THE UNIVERSITY OF MANTOBA

Effects of Interspersal versus Concurrent Training of Picture-Names on Acquisition, Maintenance, and Generalization

by

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A Thesis
Submitted To The Faculty Of Graduate Studies
In Partial Fulfillment Of The Requirements For The Degree
Of Master Of Arts

Department of Psychology

Winnipeg, Manitoba

July, 1980

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Acknowledgment

I am grateful to Dr. J. Pear for supervising this study, Dr. G. Martin for his generous support, and Dr. G. Lowther and the staff of the St. Amant Centre for their co-operation and help.

Abstract

Effects of interspersal and concurrent task presentation on picture-names acquisition, maintenance and generalization were compared. Two retarded children participated. During the interspersal training procedure a criterion picture - a picture that the child consistently names correctly - was alternated with a subcriterion or unknown picture. During the concurrent procedure two subcriterion pictures were presented alternately. Each child was exposed to an interspersal (A) and a concurrent (B) training procedure in an ABA or BAB sequence. Verbal identification of objects depicted in pictures was established by both training procedures. It was found however, that following concurrent training at least twice as many picture names were learned with better maintenance and wider generalization. The results suggest that teaching picture names concurrently may be more beneficial, in terms of the child verbal repertoire, than teaching via the interspersal procedure.

Introduction

In the analysis of verbal behavior, increasing attention is being given to imitation and object or picture naming as important factors in language development and socialization (Bandura & Walters, 1963; Bijou & Baer, 1965; Hartung, 1970; Gewirtz & Stingle, 1968; Harris, 1975; Risley, Hart & Doke, 1972; Baer, Peterson & Sherman, 1967; Peterson, 1968; Lovass, Berberich, Perloff & Schaeffer, 1966).

Much research has shown the usefulness of the operant paradigm in the development of language through picture naming (Biberdrof & Pear, 1977; Kircher, Pear & Martin, 1971; Risley & Wolf, 1967; Bricker & Bricker, 1970; Kent, Klein, Falk & Guenther, 1972; Jensen & Womack, 1967; Goldstein & Lanyon, 1971; Bricker & Bricker, 1972; Stephens, Pear, Wary & Jackson, 1975; Wolf, Risley & Mees, 1964). Expansion of vocal verbal repertoires often involves procedures that transfer behavioral control from one type of stimulus to another. Thus, in a typical picture naming program, stimulus control over the subject's responding is shifted from the experimenter's vocalization to pictures of objects. Responses in this kind of procedure are trained in a serial fashion in which each response is trained to an appropriate level of accuracy before the next is introduced.

A potentially more effective technique for training two or more responses was examined by Shroder and Baer (1972) and Panyan and Hall (1978). These authors compared two types of

sequencing arrangements, concurrent and serial, in training programs for vocal imitation and tracing. According to the concurrent procedure two different tasks were trained within a single session before either task reached the criterion level of performance. Although there were no significant differences between concurrent and serial training procedures in terms of trials required to reach criterion performance, Shroder and Baer noted that the increase in probe accuracy following concurrent training was consistently greater than that following serial training.

Another training procedure involves interspersing trials on known items with trials on unknown items. Neef, Iwata and Page (1977; 1980) found that both acquisition and retention of spelling and sightreading words were facilitated by this procedure in comparison to a serial procedure.

Since an extensive object and picture naming repertoire seems important for further verbal development, it is important to know how this can be achieved more effectively. As mentioned, the concurrent and interspersal procedures have been found more beneficial than the serial procedure in terms of the gains by the child and saving of staff time required to produce a given amount of learning. However, no investigation has compared these two methods. In the present study, the relative efficiency of interspersal and concurrent training on a picture naming task was examined. A direct comparison was made for (a) acquisition rate, (b) probe accuracy, (c) maintenance, and (d) generalization across settings and experimenters.

Method

Subjects

One retarded boy and one retarded girl participated in this study. The children were residents of the St. Amant Centre in Winnipeg.

Gimmi was six years old with a diagnosis of Down's Syndrome. At the beginning of the study he imitated a number of vocal sounds and identified a few pictures. His spontaneous vocal behavior consisted of a small number of words and phrases (e.g. "bye", "come", "good boy", "no", "go").

Michelle was ten years old and also had a diagnosis of Down's Syndrome. At the beginning of the study she imitated a number of vocal sounds and identified a few pictures. Her spontaneous vocal behavior consisted of babbling and a few words (e.g., "hi", "no", "girl", "bye").

Michelle was new to the procedures used in this study, whereas Gimmi had had prior exposure to some of the procedures.

Setting, Apparatus, and Materials

Experimental sessions were conducted with each child individually in a small experimental room. The child and the experimenter sat at a table facing each other. On the table near the experimeter was a timing device for regulating trial presentations and on a nearby shelf a large stop-clock which timed the length of each session. A tape recorder, used to record the verbal responses emitted during each session was located beside the stop-clock.

Picture cards from a Peabody Articulation Kit were used as the stimuli for picture-name training. Ice cream (one teaspoonful per reinforcement) was used as the primary reinforcer for Michelle; diet dessert (one teaspoonful per reinforcement) was used as the primary reinforcement for Gimmi.

Sessions

Two 20-minute training sessions, separated by a ten minute break, were conducted six days a week with each child individually.

Preliminary Picture-Name Assessment

An assessment (or sample) of each child's picture-naming repertoire was made before picture-name training began.

Sixty pictures were presented to the child. When a picture was presented, the child was asked, "What's this?" and had eight seconds to answer. The trial terminated when a vocal response occurred or the eight seconds of time limit elapsed. Following a five second inter-trial interval, the child was asked to respond to another item in the same manner. This was repeated three times for each of the pictures presented. If a correct picture-naming response occurred on all three trials for a particular picture, the picture was called a criterion picture. If no response or an incorrect response occurred within the eight seconds the experimeter prompted the child on the next trial by saying the correct word. If the child did not correctly name the picture on all

three tials but correctly imitated the experimenter's prompt within eight seconds the picture was called a subcriterion. Pictures that were not classified as criterion or subcriterion were discarded.

On the basis of this assessment, ten control pictures were chosen randomly for each child from the pool of subcriterion pictures. These pictures were not trained but were tested periodically throughout the study to estimate the extent to which picture-naming learning might be occuring as a result of external uncontrolled sources rather than the specific training procedures being used in this study.

Procedure

Following the above preliminary picture-name assessment, each child was trained individually on a picture-naming task. Each child was exposed to an interspersal procedure (A) and a concurrent procedure (B) in ABA or BAB sequence. Michelle was trained in Phase 1 by the interspersal method (A), in Phase 2 by the concurrent method (B), and in Phase 3 by the interspersal method (A); whereas Gimmi was trained in Phase 1 by the concurrent method (B), in Phase 2 by the interspersal method (A), and in Phase 3 by the concurrent method (B).

The procedure for teaching the child to name pictures was similar to that used by Stephens et al. (1975).

Interspersal Training

During interspersal training, each picture to be taught

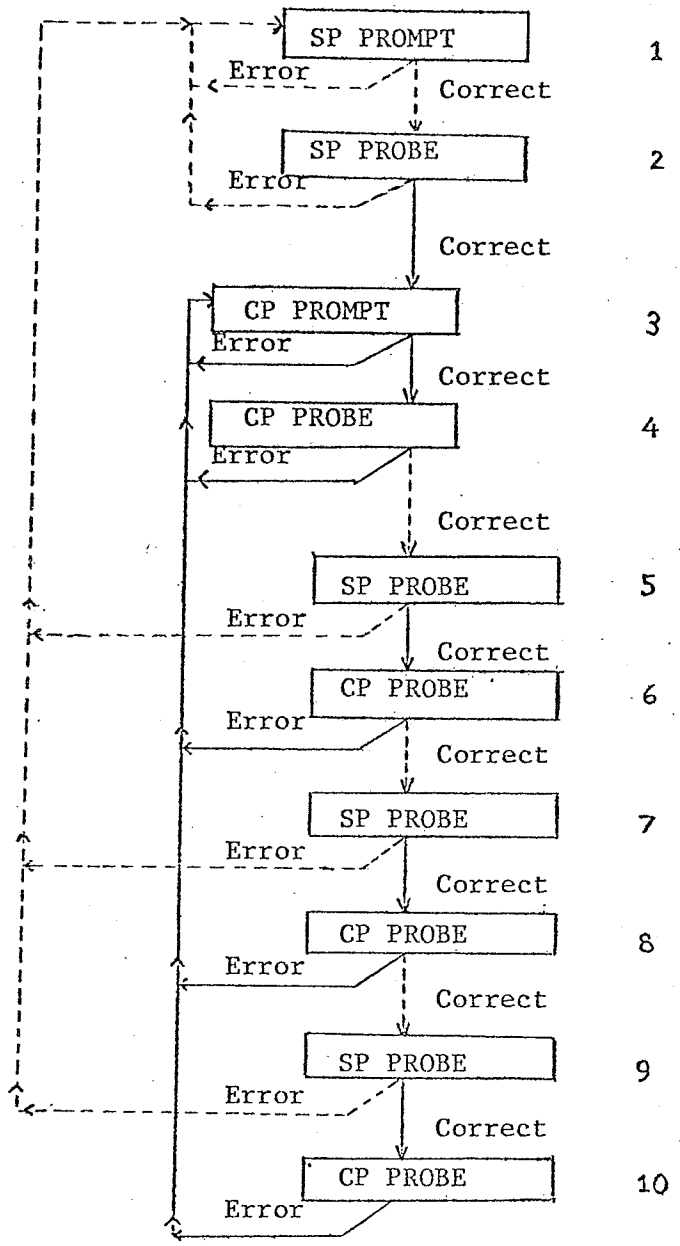
went through a systematic sequence in which criterion pictures were alternated with the subcriterion pictures. Thus, on each trial the experimenter presented either a criterion or a subcriterion picture.

Two types of trials were used: prompt trials on which the experimenter named the picture, and probe trails on which the experimenter simply asked the name of the picture. The sequence by which the subcriterion pictures were taught is illustrated in Figure 1.

On Step 1 in the sequence, a randomly selected subcriterion picture from the pretest sample was presented on a prompt trial. This step was repeated with the same subcriterion picture on the next trial if the child made an error; i.e., an incorrect response or a response omission. A response omission was said to occur if the child did not respond within eight seconds after the picture presentation. If the child responded correctly on step 1, a probe trial was presented on Step 2. If the child made an error on the probe trail Step 1 was repeated. On Step 3 a randomly selected criterion picture was presented on a prompt trial and on Step 4 on a probe trial. Again, if an error occurred, either Step 3 or Step 4 was repeated as indicated in the figure.

On Steps 5 through 10, the criterion picture was alternated with the subcriterion on probe trials. If an error occurred on a probe trail on a subcriterion picture, the child returned to Step 1 with the same subcriterion picture. If an error occurred on probe with a criterion picture the child returned to Step 3

PICTURE-NAMING PROCEDURE



SP=Subcriterion Picture

CP=Criterion Picture

On the interspersal procedure a criterion picture (CP) was alternated with a subcriterion picture (SP).

On the concurrent procedure two subcriterion (SP) were alternated.

Fig. 1

with the same criterion picture.

When a subcriterion picture completed the ten steps three times, being alternated with the same criterion picture each time, the subcriterion picture was said to have "reached criterion". A subcriterion picture was discarded from the experiment if it didn't complete the picture-name training within ten sessions or if fifteen consecutive errors occurred, in which five may have been omissions, on a prompt trial.

Concurrent Training

During concurrent training, two randomly selected subcriterion pictures were presented and trained alternately. The same general procedure was used as in the interspersal training except that two subcriterion pictures were alternated, rather than a criterion and a subcriterion.

Reinforcement Schedule

During each step of the ten steps of picture-name training, praise ("good") followed all correct responses to both prompt and probe trials.

The schedule of primary reinforcement differed for prompt and probe trials. The reinforcement schedule for prompt trials was a fixed ratio whereby every fifth correct response was followed by a primary reinforcement. For probes every correct response was reinforced (Olenick & Pear, 1980).

Retention Tests

Every picture that reached criterion was tested periodically for retention at one or two week intervals. The procedure

was similar to that used in the preliminary assessment however neither correct nor incorrect responses were consequated. These tests were administered before the regular training sessions, and an unknown control picture was presented, on a random basis, before or after the presentation of the criterion picture.

Generalization

Probes for generalization were conducted in a small play room, within a specially designed research section, at the end of each training phase by a second experimenter who was not involved in the training procedure. Criterion pictures and the ten control pictures were presented in a random order. The procedure was essentially the same as that used during preliminary assessment and retention tests; however, motor imitations were interspersed among the items presented. The rational for this procedure stems from research which has found that children will continue to emit responses which are never reinforced as long as they are interspersed among other responses which are reinforced (Martin, 1971; Bucher, 1973; Whitman, Zakaras & Chardos, 1971). Thus, the children were reinforced for correct motor imitation but not for responses to picture presentations.

Interobserver Reliability

About one-sixth of the experimental sessions were tape recorded and played to an independent observer after he had familiarized himself with the experimenter's criteria for

correct and incorrect verbal responses. The observer scored each response before hearing the experimenter's decision. The interobserver reliability measures used were the ratio of agreements to agreements plus disagreements on responses the experimenter called correct and on responses the experimenter called incorrect. Interobserver reliability coefficients for correct and incorrect responses, respectively, were 0.98 and 0.96 for Gimmi, and 0.99 and 0.97 for Michelle.

Results

Correct Probes and Accuracy

Figure 2 presents the daily number of correct responses to probes for each child. As shown in this figure more correct responses were emitted during the concurrent training procedure than during the interspersal training procedure. The same trend appears when examining probe accuracy. Probe accuracy was defined as the proportion of probe trails responded to correctly. Figure 3 presents the daily probe accuracies. A marked increase in the magnitude of accuracy was shown on the concurrent condition, whereas probe accuracy declined following interspersal training procedure. This pattern was consistant over all of the concurrent-interspersal alternations, for both children.

Acquisition Rate

Over a total number of seventy-five training sessions, Gimmi learned to name 36 pictures and with the same number

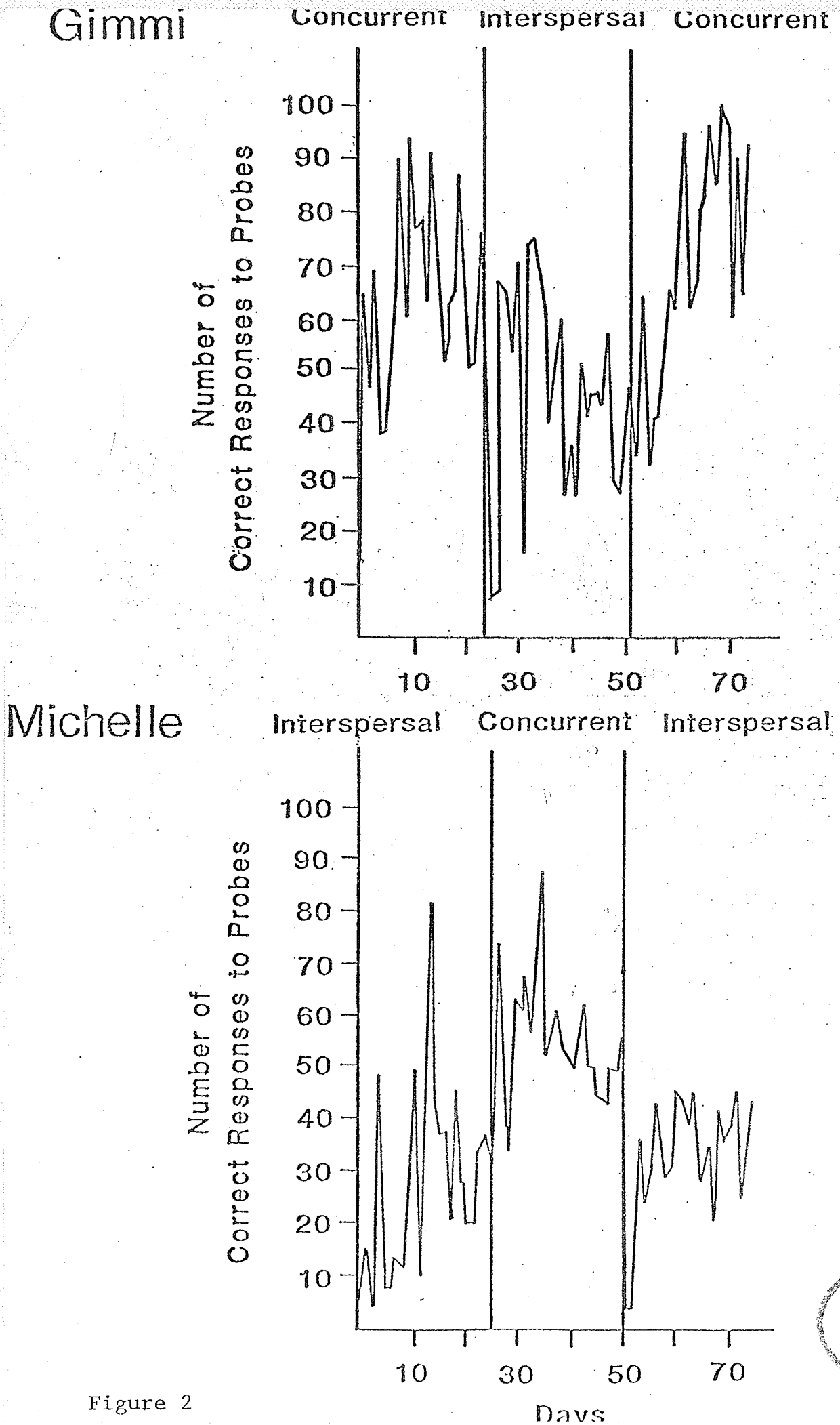
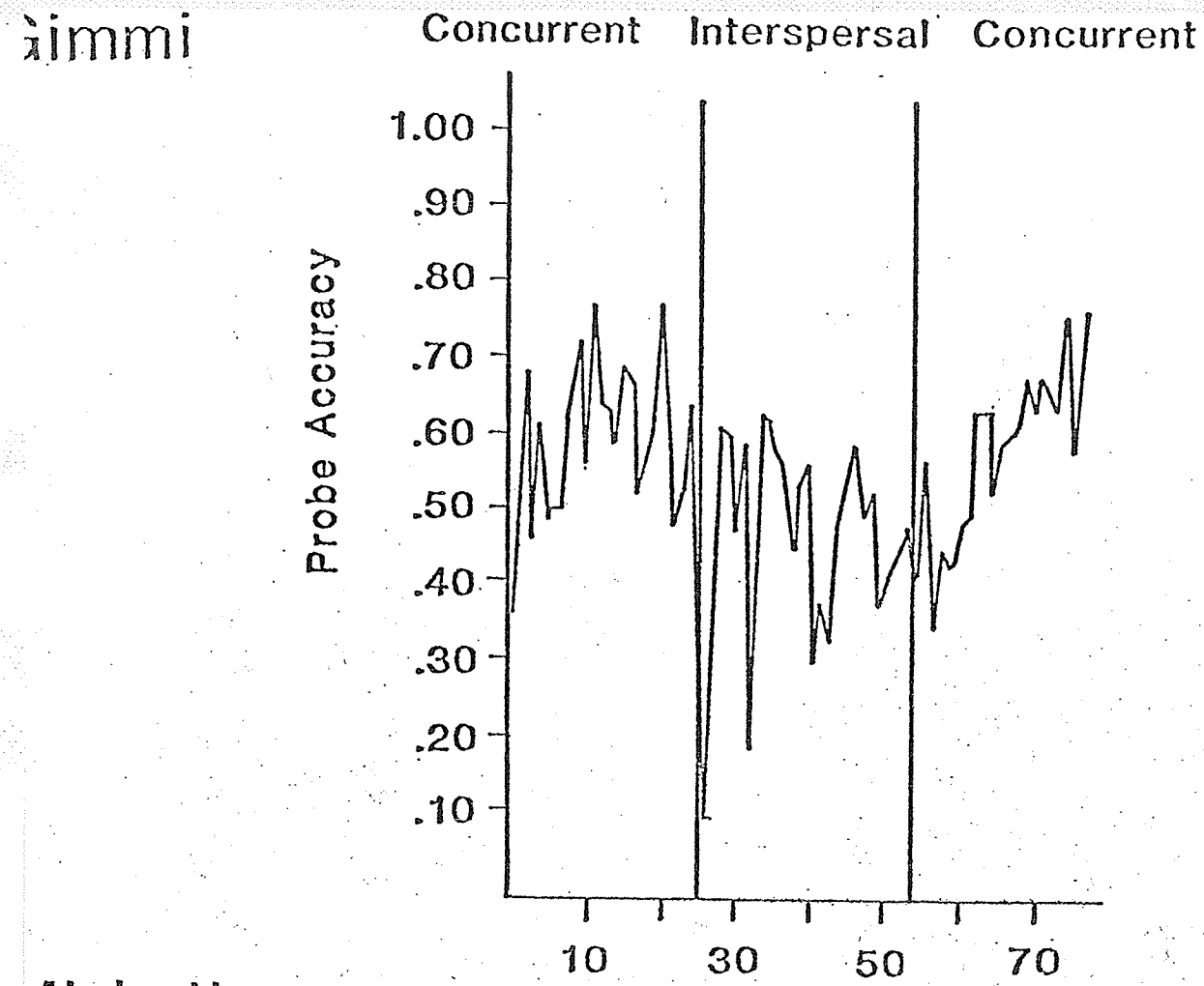


Figure 2


Jimmi
Concurrent
Interspersal
Concurrent
Probe Accuracy
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
10
30
50
70

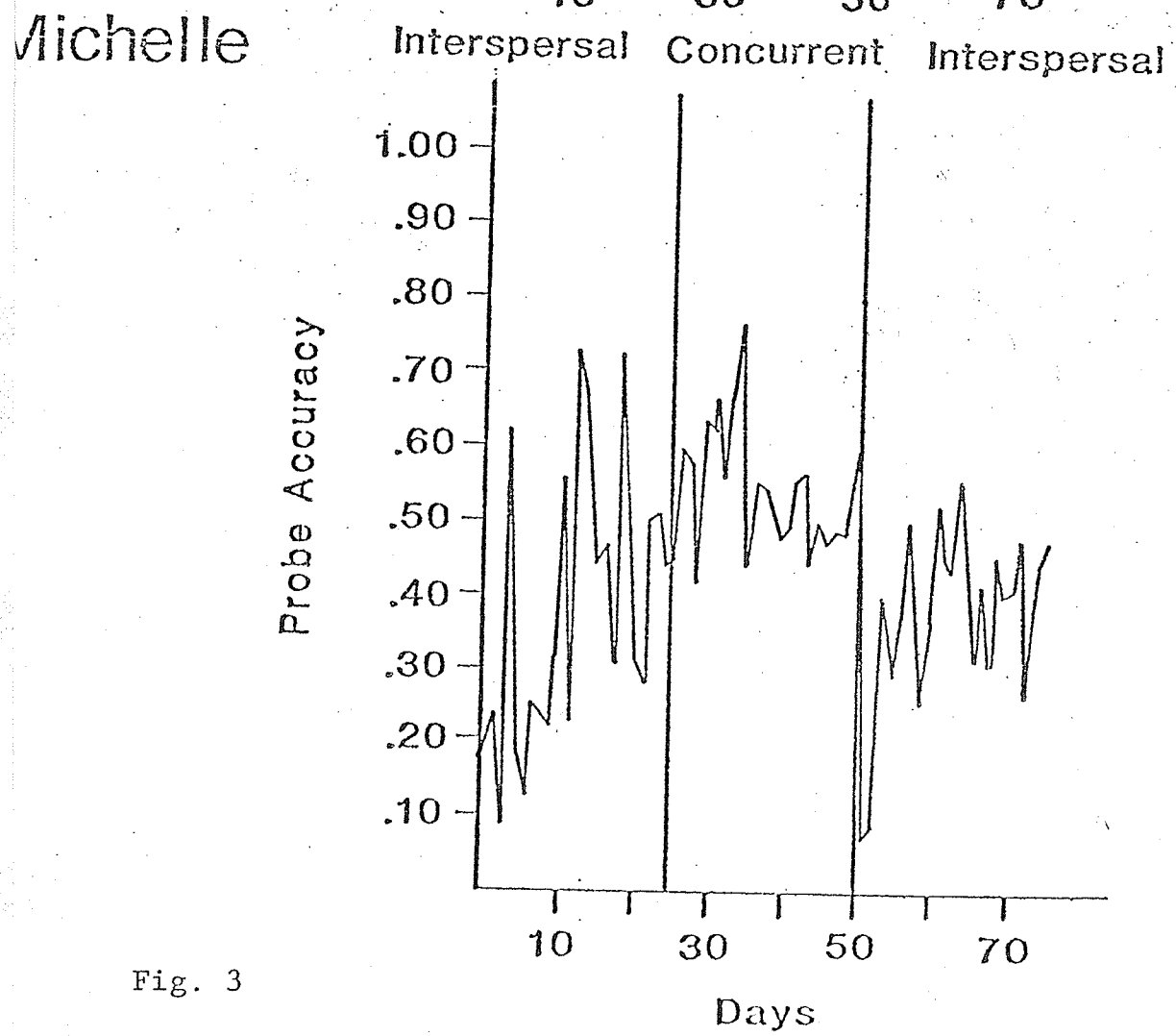

Michelle
Interspersal
Concurrent
Interspersal
Probe Accuracy
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
10
30
50
70
Days

Fig. 3

of training sessions Michelle learned to name 18 objects depicted in pictures. Figure 4 indicates individual learning rate, in terms of cummulative records across days of the pictures reaching criterion, in each condition. As can be seen in this figure, there was a dramatic increase in the rate at which pictures reached criterion under the concurrent condition compared to the interspersal condition. It is apparent that at least twice as many pictures reached criterion level of performance under concurrent procedure than under the interspersal procedure during the same number of training sessions.

Retention

The results of the retention probes were calculated in the form of percent correct responses at specific time intervals. In general, picture-name retention following both interspersal and concurrent training showed a decline over time. For Gimmi 61%, 30%, 13%, 13% and 12% of the retention trials were correct, and for Michelle 83%, 37%, 30%, 9% and 6% were correct one week, one month, two months, three months, and four months, respectively, following training of the corresponding picture names.

In order to determine whether there were any differences in the retention of picture names trained interspersally or concurrently further analysis of the data was performed. Figures 5 and 6 present the mean number of correct responses per criterion picture trained by the interspersal procedure and

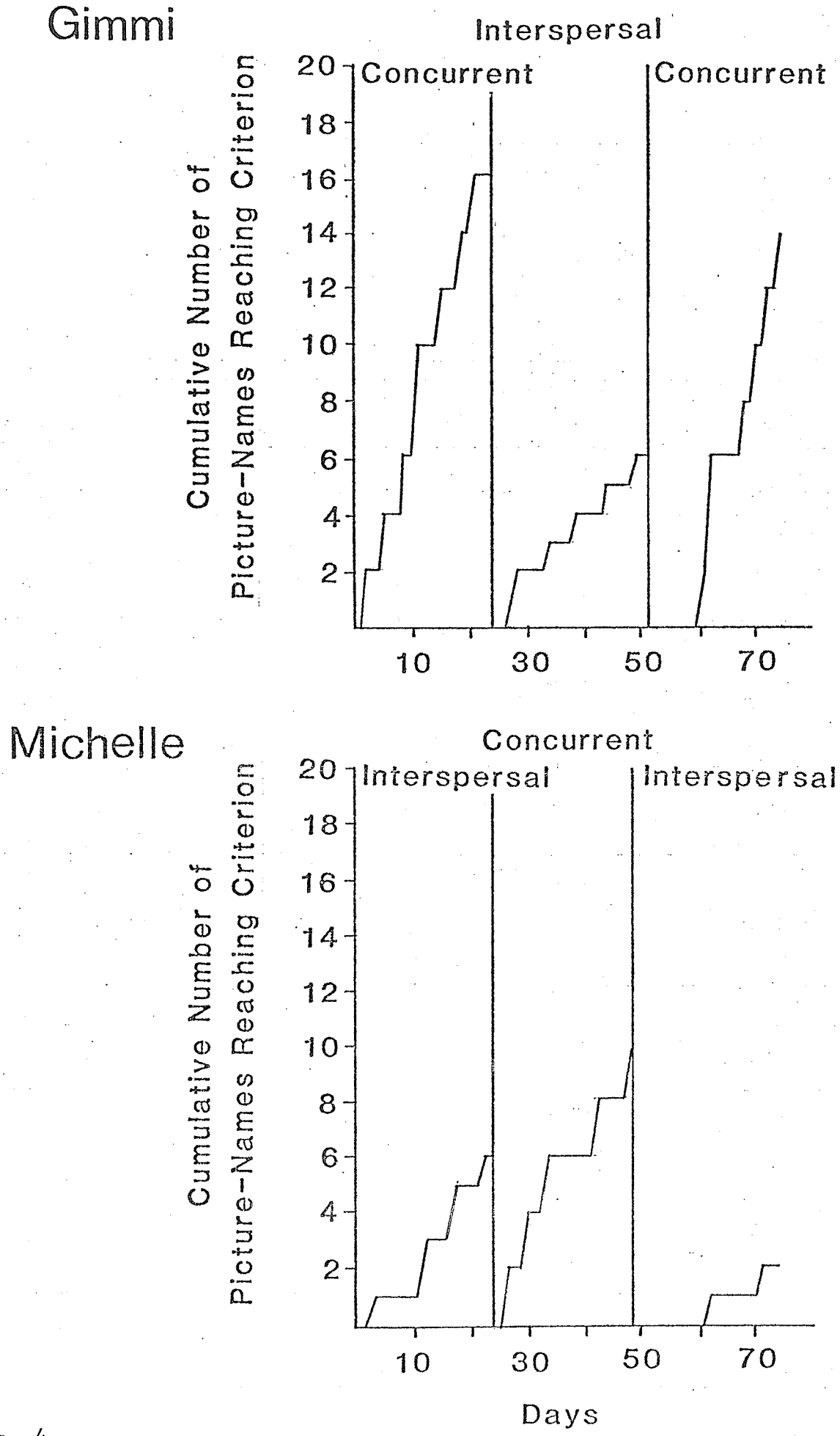

Gimmi
Interspersal
Concurrent
Concurrent
Cumulative Number of
Picture-Names Reaching Criterion
20
18
16
14
12
10
8
6
4
2
10
30
50
70
Michelle
Concurrent
Interspersal
Interspersal
Cumulative Number of
Picture-Names Reaching Criterion
20
18
16
14
12
10
8
6
4
2
10
30
50
70
Days

Fig. 4

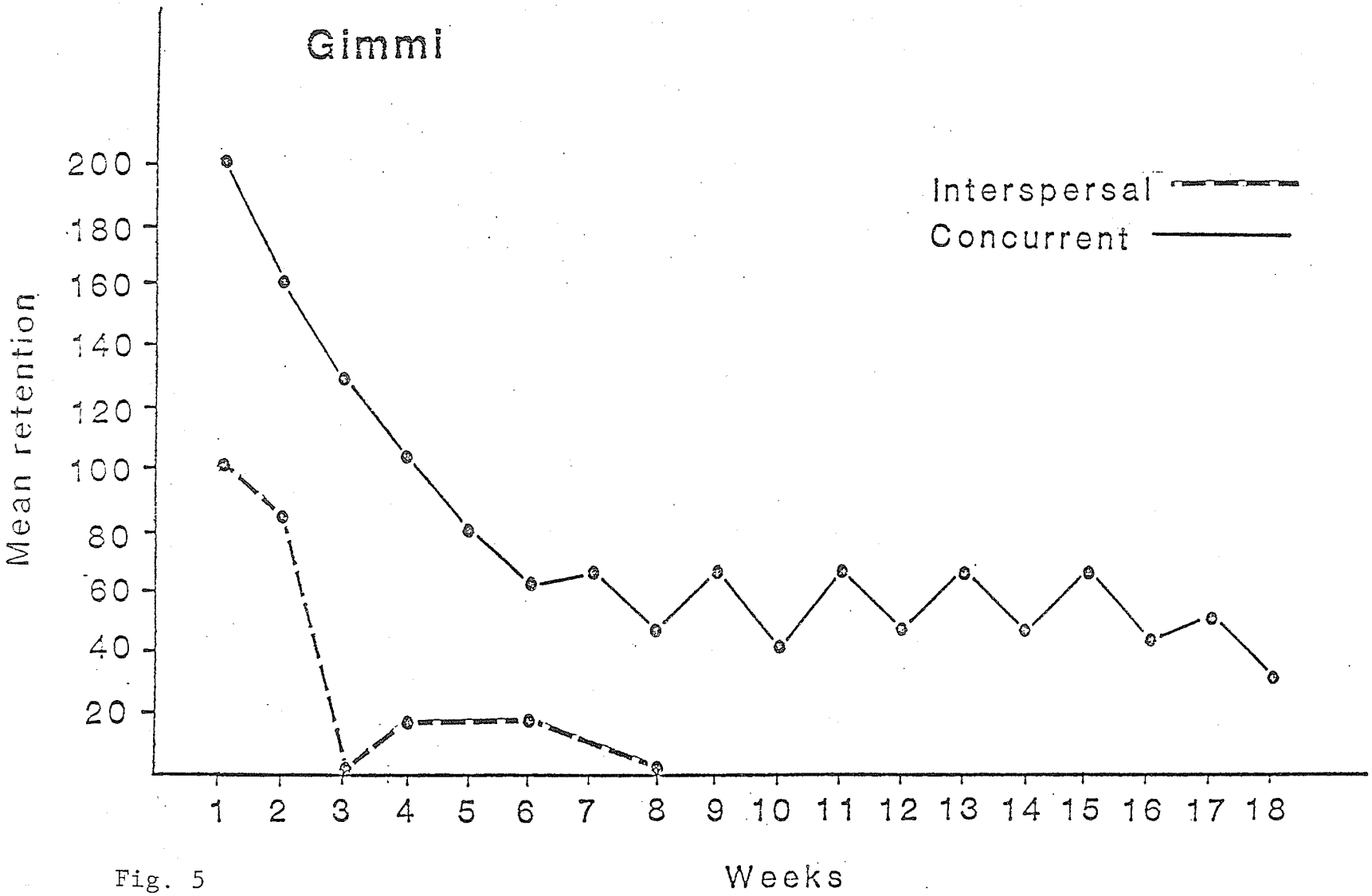

Gimmi
Interspersal
Concurrent
Mean retention
200
180
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Weeks

Fig. 5

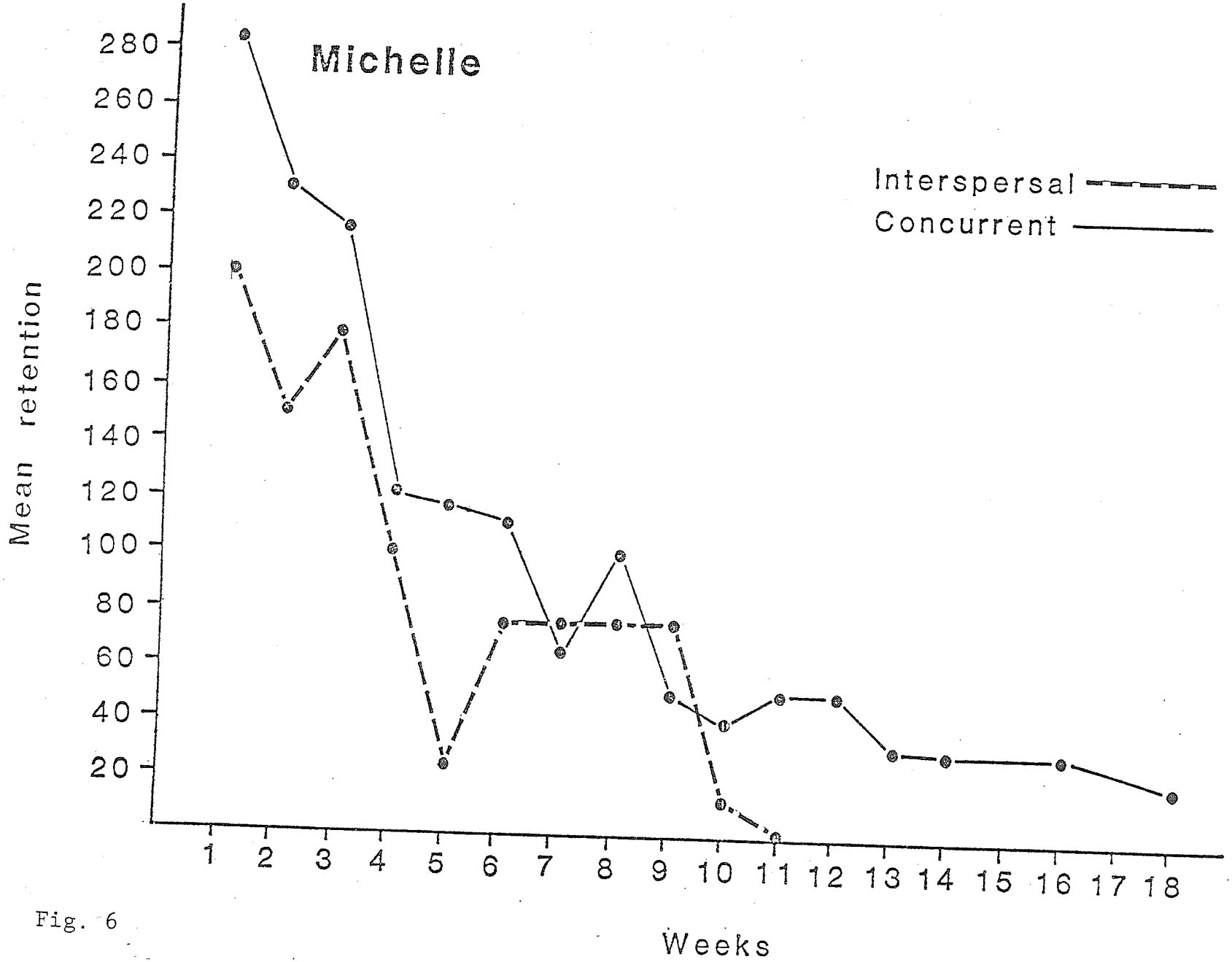

Michelle
Interspersal
Concurrent
Mean retention
280
260
240
220
200
180
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Weeks

Fig. 6

the concurrent procedure. As shown in these figures, both children performed better on the retention probes following concurrent training. This becomes more apparent when comparing the direction of change at each point from the preceding point for the two methods. Picture-names learned during the concurrent procedure scored initially higher and were retained much longer than picture-names learned during the interspersal procedure.

Generalization

The results of successive probes for generalization following each training phase were calculated in percentage of correct responses. Gimmi scored 35% following the first concurrent condition (B), 0% following the interspersal condition (A), and 24% following the second concurrent condition (B). Michelle scored 6% following the first interspersal condition (A), 47% following the concurrent condition (B), and 33% following the second interspersal condition (A). In summary, both children displayed considerably more generalization across settings and experimenters when trained concurrently.

Discussion

In this study verbal identification of objects depicted in pictures was successfully established by both the interspersal and concurrent training procedures. However, the two training procedures had different outcomes in terms of acquisition rate, retention and generalization. With the concurrent procedure at least twice as many picture-names

were learned with higher accuracies, better retention, and wider generalization across settings and experimenters.

The differences in these effects may be attributed to the distinctive characteristics of the two training methods. Considering the training procedures, per se, their basic difference was the task requirement pressed on the child. On the interspersal training procedure one subcriterion picture was presented repetitively until a given level of accuracy was reached. On the concurrent training procedure two subcriterion pictures were trained alternately. Thus, by the end of the ten steps of the picture naming procedure twice as many new picture names were learned under the concurrent procedure than under the interspersal procedure.

Alternatively, the differences in effectiveness may have been due to secondary side effects. The results indicate that overall performance levels were lower during interspersal training relative to performance during concurrent training. In fact, there were fewer correct naming responses, less accuracy, and a slower acquisition rate during interspersal training compared to concurrent training. This finding is particular noteworthy since it was somewhat unexpected and probably can be explained by the interspersal task being less "intrinsically" reinforcing for the children. This possible effect appears to be related to the interspersal condition, whereas no disruptive effects were associated with the concurrent training procedure.

Finally, the finding that the concurrent training procedure

resulted in more generalization replicates the findings of Shroeder and Baer (1972) and Panyan and Hall (1978). Whether the same procedure that facilitates acquisition also facilitates retention and generalization is a question which deserves further examination. Nevertheless, Stokes and Baer (1977) emphasized that a number of stimulus and/or responses examplars should undergo training to facilitate generalization. It seems that with the concurrent procedure sufficient examplars were trained, yielding a more effective outcome. Thus, the major conclusion to be drawn from this study is that the concurrent procedure is superior to the interspersal for picture name training and probably more important for maintenance and generalization. The control procedures which were used in this study allow a considerable degree of confidence to be placed in the results. The ten control stimuli used throughout the study were never learned, suggesting that influences from external sources were minimal. Further research should examine the parameters of this technique such as the number of subcriterion pictures that can be increased gradually without loss of effectiveness and the extent of response generalization. If this technique has a theoretical relevance and practical significance than determining those parameters that generate appropriate verbal behavior is obviously an important issue.

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