*ANALYSIS OF THE EFFECTS OF SEQUENTIAL REINFORCEMENT
CONTINGENCIES ON ASPECTS OF COMPOSITION¹*

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The procedures of manipulating consequent events were applied to the problems of teaching composition in a fifth-grade remedial classroom. Three objective aspects of composition, total number of words, number of different words, and number of new words, were selected for manipulation and reinforcement contingencies were sequentially applied to these components. The writing output of all subjects was greatly increased.

The problem of creating new behaviors or adding to an organism's behavioral repertoire has been approached in a variety of ways in the operant literature. The procedures of shaping, *i.e.*, differential reinforcement of successive approximations, are often pointed to as prototypes for the analysis of the development of new behaviors. The classic example of shaping procedures is the "Dickey" study (Wolf, Risley, and Mees, 1964), in which a young "autistic" boy was taught to wear glasses to prevent blindness. In shaping, the basic procedure is the manipulation of the delivery of consequences, by requiring closer and closer approximations to the terminal behavior for the delivery of reinforcement (Bijou and Baer, 1961).

An alternative form of shaping might be the use of reinforcement contingencies to improve and combine current behaviors, thus producing a more complex set of behaviors. The resulting

composite should be a set of behaviors substantially different from the initial occurrence of the responses. It may be that some complex human behaviors can be analyzed in terms of component parts, and these components taught sequentially to produce the complex skill in question.

A set of behaviors where this approach seems to be appropriate is writing or composition. In contrast to the large-scale experimental and applied efforts associated with the other members of the "three Rs", writing has received little experimental attention. There are probably many reasons why composition has not been more systematically analyzed. While there is a great deal of controversy about how to teach reading, what needs to be taught is reasonably clear. This does not appear to be true for writing. What is a good story? Is it grammar, ideas, length, variety? Another source of difficulty is the assumption that while reading may be taught, writing is something that flows from the writer. Consequently, most efforts to teach composition have emphasized stimulating the student to write, such as having the students read or view a set of stimuli and then write stories about them. It is often assumed that once the student starts writing he will improve in the more mechanical quality aspects of composition.

An alternative approach to writing might specify a number of objective aspects of composition, place reinforcement contingencies on them,

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and examine outcomes. Thus, it might be possible to produce improved compositions by sequentially reinforcing specific writing skills.

There are a great many objective components of writing that could be selected for analysis: grammatical structure, spelling, word class, word usage, *etc.* However, since the students participating in the study were severely academically deficient in most areas, it was decided to use concrete and easily defined writing behaviors. On that basis, number of words, number of different words, and number of new words used in a story were selected as the aspects of writing to be directly manipulated and examined. It was expected that positive changes in these components would increase the length of the stories (number of words), reduce the redundancy within the stories (number of different words), and increase the written vocabulary, possibly expanding the number of ideas in the stories (number of new words). Finally, if these objective components could be improved, the overall quality of the compositions would also improve.

METHOD

Subjects

Thirteen male members of a fifth-grade "adjustment" classroom had been placed in this classroom for combinations of academic failure and behavior problems. As a group, they were more than 2 yr behind academically on standardized test scores at the beginning of the school year. Initially, the class consisted of 15 students, but over the course of the study one was "promoted" to a regular classroom and the other was expelled from the school.

Setting

The adjustment classroom was designed to apply operant learning principles to the students' academic and behavioral problems. The staff consisted of a lead teacher, an aide, and various supplement personnel who assisted periodically. Instruction was mainly individualized with programmed curriculum materials. Finally, a token system of marks or points was in effect at all

times. The points were given by marking off squares of appropriate value on the student's point sheet. The students earned points for both academic work and appropriate social behavior. The points could be traded at various prices for the privileges of the room. It appeared that the major reinforcer was an excellent arts and crafts program developed by the lead teacher. (See Wolf, Giles, and Hall, 1968 for a more extensive description of this type of point system.)

General Procedures

Since the students were scheduled for various academic activities throughout the day, writing was directly introduced into their schedules (on the average twice a week) as a required period. The students were unsystematically divided into three groups for the first session. Each group was scheduled to write together. In the first session, the students were given paper and were asked to write a story about the things they liked to do. The teacher gave a short explanation for 2 to 5 min about how they could write about what they liked to do with friends, family, *etc.* A topic and short explanation were given for each composition session. The students were also given a card on which words would be spelled. If the student raised his hand, and asked the spelling of a word, the teacher would write it out on the card and make a contact mark on his paper. All contacts for spelling or other reasons (point delivery, explanation, *etc.*) were marked on the top of the student's paper.

While the students always began writing as a group, they were free to quit at any time or write as long as they wished. Since there were few large group instructional periods in the classroom, students had at least 1 hr available to write each session. Starting and stopping times were also recorded at the top of each composition.

After the first session, the papers were scored and the groups were redivided on the basis of the number of words to form groups of fairly equal initial performances.

The writing teacher was the same for all groups throughout, except for the last six ses-

sions for Group C. To test if the major procedure could be replicated across teachers, the classroom lead teacher took over Group C from Session 8 until the end of the study. All other procedures remained the same.

The experimental manipulations consisted of a series of sequentially additive contingencies for each group. That is, rather than moving the contingency from one aspect of writing to another, new contingencies were added related to each specific feature of composition.

Baseline: Points Contingent on General Work Behaviors

The students received points for sitting down, paying attention, doing good work (writing), staying in seat, and finishing. Along with the points, the teacher praised and encouraged all of these activities. While points and praise were given contingent on working, there was no consistent relationship between points and any specific aspects of the writing. A typical point delivery might be: "Good work, Anthony, 10 points because you are working so hard." The number of points earned by students in baseline ranged from 60 to 100.

Points for Number of Words

The students were told that they would now receive one point for every word they used in their story. The children were praised through the session for working and the points were delivered (marked off on the point sheets) after the session. The students continued to receive bonuses for sitting down and starting, but at a reduced rate.

Points for Different Words

In addition to the points for the number of words in the story, the students were told that they would receive two extra points for each different word in the story. A different word was defined as the first usage in that day's story (*i.e.*, "I like baseball, I like football," totals six words but only four different words). Therefore if the word "was" appeared six times in a day's

story it was given six points in the total words category and two points as a different word. The procedure was explained to the students by having them look at several sentences and tell which were the different words.

The procedure was designed to decrease the within-story redundancy, because it had been observed that much of the children's writing consisted of similar sentences with single word substitutions. The extra points for sitting, starting, *etc.*, were eliminated at the beginning of this manipulation.

Points for New Words

The students were told that in addition to the points for total number of words and different words, they would now receive three points for each new word that they used in the story. A new word was one that the student had never used before in any of his stories. The students were given an alphabetized list of all of the words they had used in prior stories to refer to in writing the stories in this condition. Because of the difficulty of scoring the stories for new words, the students received two sets of points in this condition. Points for the total number of words, and different words were given right after the writing period, but the points for new words were not given until the next day.

The contingencies were manipulated at different times for each group as a modification of the multiple baseline design described by Baer, Wolf, and Risley (1968). The sequence and duration of the manipulations for each group are presented in Table 1.

Scoring

Each story was scored on the three objective measures, total number of words, different words, and new words. A story-by-story alphabetized record was taken of each word used by a student. In addition, the time spent writing, number of teacher contacts, and number of points earned were all recorded.

In constructing the running record (dictionary), each story was rescored by a data clerk

Table 1

The Order and Number of Stories Written Under Each Condition by Each Group

<i>Conditions</i>	<i>Baseline</i>	<i>Number of Words</i>	<i>Different Words</i>	<i>New Words</i>
Group A	1 & 2	3 through 6	7 through 9	10 through 13
Group B	1 through 6	7 through 9	10 through 12	13 through 15
Group C	1 through 9	10 through 13	*	*

*Group C did not participate in these procedures because of the completion of the school term.

who had no other knowledge of the study. These scores were used in the data analysis. In addition, 40 stories selected on a random basis were re-scored by the first author. Since the dictionary entries were dated, it was possible to check each aspect of the scoring, number of words, different words, and new words against the original story. Each scorer's counts were totalled and compared (low total score/high total score); rescoring agreement was 95% or better.

Since one objective of the study was to examine the possibility of improving the overall quality of the writing by manipulating various objective aspects of composition, an instrument was developed to evaluate the quality of each composition. After much trial-and-error work on sample stories from another classroom, five dimensions were selected for rating the stories that seemed to discriminate the quality of the stories. The dimensions developed were: (1) Mechanical aspects, length, spelling, grammar, punctuation; (2) Vocabulary, variety, and word usage; (3) Number of ideas; (4) Development of the ideas; (5) Internal consistency of the story. All dimensions were scored from 0 to 5. No operational definitions were given for any of the measures; instead, during training, examples were judged and discussed until there was agreement on scoring each dimension. This took approximately 1.5 to 2 hr for each judge. The judges were five upper division students with divergent backgrounds, Art, Education, Engineering, Psychology, and Psychology.

After the training periods, all judges worked independently. For rating, all the stories were retyped, maintaining exactly the patterns of

spelling, punctuation, and structure of the originals. Each story was coded and rated randomly. The judges themselves had no knowledge of the design of the experiment or even that it was an experiment. They were simply told to rate this set of stories by the system that they had just learned.

In addition, various samples of the children's stories are reproduced in Table 3 for the reader to evaluate.

RESULTS

The numerical aspects of the results may be summarized simply: in all groups, the performance changed most in the number-of-words procedure. In each group there was an immediate increase in the number of words written in each story with a correlated increase in the number of different words, number of new words, and the time spent in writing. The number of words and the time was approximately double that under the non-specific baseline contingency. The group curves are representative of the functional properties of the performance of all subjects in regard to number of words and time; there was more variation in the individual performance on the other two measures. The change from the non-specific interval procedure to the number-of-words condition while changing the contingency between writing and the delivery of points did not appreciably change the amount of reinforcement for Group A and B; *i.e.*, the total points earned by the students in the baseline and points for number of words fell within the same range (60 to 100) and appeared to be

fairly consistent from subject to subject. On the other hand, Group C had a higher baseline production of words and the change of conditions along with increased production resulted in their earning more points than in the baseline period.

The change in teachers for Group C was correlated with an increase in their overall performance. In Sessions 6 and 7, the average number of words was 21 and 17, but increased to 42 and 49 for Sessions 8 and 9, the first sessions for the new teacher. While Group C's performance generally increased, the increase was greater with the change to the number-of-words condition. Overall, the results for Group C with the new teacher appeared to be consistent with those of Groups A and B.

The procedures that were aimed at increasing the number of different words and the number

of new words produced equivocal results. The different-words and new-words contingencies had little overall effect on the performance of the students in Group A and B. The advent of the new-word contingency (three points for each new word) was followed by a jump in the number of new words for both A and B the first day of this condition. However, the next sessions the use of new words dropped off. Paradoxically, the contingency itself may have contributed to this decline because the students were observed spending more time looking at their word lists, apparently trying to come up with new words, rather than simply writing. While the new-word procedure did not yield a clear increment in the use of new words, new words were consistently emitted throughout the

Fig. 1. The mean number of words used in each story per group across Baseline and Experimental Conditions.

Fig. 2. The mean number of different words used in each story per group across Baseline and Experimental Conditions.

Fig. 3. The mean number of new words used in each story per group across Baseline and Experimental Conditions.

experimental manipulations. The students used a number of new words during the study, indicating that the stories were not simply repetitions of earlier stories.

The results of the rating of the quality of the stories are presented in Table 2. The change from the baseline non-specific reinforcement procedures to the points for number-of-words conditions was followed by increased ratings for all groups in the first session. For Group A, all of the scores in the number-of-words condition were higher than scores in baseline; with Groups B and C there were single points of overlap. Overall, the means of the individual ratings in baseline and number of words conditions were: A, 7.9 and 9.9; B, 7.7 and 10.0; C, 8.16 and 11.1. An analysis of the rating dimensions showed this increase to be due mainly to higher

scores on vocabulary and mechanical aspects. Interestingly, there seemed to be a negative practice effect in baseline with the mean ratings falling across baseline for Groups B and C.

The different-words conditions appeared to have little effect, either positive or negative, on the quality of the stories. However, in contrast to the small effects on the word-count measures, the new-words condition correlated with the highest quality ratings of the study for Groups A and B (Group C did not participate in this condition). In the new-words conditions Group A's scores were 13.0, 12.2, 9.3, and 13.0 compared to a previous high of 11.8. Similarly, Group B's scores were 12.5, 11.4, and 13.2 compared to a previous high of 10.6. The increase in the scores appeared to be a result of

Fig. 4. The mean amount of time in minutes spent in the writing session per group across Baseline and Experimental Conditions.

Table 2

The mean ratings of the compositions for both individuals and groups are presented across conditions. The stories were rated by five judges on the following dimensions, mechanical aspects, vocabulary, number of ideas, development of ideas, and internal consistency of the stories. Each dimension was rated from 0 to 5, producing a possible range of total scores from 0 to 25.

Group A	Baseline		Number of Words				Different Words			New Words			
	1	2	3	4	5	6	7	8	9	10	11	12	13
Abner	11.2	8.6	14	9	12.6	11	12.4	13.6	10.4	14.6	9.2	8.6	14.2
Bob	7.2		14.6	9.4	10.4	9	13.4	9.2	10.8	12.4	16.4	8.2	14.4
Calvin	6.8	7.4	8.4	7.2	10	7.2	11.6	10.6	9.2	11.4	10.2	9.2	11.8
Donald	7.4	8	10.4	9	11.2	8.4	8.6	11.8	6.2	14.2	12.2	9.4	12.4
Edward	6.8		11.6	7.6	7.6	9.8	7.6	8.6	9.2	12.6	13.2	11	12.4
Mean	7.9	8.0	11.8	8.4	10.4	9.1	10.7	10	9.1	13	12.2	9.3	13

Group B	Baseline		Number of Words				Different Words			New Words					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Frank	8.8		10	9.6	7.4	5.6	12.2	8.2	8.4	8.2	7.6	10.4	12.6	12.4	13.6
George	6.6	8.8	7.4	4.6	6.6	4.8	9.2	10	8.4	6.8	10.4	9.8	11.4	9.8	13.8
Howard	7.2	7.6	14	7.2	5.8	8.2	10.6	10.2	13	10.6		11.4	13.6	12	12.2
Mean	7.5	8.2	10.5	7.1	6.6	6.2	10.6	9.5	9.9	8.5	9.0	10.5	12.5	11.4	13.2

Group C	Baseline		Number of Words				Different Words			New Words				
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Ignatius			7.4	8	6.6	7.6	7.8	6.4	7.2	5.4	9	6.2	11.4	
Jeremy		8	8.8	10.4	10.4	8	3.4	8.2	10.4	7.6	15.6	10.8	12.4	12.2
Karl		9.2		11.6	12.8	10.6		9	10.4	10	15.2	12.6	12.6	17.6
Leon		11.6		10	6.8	5.6	5.8	5	10	7.8	8.6	8	11.2	11
Matthew		8.2	5.2	6	9.8	5.6	6.2	5.8	8	9	7.2	8		10.2
Mean		9.2	7.1	9.2	9.3	7.5	5.8	6.9	9.1	7.9	11.1	9.1	11.9	12.7

higher ratings given by the judges for the number of ideas and for the development of ideas.

Another subjective change in the students' performance was the shift in their interests and attitudes, *i.e.*, behaviors in regard to writing. At the beginning of the study, most of the students expressed disinterest or resistance to writing: "It's no fun", "I don't want to write today", "I can't write", *etc.* It was difficult to get them to come to writing; it usually took at least 10 min to get a group together. They also quit writing as soon as possible. When the conditions were changed from baseline to points for words, there was an immediate increase in the amount of

time spent in the writing group. Further, there was a corresponding decrease in the latency between the announcement of writing and the point when everyone was ready. There were similar changes in the students' verbal comments about writing as the study continued.

DISCUSSION

The present study tends to support the notion that complex behaviors such as composition may be synthesized by applying specific contingencies of reinforcement to aspects of the behaviors that make up the terminal skill. In this study, there were two basic changes in the students' writing

Table 3

The following stories are representative samples of the students' work. They are neither the best nor the worst stories of these students or the class as a whole. The stories as presented are direct transcriptions of the students' work.

Student A Group A

Baseline Story: I like to play football, Sometimes I like to play baseball, Sometimes I go to the boys Club. I like boy Club. because we can play pool, hockey, basketball, swimming Gym.

Story from New Words Condition: "My Classroom" In my class we have Arts and Craft. We make molds, beans, flowers, houses out of sticks, pictures, Art, painting. We move the board. We have locks on our door and cabinet. We have lots and lots of things. We go on trips. We went to the Planetarium, and the Museum of Natural History and the Bronx Zoo. We are the only class that have Arts and Craft, and three other classes. We have multiplication, Divide, Adding. We have Morning Block. We play a game that nobody ever played before. It's bonus and jackpot prizes. We earn points by doing our work. And we play a lot of games on Wednesdays we go out side to play games. We Read Reader Digest And Science Readers I did not do my morning Assignment because my Mother came in to talk to Mr. Kramer. Just now Principal walked in. He is seeing how we work. He likes the class. The End

Student B Group B

Baseline Story: I like to play football with my friend I like to go swimming in the boys school

Story from New Words Condition: If I were President the U.S.A. there wouldn't be no Black Panthers and there wouldn't be no President in the city. And there would be no war. And policement wouldn't use clubs without trouble. And there wouldn't be more school in new united states. There wouldn't be no junkies in the United States of America.

Student C Group C

Baseline Story: I like to go swimming. I like to rid Bikes. I like to run all day. I like to Play games. Jailbrabk pull off. round-up tag. freeeze tag Pull of is My Favorite games.

Story from Number of Words Condition: *The Spring Thing* Me and my Mother is going to the Spring Festival. My Mother is bringing a Cake to the Festival. We are going to sell horse and we sell dogs and we seld fishes and we sell clowns. We have fun making molds and we have fun making wheelbarrels. I painted brick for the Festival. It is nice to make nice things. We made sticks and we made churches. Tim is bringing cookies and a cake. Terrence is bring a cake also. Eddie is bring a cake and some cookies for the Festival. We is selling necklaces braclert and rings. It is going to be a beautiful show at the Festival. We are selling Our thing to put basketball hoops and baseball fields. We is going to eat food at the Festival. I am going to sell my Clown at the Festival. Eddie made a robot for the Festival. We made different kinds of things, I have made plenty things for the Class Room. I would like to sell My clown for a one \$1.00 piece.

behaviors, the increase in the length of the compositions, and the overall improvement in the quality of the compositions.

The increase in length or number of words appears to be a function of the change in the reinforcement contingency from the baseline non-specific reinforcement schedule to the points for number-of-words contingency. This manipulation was carried out at different times for the three groups, and each time there was a clear increase in the number of words. Since the amount of reinforcement stayed approximately the same in the two conditions for Groups A and B, it suggests that the change in performance was due mainly to how the reinforcement

was delivered and not the amount of reinforcement.

The overall improvement of the compositions in terms of content presents a more difficult problem for analysis. Two distinct changes in the quality of the compositions occurred, possibly as a function of the experimental manipulations. The change from the non-specific baseline contingency to the points for number-of-words contingency was clearly correlated with increased quality ratings, *i.e.*, better. There was an increase in all of the word-count measures and as a result, the compositions appear to have been rated consistently higher on the dimension of vocabulary and mechanical aspects. In this

case, there was a direct relationship between the change in contingency, the increase in word-count scores, and the increased ratings.

Unfortunately, the increased ratings associated with the new-words condition does not have the same kind of objective underpinnings. In fact, after an initial increase there was a general decrease in the word-count measures. As a consequence, the relationship between the contingency and improved ratings does not appear to be a simple direct one, as in the first case. A possible, but certainly not conclusive explanation, is that under the impact of the new-words contingency, the students directly tried to use new words rather than simply writing. In trying to use new words, they worked harder and spent more time on the sentences, thereby producing more and better ideas while actually writing less.

Overall, the results of both the word-count and rating measures present a mixed picture of the accuracy of the present attempt to analyze composition. The sequential nature of the manipulations and the correlated changes in behavior argue that the points-for-words and new-words conditions did in fact effect the performances. This suggests that the basic strategy of objective analysis and reinforcement has some merit. But it is clear that this approximation is not adequate, and that many more variables and relationships need to be examined.

The change in what the students said about writing from negative to very positive is one that needs further investigation. At the beginning of the study, the students were poor writers and the payoff for writing was relatively low in relationship to other activities in the classroom. Later, as the payoff and skill increased greatly, the verbal responses in regard to writing became enthusiastic. Whether this enthusiasm and effort in writing would have continued if the payoff had been reduced is another question. However, there is a growing body of literature indicating consistent correlated changes in behaviors classified as attitudes with changes in other directly manipulated behaviors. (Nordquist, 1971; Bandura, 1971).

The analysis of composition, "creativity", and similar topics are particularly important today because of the growing influence of the free schools and British Infant Schools. Many teachers in these schools fervently believe that there is a reservoir of "creativity" within children—that if only teachers would leave children alone, original and scintillating stories would soon appear. Thus, rigorous study and analysis of such problems as creativity is essential.

Finally, composition seems to have a number of characteristics that recommend it for experimental study. While it has many important subjective aspects, a wide variety of objective dimensions could be studied and manipulated, word usage, sentence structures, spelling, *etc.* Further, writing leaves a permanent trace for easy repeated analysis. In short, composition is a complex set of human behaviors that deserves more experimental attention.

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