RESPONSE CONTINGENT SMALL STEP TREATMENT--
A Treatment Methodology for the Management of Brain-Injured Communication Disturbed

Rick L. Bollinger, Ph.D. and Connie E. Stout, M.A.
Department of Rehabilitation Medicine
University Hospital, Seattle, Washington

The treatment methodologies employed in the management of brain-injured communication disturbed patients reflect broadly divergent views regarding the nature of speech and language recovery following cerebral insult. A continuum of the strategies which have been and are employed in the particular area of aphasia rehabilitation range from no treatment (reliance on natural restitution alone) to the carefully controlled clinician directed operant programs and use of teaching machines. Between these two extremes is a continuum of treatment paradigms including general language stimulation, non-directed group interaction, assisted general language stimulation, general stimulation with specific modality emphasis, and structured drill directed toward the given communication modality (ies). The primary differences among these methodologies appear to be reflections of 1) the philosophy of the clinician regarding the amount and type of learning (behavioral change) that can or will occur as a result of intervention and 2) the relative amount of structure employed.

The first factor, the consideration of learning principles relative to aphasia rehabilitation, has received attention (Tikofsky and Carson, 1967; Goodkin, 1969). It has been demonstrated that while differences in the rate and amount of information learned (and the resultant behavior change) differ between non-brain injured and brain injured adults, the application of behavioral methodologies (establishing of functional consequences, stimulus control, etc.) have been shown to be effective in producing desired changes in linguistic and non-linguistic performances. The amount of expected learning in brain-injured patients, however, will be dependent upon each individual's locus and extent of brain lesion.

The second factor, that of structure, is compatible with and most often necessary (in differing degrees) to the appropriate application of behavioral methods. Structure implies control of a given task or stimulus presentation with awareness of the relative importance of stimulus attributes and their influence in cueing the desired response. Similarly, structure implies a knowledge on the part of both clinician and patient of the appropriateness of a given response. Both are provided with criteria for comparing the cued response with that desired. In this manner, the patient is provided with a well-defined behavioral target.

Barring the no treatment approach, differing combinations of structure and application of behavioral methods are present in all the aforementioned treatment paradigms. Similarly, the diversity of individual patients' communication problems is such that the application of both specific and general language stimulation procedures may be appropriate. The tasks presented to a given patient, however, and the manner in which they are presented, should be dependent upon the patient's present communicative behaviors with later tasks being commensurate with the patients' changing status.

The treatment methodology currently employed at the University Hospital has been developed on the premise that the approach to the treatment of any brain-injured individual should consider that the brain injury has resulted in a lessening of the ability to cognitively organize covert and overt responses. While the amount of this inability to organize will be largely dependent upon the extent of the brain injury, clinical experience would suggest that all brain injured communication disturbed patients require external structure (response constraints) prior to the development of efficient covert programming of speech/language behaviors. When the goal of communication management is to facilitate more efficient covert and overt symbolic manipulation, then the role of the speech clinician must include the presentation (teaching) of retrieval strategies designed to achieve that end. Such presentations should occur within a structured framework; one in which the patient proceeds from maximum external structure (clinician provided) to maximum internal structure (patient integration of treatment strategies). Within such a treatment paradigm, the speech clinician should provide external structure via a sequence of carefully controlled tasks (antecedent events) and must also act as a mechanism of feedback. In such a manner, the communication disturbed patient would work from highly structured specific response behaviors to the more non-directed general language communication environment.

RCSST

The aforementioned management considerations have provided the framework for the development of Response Contingent Small Step Treatment (RCSST), an approach which has been employed with a variety of brain injured communication disturbed patients at the University Hospital. While many revisions have been made over the past three years, the basic format as developed, has allowed our speech staff to 1) more accurately define the communicative tasks presented during treatment, 2) provide for flexibility of task difficulty based upon the patient's rate of success, 3) allow for maximum success by the patient during each task presentation ("minimum error learning"), and 4) maintain an accurate measure of the patient's performance and current communication status.

The treatment methodology (termed "small-step") has some correspondence to operant methodology in that it is quantitative, structured, and is directed by the patient's response to the stimuli presented. Treatment paradigms similar in nature have been reported by Hedrick et al (1972) and Rosenbeck et al (1973). As with the approach reported by Rosenbeck, Response Contingent Small Step Treatment employs the multi-dimensional scoring system developed by Porch (1967) for qualifying patient performance. More importantly, however, it corresponds in philosophy to that employed by Hedrick et al in that it differs from operant procedures by emphasis upon structuring and manipulation of the antecedent event rather than shaping behavior through selective reinforcement of responses.

Treatment Programming

Critical to the successful implementation of small step methodology is the identification of task hierarchies. Each primary target behavior desired during a given treatment session is presumed to have a number of preceding targets or steps which may or may not be necessary for the patient's successful progression to more difficult levels. Each step in the hierarchy is determined by the relative stimulus power and stimulus number.

Stimulus Power

Power is operationally defined as the stimulus event strength required to cue the desired response. Primary to this definition is the ease with which the response is facilitated. The factor of stimulus power is then relative, being dependent upon the individual patient's response. Because patients will have differing degrees of linguistic (rule and word retrieval) and extralinguistic (attention, perseveration, and perceptual) involvement dependent upon the extent and locus of the brain injury, stimulus attributes that may readily cue a response from one patient may be ineffective for another. Thus, a patient with severe visual-perceptual problems in addition to the aphasic disorder, may respond better to a combined auditory visual presentation (pointing to a picture named by the clinician) than to what may appear on the face of it to be a more powerful stimulus combination (pointing to word and picture in response to name given). Similarly, it is assumed that the more efficiently the language and non-language behaviors are performed, the less powerful is the stimulus event necessary to cue the desired response. Thus, the relationship between ease of response and strength of stimulus should be inverse during the early treatment and less so as the patient's communicative functioning becomes more efficient.

Stimulus Number

The stimulus parameter of number is quantitative (i.e. the number of stimuli in a given response field and/or number of items per task). This parameter appears to be influenced by extralinguistic brain-damage behaviors such as ability (or lack of ability) to shift, attention span, and other perceptual skills. The variable of stimulus number appears to reflect the patient's ability to utilize the non-symbolic perceptual processes necessary for efficient linguistic processing (i.e. the speed with which he can process, track, and organize information). As these skills improve or are circumvented via some type of compensation, the number of units to be processed can be increased. Table I details the manipulation of power and number variables in determining antecedent event strength. Each increase or decrease in difficulty is the result of the manipulation of a single variable.

Additional Hierarchy Considerations

In addition to the primary stimulus control of power and number, two additional factors, response criterion and response constancy, are considered in the development of a target hierarchy. Response criterion is that level of performance established as a necessary prerequisite for successful performance of the next higher task. As shown on Table 1, performance criterion is defined as the percentage of responses in a given task at a designated performance level notated by a PICA score describing quality of response (Porch, 1967) . The final target response criterion is usually determined as 90 to 95% of responses at a level of 13 or above (delayed complete response or prompt complete response). Criterion levels below 10 (self-corrected response) are not employed since they reflect essentially different tasks than the target.

Response constancy is similar to response criterion in that it is reflected by the number of items successfully completed at the required level of performance. It differs, however, in that it reflects the stability of performance at that given task. Response constancy would be reflected by criterion attainment on from two to four task presentations of 10 or more stimulus items each.

Implementation

Once a treatment hierarchy for a given target has been established, the patient is presented with the lowest level of the hierarchy (most powerful antecedent) and worked toward his particular level of performance by single item presentations from each step. At that point where the patient first experiences failure, the clinician drops back to the preceding step where formal task presentation of multiple items begins.

Table 1. Sample Hierarchy RCSST

Target behavior: auditory-visual match

Input modality: combined aud/vis

Output modality: gestural

	Power	Number	Criterion
1.	Vis: word & picture Aud: name x 2 Word Freq: high Other: 50% each mono & bisyllable	20 Field 2 (1 each mono & bisyll) Each pair dif. x 1 (1 retained, 1 novel)	100% 10↑
2.	"	"	90% 13↑
3.	"	20 Field: 2(1 each mono & bisyll) each pair dif. x 2	90% 10↑
↓			
30.	Vis: picture Aud: name x 1 Word frequency: varied Other: random	24 Field: 8 Each task field different x 8	90% 13↑

Flexibility of task presentation is built into the treatment planning. If the patient performs below criterion level on four consecutive first item presentations, the next lower level in the task hierarchy is presented. When a marked discrepancy is apparent between two consecutive levels (steps), in that the patient performs at criterion on the preceding level and does not at the next higher level, the clinician must reassess the hierarchy to determine whether or not a step has been neglected. If no intervening step can be formulated, and the patient's performance does not meet criterion levels established for the next higher level, it must be speculated that a plateau has been reached for that particular task.

Similarly, a patient is not restricted by the hierarchical steps. Each treatment session incorporates a 5 minute probe period wherein the patient is presented with tasks above his present level of functioning. If he succeeds in performing at a higher level, the intervening steps are omitted. This procedure allows for the not infrequent rapid changes observed in the performance of aphasic adults during the early stages of spontaneous recovery. This "probing" and omitting intervening steps when indicated, reflects the clinical philosophy that language treatment is restimulation, and that when optimally stimulated the aphasic patient may retrieve language behaviors not specifically presented to him during treatment. Thus, while a designed hierarchy may have as many as 50 to 100 steps, the patient may actually need work through only 20 to arrive at the terminal behavioral target.

Treatment Forms

RCSST Treatment Forms I and II are shown in Figures 2 and 3. Form I has been developed for use with more discrete response modality specific speech and language tasks (i.e. imitation, naming, auditory comprehension of single units, etc.). Form II is used for longer input and output tasks where many factors may be responsible for successful performance (i.e. sentence generation, following directional commands, etc.).

A patient's small-step programming of a particular task for a given treatment session is detailed on the lower portion of the treatment form in the space provided. Steps above and below the target behavior are indicated by a plus or minus. This hierarchical delineation of a given task is completed prior to the treatment session and is based upon the patient's previous performance. If upon any given item presentation within the task the patient does not respond at the desired criterion level, the item is presented again with the modifications indicated at the -1 level (increase in stimulus power or decrease in number). If continued item presentations at the target behavior level do not cue the desired response, and the patient consistently needs to drop back to an easier presentation, the target task is discontinued and the preceding step (-1) is presented. A change in task presentation is indicated by the notation of the plus or minus target behavior above the particular response column.

Date _____

Dept. Rehabilitation Medicine
University of Washington

TREATMENT RECORD (Form I) Date _____

I. Target Behavior _____
Input Modality _____
Output Modality _____
Stimulus _____
Resp. Crit. _____
Plnnd. Conting. _____

II. Target Behavior _____
Input Modality _____
Output Modality _____
Stimulus _____
Resp. Crit. _____
Plnnd. Conting. _____

	Stimulus	Response	Conting.		Stimulus	Response	Conting.
1.				1.			
2.				2.			
3.				3.			
4.				4.			
5.				5.			
6.				6.			
7.				7.			
8.				8.			
9.				9.			
10.				10.			
11.				11.			
12.				12.			
13.				13.			
14.				14.			
15.				15.			
16.				16.			
17.				17.			
18.				18.			
19.				19.			
20.				20.			

RESPONSE SUMMARY

I.

Response Range:

Average Response:

Conting. Rate:

%age Resp./Crit. Level:

TREATMENT HIERARCHY

I	Stimulus	Target Beh.	Conting.	Crit %
-3				
-2				
-1				
T				
+1				
+2				
+3				

RESPONSE SUMMARY

II.

Response Range:

Average Response:

Conting. Rate:

%age Resp/ Crit. Level:

TREATMENT HIERARCHY

II	Stimulus	Target Beh.	Conting.	Crit %
-3				
-2				
-1				
T				
+1				
+2				
+3				

C- Bollinger/Stout
Seattle, Washington, 1974

Figure I

Pt. Name _____

Dx _____

Speech Pathology Services
Dept. Rehabilitation Medicine
University of Washington

TREATMENT RECORD (FORM II)

Target Behavior _____
Input Modality _____
Output Modality _____
Stimulus _____
Resp. Crit. _____
Plnnd. Conting. _____

Response Summary: _____
Response Range: _____
Average Response: _____
Conting. Rate: _____
%age Resp./Crit. Level _____

I.

		Score	Conting.
1.	S		
	R		
2.	S		
	R		
3.	S		
	R		
4.	S		
	R		
5.	S		
	R		
6.	S		
	R		
7.	S		
	R		
8.	S		
	R		
9.	S		
	R		
10.	S		
	R		
11.	S		
	R		
12.	S		
	R		
13.	S		
	R		
14.	S		
	R		
15.	S		
	R		

TREATMENT HIERARCHY

Stimulus	Response	Conting.	Crit%
-3			
-2			
-1			
T			
+1			
+2			
+3			

(Scoring System (Porch, 1967)

16 COMPLEX
15 COMPLETE
14 DISTORTED
13 COMPLETE/DELAYED
12 INCOMPLETE
11 INCOMPLETE/DELAYED
10 SELF-CORRECTED
9 REPEATED
8 CUED
7 RELATED
6 ERROR
5 INTELLIGIBLE
4 UNINTELLIGIBLE
3 MINIMAL
2 ATTENTION
1 NO RESPONSE

C- Bollinger/Stout
Seattle, Washington 1974

Figure 2

Response Contingencies

As indicated on the treatment forms, a within task treatment structure employed in RCSST is the clinician provision of positive, negative, and neutral response contingencies. While the effect of such contingencies cannot be stated with assurance, their presentation appears to provide the patient with feedback regarding his performance. It is, in effect, an external overt "stop and go" during the task, suggesting that the contingency schedule is a method of increasing response awareness rather than a direct reinforcement. The response contingency schedule is determined in accordance with the task item criteria. When the patient responds with a behavior below that required, the negative contingency tells him that he needs to continue his language processing for the retrieval of the appropriate response. Similarly, the patient's failure upon the first presentation of a given task item (the only scored response) indicates to the clinician that the patient needs more information (increased stimulus power) to respond. The clinician then small steps backwards (increasing the power of the stimulus or decreasing number) until the patient responds appropriately. At the point of successful response a neutral contingency is provided ("That's the one you wanted."). The contingency types are notated as + (positive), 0 (neutral), and - (negative) in the contingency column parallel to the stimulus column.

The dropping back to easier levels of task difficulty when the first response is below the criterion level is the actual treatment. Each step back provides the patient with more information, increasing the likelihood of the correct response. It allows him to practice word and rule retrieval at levels which stimulate and facilitate retrieval at higher levels. The increasing and decreasing of item difficulty within a task maintains a successful yet challenging activity with a minimum of frustration and failure.

The small step programming for speech and language tasks at the sentence and phrase level is completed in the same fashion as for the more discrete tasks. Form II has been developed in such a manner that more descriptive information (in addition to the PICA scoring) can be maintained. For example, if the task is following a series of directions, a score of 12 (incomplete response) indicates only that the patient did not perform all the directions. If, however, notations are made as to which items were not performed, a pattern of difficulty may be observed. Similarly, the verbatim verbal output presented in a sentence generating task in response to picture description, provides a wealth of data for analysis for future treatment programming.

It should be noted that during the early presentation of tasks with phrase and sentence targets (either verbal or graphic), the target per se is scored. That is, if the sentence is complete

it will be scored as a 13 or 15 (delayed complete; prompt complete) regardless of spelling or articulation errors. Only when the target response has been stabilized will the criterion be raised to include accuracy of production. While this is a deviation from the scoring procedure as developed by Porch, it is felt to be necessary for small step programming. Attention to details of spelling and articulation during the early stages of phrase and sentence generation are time consuming and detract from the target. Also, when the response criterion is a 10 (corrected response), scores of 11 and 12 (delayed incomplete and prompt incomplete) are not accepted. A score of 10 appears, in fact, to be a more powerful score, indicating an awareness of the task to be performed and an ability to perform it. An incomplete response designation (12) provides little valuable information regarding the target performance (why it was not performed).

Response Summary

Appropriate space is provided on the treatment forms for the detailing of patient responses. These descriptive summaries are utilized in planning forthcoming treatment. They also provide information regarding the probability of change, the influence of response contingencies, and in retrospect, suggest patterns of recovery.

Current Application

The RCSST methodology has undergone many modifications since its inception. In its present state of application it has significantly influenced the patient treatment and clinical training of graduate students at the University Hospital. It has been demonstrated that it is applicable to a wide range of communication disorders and the development of the treatment hierarchies and the data collection from specific patient treatments, has yielded important treatment information applicable to patients manifesting dysarthria, apraxia, and aphasia. Similarly, the methodology has provided for a more structured presentation of treatment rationale and direction for novice clinicians. While the "art" of clinical management continues to be important for patient-clinician rapport, the subtleties of intuition and the "feel" for patient needs usually requires experience. The utilization of RCSST minimizes the influence of more subjective factors and establishes a firm foundation for clinical treatment. After the PICA scoring system and the rudiments of target hierarchy development have been taught, a student clinician has sufficient direction to plan consistent appropriate treatment regardless of the severity of communication involvement.

The development and use of Response Contingent Small Step Treatment has enabled our program to more positively approach the broad issue of accountability. The benefits of such an approach are summarized as below. The data obtained allows for:

1. obtaining an accurate baseline of patient performance on a treatment by treatment basis (often used to convey comunication status to other staff members and third party providers),

2. determining future small step targets,

3. increasing clinician observation of patient performance,

4. enforcing more systematic treatment that is appropriate to the patient's level of ability,

5. retrieving of information regarding language recovery patterns,

6. providing for baseline behavioral determination when standardized testing cannot be completed.

BIBLIOGRAPHY

Goodkin, R., "Changes in word produciton, sentence production and relevance in an aphasic through verbal conditioning. Behav. Res. and Therapy, 7, pp. 93-99 (1969).

Hedrick, D. L., Christman, M. A., and Augustine, L., Programming for the antecedent events in therapy. J. Spch. Hrng. Dis., 38, 3, 339-344 (1973).

Rosenbeck, J. C., Lemme, M. L., Ahern, M. B., Harris, E. H., and Wertz, R. T., "A treatment for apraxia of speech in adults." J. Spch. Hrng. Dis., 38, 4, 462-472 (1973).

Tikofsky, R. S. and Carson, D. H., "Concept and discrimination learning by aphasics". Dept. of Psychology and Speech Clinic, U. of Mich., Ann Arbor, Mich., N.I.H. Grant No. NB-05374-03, Bethesda, Maryland, (1969).