ss generalised correct production from words to sentences. It was observed that the control Ss produced the stimulus word correctly but had difficulty generalising correct production to other target phonemes in the sentence. The control Ss were oriented towards a one-to-one relationship between response and reinforcement whereas the experimental Ss were rewarded for a diversity of responses. The latter

appears to reduce the child's focus on specific stimuli. Rather, the child is made aware of the generality of correct production.

SUBJECT	PROBE	PHASE OF THERAPY								
		BASE-LINE	DIS-CRIM.	I	F	M	SENT.	SP.SP.	PI	P2
E1	/s/ SPT	0	1	17	18	/	20	/	20	20
	/z/ SPT	0	0	11	14	/	20	/	20	20
C1	/s/ SPT	0	0	18		/	20		20	20
	/z/ SPT	0	0	19	/		15	-	20	20
E2	/s/ SPT	0	0	6	16	/	20	-	20	19
	/z/ SPT	0	0	0	13	/	20	-	20	20
C2	/s/ SPT	0	3	18		/	20	-	20	20
	/z/ SPT	0	0	10	/		16	-	20	18

Discrim. = discrimination training  
 Sp.Sp. = Spontaneous Speech  
 P1 = 24 hour retention test  
 P2 = 3 week retention test

/ = No therapy indicated  
 - = Probe not administered  
 | = Termination of therapy

TABLE II. Total Number of correct articulations for all subjects on sound production tasks.

**B. Carry-Over Tasks**

In order to afford a comparative analysis the graphs of matched experimental and control Ss will be compared.

*Comparison between E1 and C1 (See Figure 2)*

E1 and C1 obtained similar results on the reading tasks and Intra-therapy Talking Task. However, scores on the Extra-therapy Talking Tasks differed for these two Ss. E1 showed spontaneous generalisation to extra-therapy situations following the sentence phase of therapy. C1 failed to demonstrate generalisation to these contexts until correct production had been reinforced in extra-therapy settings. Parental reports confirmed that E1 had attained complete carry-over to all speaking situations and consequently she was dismissed at the end of the sentence phase of therapy. C1 retained 100% scores on the retention tests.

After having been subjected to carry-over therapy C1 remained inconsistent in his generalisation of correct production to the Extratherapy Talking Task. Further, the results of the three week retention test suggested that C1 had regressed rather than improved in his carry-over ability.

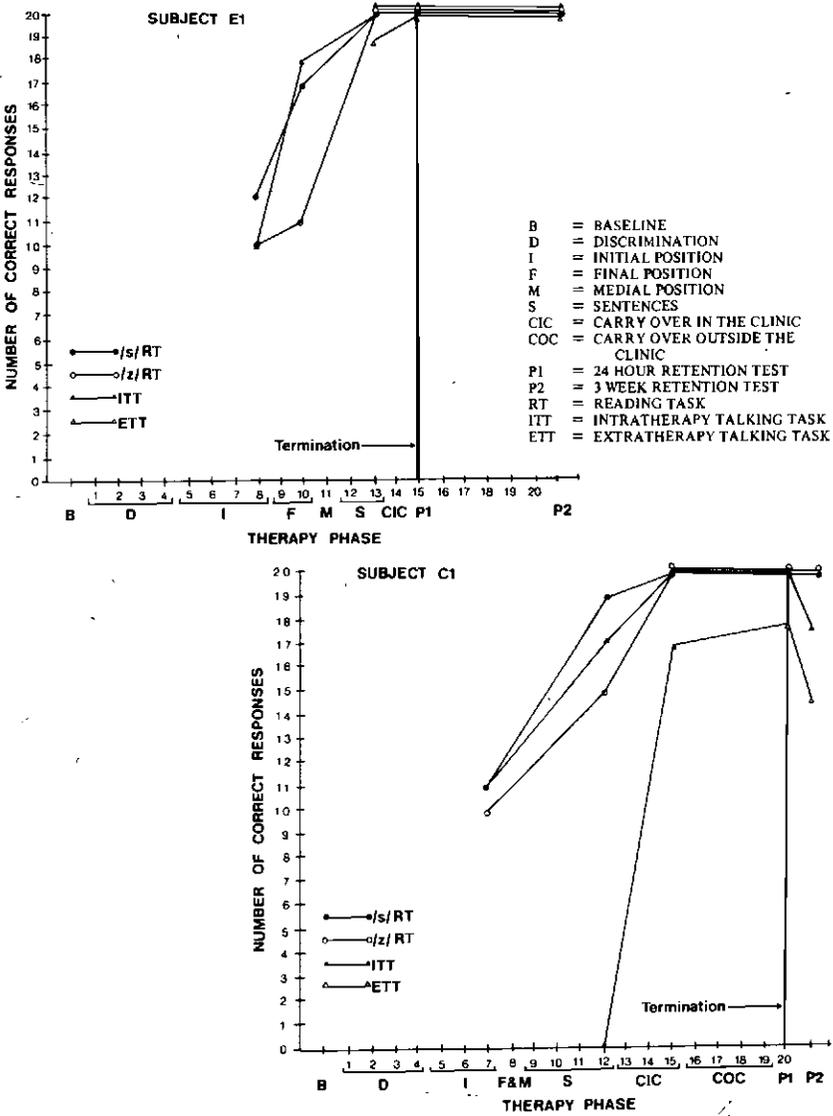


Figure 2: Performance of E1 and C1 on Reading Tasks and Talking Tasks at each Phase of Therapy.

Comparison between E2 and C2 (See Figure 3)

E2 did not attain the 50% criteria at the end of the initial position phase of therapy for the administration of carry-over tasks. C2 attained this criteria but failed to demonstrate any carry-over at all. E2's carry-over to spontaneous speech was investigated at the end of initial position training and the data indicates a greater degree of generalisation than C2 had shown to the initial carry-over tasks.

E2's generalisation to the reading tasks and the Intra-therapy Talking Task was similar to that of C2. However, E2 showed some spontaneous generalisation to the Extra-therapy Talking Task at the end of the sentence phase of therapy while C2, like C1, failed to show generalisation to these contexts until correct production had been reinforced in spontaneous speech. E2's scores on the Extra-therapy Talking Task exceeded those of C2 at all levels of therapy. Neither of these Ss attained complete carry-over before termination and both showed regression following the three week break.

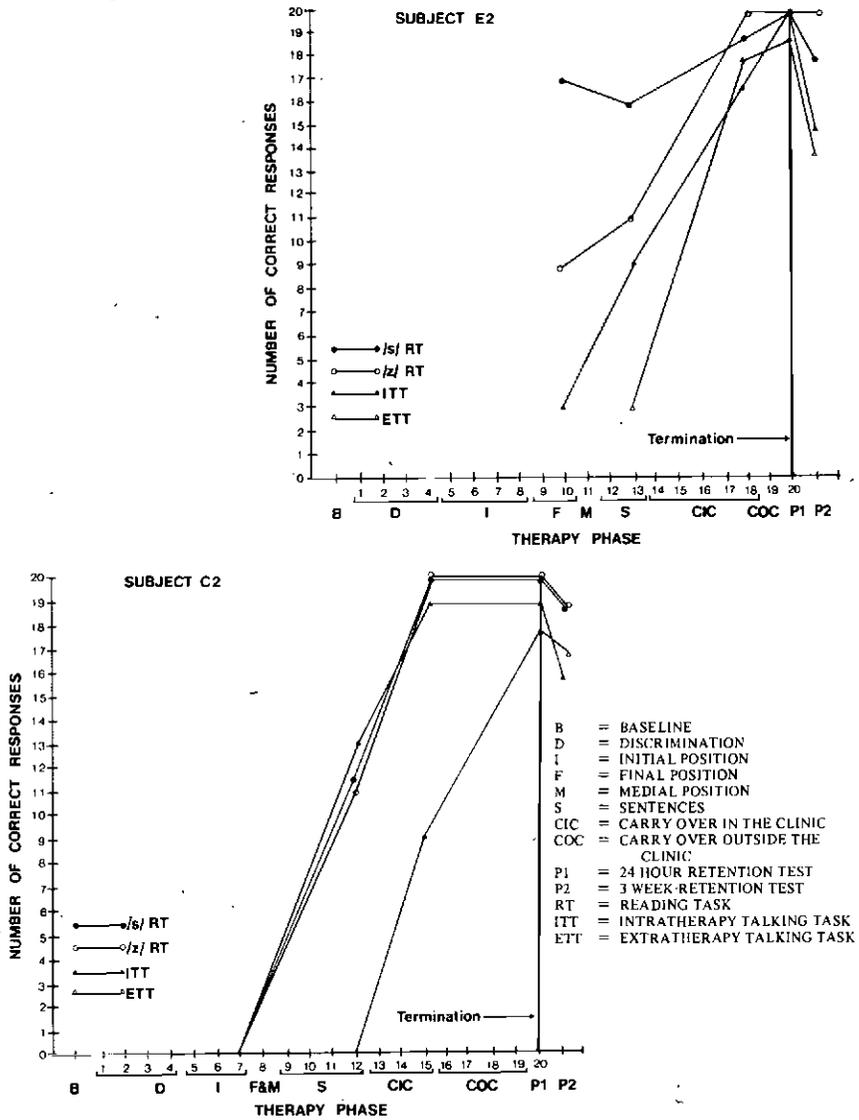


Figure 3: Performance of E2 and C2 on Reading Tasks and Talking Tasks at each Phase of Therapy.

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A general trend emerges from the close comparison of the intra-therapy probe test results of matched experimental and control Ss. In the initial acquisition stages of therapy the scores of the control Ss exceeded that of their matched experimental counterparts. However, this situation reversed itself starting at the sentence phase of therapy. Of significance are the greater scores obtained by the experimental Ss on the Extra-therapy Talking Task. Although a limitation of the present study is a lack of accurate assessment of carry-over to non-clinic environments, these scores appeared to demonstrate that both experimental Ss were readily able to generalise correct production to situations unrelated to speech therapy.

*Reliability of Data (See Table III)*

PHASE OF RATING	R1 AND R2	R1, R2 AND E2	E1 AND E2
DISCRIMINATION	59,4%	46,9%	91,2%
INITIAL POS.	90,6%	69,4%	80,0%
24 HR. RETENTION	90,0%	87,8%	96,0%

R1 AND R2 – rating between 2 independent judges  
 R1, R2 AND E2 – Agreement between raters and the experimenter  
 E1 AND E2 Agreement between 2 sets of measurements made by the experimenter

TABLE III. Mean Percentage of Inter-judge and Intra-judge Reliability.

The poor reliability scores found in this study seem to indicate that listener judgement alone is inadequate due to the acoustic similarity between /θ/ and /s/. The use of visual cues as in videotaping and a more objective measure such as spectrographic analysis could eradicate some of the uncertainty.

### GENERAL DISCUSSION

A number of factors have been said to be important in determining an individual's ability to modify his behaviour.<sup>29</sup> The unique characteristics of each Ss progress suggests that these factors must be taken into account when examining the efficacy of a therapeutic technique.

A limitation of this study was the number of inter-subject variables that had to be controlled for. The results of this study suggest that the presence of a tongue thrust did not impede E2 and C2's ability to acquire correct production. These results support Mason and Proffit's<sup>16</sup> contention that the speech defect can be corrected without prior correction of the tongue thrust. Tongue thrust does not appear to be related to carry-over problems since C1 experienced the

same difficulty. However, the influence of motivational factors, differences in chronological age and variations in learning ability may have contributed to the differing rates of progress observed.

The effect of certain therapeutic variables was controlled for since all Ss were seen for intensive group therapy. Since the E was the therapist for both groups, the role of therapist variables and experimenter bias cannot be excluded.

Despite these confounding variables, it is important to ask what factors inherent in the principle of mass generalised learning may have accounted for the finding that E1 showed spontaneous carry-over of correct production. The following tentative explanation is offered on the basis of certain concepts taken from Piagetian and phonological literature.

The writer postulates that 'grouping' based on distinctive feature similarity may serve to provide the child with a *permanent* system of articulatory monitoring. The grouping together of sounds closely related to one another provides the child with the opportunity of discerning the relationship between sounds already in his repertoire namely /s<sup>v</sup>/, /z<sup>v</sup>/, /t<sup>v</sup>s/ and /d<sup>v</sup>z/ and the target phonemes /s/ and /z/. Studies have shown that the child improves his articulation of phonemes that share distinctive features with the phoneme being taught.<sup>18,33</sup> Similarly, it is possible that the child will generalise the properties of the sounds he is already able to produce to those sounds that are in error.

Distinctive feature classes are reported to have corresponding clusters of sensory and motor feedback networks.<sup>28</sup> Thus, when the child attempts production of /s/ and /z/ correspondence to the feedback patterns associated with /s<sup>v</sup>/, /z<sup>v</sup>/, /t<sup>v</sup>s/ and /d<sup>v</sup>z/ would be a signal to the child that his attempts were successful. It is hypothesized that if this internal referent system is established for the child in the early stages of therapy, carry-over of correct production to speech contexts unrelated to the speech therapy situation will be facilitated.

The efficiency of this procedure may reside in its ability to provide the child with an *independent* system of articulatory monitoring. Herein lies the major downfall of traditional procedures. The result of their focus on the stimulus-response reinforcement paradigm is that the child is dependent on the therapist to monitor and reinforce his attempts at correct production. Mass generalised learning experience, however, seems to provide the child with a *strategy for coping with correct production regardless of the presence or absence of stimuli related to correct production in the clinic.*

## CONCLUSION

Despite the limitations and difficulties inherent in this type of study, the results do provide some support for Morehead and Johnson's<sup>20</sup> hypothesis and also seem to suggest that the application of this principle in the field of articulation therapy may offer the speech therapist the advantage of naturally and effectively attaining successful carry-over.

## REFERENCES

1. Backus, O. and Dunn, H.M. (1947): Intensive Group Therapy in Speech Rehabilitation. *J. Speech Dis.*, 12, 2, 135-142.
2. Carrell, J.A. (1968): *Disorders of Articulation*. Prentice-Hall Inc., Englewood Cliffs, N.J.
3. Compton, A.J. (1970): Generative Studies of Children's Phonological Disorders. *J. Speech Hear. Dis.*, 35, 4, 315-399.
4. Crocker, J.R. (1969): A Phonological Model of Children's Articulation Competence. *J. Speech Hear. Dis.*, 34, 3, 203-213.
5. Elbert, M. Shelton R.L. and Arndt, W.B. (1967): A Task For the Evaluation of Articulation Change: I. The Development of Methodology. *J. Speech Hear. Res.* 10, 2, 281-288.
6. Fry, D.B. (1968): The Phonemic System of Children's Speech. *British J. Disorders Communication.* 3, 1, 13-19.
7. Goda, S. (1970): *Articulation Therapy and Consonant Drill Book*. Grune and Stratton, N.Y.
8. Goldman, R. and Fristoe, M. (1969): *Goldman-Fristoe Test of Articulation*. American Guidance Service Inc., Minnesota.
9. Guile, T.C. (1975): *Personal Communication*. Dept. of Phonetics and Linguistics, Univ. of Witwatersrand.
10. Halle, M. (1964): On the Bases of Phonology. In Fodor, J.A. and Katz, J.J. (Eds.) *The Structure of Language: Readings in the Philosophy of Language*. Prentice-Hall Inc., Englewood Cliffs, N.Y.
11. Hall-Powers, M. (1971): Functional Disorders of Articulation: Symptomatology and Etiology. Chapter 33 in *Handbook of Speech Pathology and Audiology*. Travis, L.E. (Ed.) Appleton-Century Crofts, N.Y.
12. Hall-Powers, M. (1971): Clinical and Educational Procedures in Functional Disorders of Articulation. Chapter 34 in *Handbook of Speech Pathology and Audiology*. Travis, L.E. (Ed.) Appleton-Century Crofts, N.Y.
13. Hannah, E.P. Standel, J. and Gardner, J. (1974): Distinctive Feature Analysis. Chapter 7 in *Applied Linguistic Analysis*, Hannah, E.P. (Ed.) Joyce Publications, California.
14. Leonard, L.B. (1973): The Nature of Deviant Articulation. *J. Speech Hear. Dis.*, 38, 2, 156-161.
15. Lewis, F.C. (1974): Distinctive Feature Confusions in Production and Discrimination of Selected Consonants. *Language and Speech*, 17, 1, 60-67.
16. Mason, R.N. and Proffit, W.R.: The Tongue Thrust Controversy: Background and Recommendations. *J. Speech Hear. Dis.*, 39, 2, 115-132.
17. McClean, J.E. (1970): Extending Stimulus Control of Phoneme Articulation by Operant Techniques. *A.S.H.A. Monographs*, 14, 4, 24-47.
18. McReynolds, L.V. and Bennet, S. (1972): Distinctive Feature Generalisation and Articulation Training. *J. Speech Hear. Dis.*, 37, 4, 462-470.
19. McReynolds, L.V. and Huston, K. (1971): A Distinctive Feature Analysis of Children's Misarticulations. *J. Speech Hear. Dis.*, 36, 155-166.
20. Morehead, D.M. and Johnson, M. (1972): Piaget's Theory of Intelligence Applied to the Assessment and Treatment of Linguistically Deviant

- Children. *Papers and Reports on Child Language Development*, 4, 143-161.
21. Mowrer, D.E. (1971): The Transfer of Training in Articulation Therapy. *J. Speech Hear. Dis.*, 36, 4, 427-446.
  22. Oller, D.K. (1970): Regularities in Abnormal Child Phonology. *J. Speech Hear. Dis.*, 38, 36-47.
  23. Pollack, E. and Rees, N.S. (1972): Disorders of Articulation: Some Clinical Application of a Distinctive Feature Approach. *J. Speech Hear. Dis.*, 37, 4, 451-461.
  24. Prins, D. (1963): Relations Among Specific Articulatory Deviations and Responses to a Clinical Measure of Sound Discrimination. *J. Speech Hear. Dis.*, 28, 4, 382-388.
  25. Raymore, S. (1970): *The Effects of Systematic Training Programs on the Generalisation of New Phoneme Responses Across Different Positions in Words*. Unpublished Master's Thesis, Kansas State University.
  26. Shafer, G. (1974): *A Spectrographic Investigation of Acoustic Cues in Reduced Consonant Clusters in Normal and Abnormal Child Speech*. Unpublished Research Report, Dept. of Speech Pathology and Audiology, University of the Witwatersrand.
  27. Shelton, R.L. Elbert, M. and Arndt, W.B. (1967): A Task for the Evaluation of Articulation Change. II. Comparison of Task Scores during Base-line and Lesson Series Testing. *J. Speech Hear. Res.*, 10, 3, 578-585.
  28. Sommers, R.K. and Kane, A.R. (1974): Nature and Remediation of Functional Articulation Disorders. Chapter 3 in *Communication Disorders: Remedial Principles and Practices*, Dickson, S.E. (Ed.) Scott, Foresman and Co., Illinois.
  29. Van Demark, D.R. (1971): Articulatory Changes in the Therapeutic Process. *Cleft Pal. J.*, 8, 159-165.
  30. Van Riper, C. (1972): *Speech Correction: Principles and Methods*. (5th Edition). Prentice-Hall, Inc., Englewood Cliffs, N.J.
  31. Weber, J.L. (1970): Patterning of Deviant Articulation Behaviour. *J. Speech Hear. Dis.*, 35, 2, 135-141.
  32. Weiner, P.S. (1967): Auditory Discrimination and Articulation. *J. Speech Hear. Dis.*, 32, 1, 19-28.
  33. Winitz, H. and Priesler, L. (1967): The Effect of Distinctive Feature Pretraining in Phoneme Discrimination Learning. *J. Speech Hear. Res.*, 10, 3, 515-530.
  34. Winitz, H. (1969): *Articulatory Acquisition and Behaviour*. Appleton-Century Crofts, N.Y.
  35. Wright, V. Shelton, R.L. and Arndt, W.B. (1969): A Task for the Evaluation of Articulation Change: III, Imitative Task Scores Compared with Scores for more Spontaneous Tasks. *J. Speech Hear. Res.*, 12, 4, 875-884.

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