

## BEHAVIORAL REHABILITATION OF FUNCTIONAL ALEXIA

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**Summary** — A 10-year-old boy with a functional reading deficit (i.e. functional alexia) was successfully treated with hospital based escape/avoidance procedures. A multiple baseline design was used to evaluate the effectiveness of treatment. Generalization of treatment effects across individuals, settings and time was demonstrated. Extension of these procedures to other functional deficits is discussed.

Functional visual deficits range from total loss of vision to various selective perceptual difficulties such as amblyopia, dyplopia, blurriness and color blindness (Pickford, 1972). Such deficits have traditionally been conceptualized in psychiatric terms ranging from hysteria (i.e. resulting from "an expression of psychological conflict or need", p. 244, DSM III, 1980) to malingering (i.e. "the voluntary production and presentation of false or grossly exaggerated physical or psychological symptoms", p. 331, DSM III, 1980). Behavioral conceptualizations of functional deficits regard such deficits not as symptoms of psychological conflict, but rather as behaviors maintained by environmental contingencies (e.g. Skinner, 1953). Consistent with this notion, various behavioral interventions have been developed and proven effective in the treatment of functional disorders (e.g. Klein *et al.*, 1985; Mizes, 1985).

A variety of approaches have been used to assess and treat functional visual deficits ranging from amobarbital sodium sessions (Oberfeld *et al.*, 1983; Ohno *et al.*, 1974) and hypnosis (Patterson, 1980) to behavioral techniques (e.g. Brady and Lind, 1961; Grosz and

Zimmerman, 1965, 1970; Theodor and Mandelcorn, 1973). Most behavioral investigations of functional visual deficits have used positive reinforcement procedures to shape and maintain improved visual functioning (Brady and Lind, 1961; Grosz and Zimmerman, 1965, 1970; Parry-Jones *et al.*, 1970; Stoltz and Wolfe, 1969) although efforts which emphasize negative reinforcement procedures [e.g. escape from electric shock (Ohno *et al.*, 1974)] have also been implemented. Of six published behavioral studies of functional visual disorders (Brady and Lind, 1961; Grosz and Zimmerman, 1965, 1970; Ohno *et al.*, 1974; Parry-Jones *et al.*, 1970; Stoltz and Wolfe, 1969) three failed to present pre-treatment baselines or demonstrate functional relationships between intervention and symptom remediation (Ohno *et al.*, 1974; Parry-Jones *et al.*, 1970; Stoltz and Wolfe, 1969) and none directly evaluated the generalization of treatment effects, an important behavioral consideration of recent years (Stokes and Baer, 1977; Wolpe, 1977).

The present study sought to improve upon these methodological deficiencies while extending behavioral approaches to an ex-

tremely rare functional visual disorder — functional alexia. We employed an escape/avoidance procedure where eye exercise regimens constituted an event which the patient could avoid contingent upon reading. The effectiveness of this intervention was evaluated using a single subject experimental design (Hersen and Barlow, 1976) and treatment effects were programmed for generalization outside the treatment setting. To our knowledge, this represents the first case of functional alexia in the literature. Large-scale surveys have reported very low prevalence rates of functional deficits in general (Lewis and Berman, 1965) and functional visual deficits in particular (Schneider and Rice, 1979) but neither of these studies reported the occurrence of functional alexia. A computer search of *Psychological Abstracts* and *Index Medicus* also failed to yield published literature regarding this problem.

## METHOD

### *Patient information*

The patient, Adam, was a 10-year-old student in the fifth grade (B-minus average). His favorite pre-morbid activity was reading. His family had no previous history of psychiatric disturbance and no family members ever evidenced similar functional deficits. Adam had been in good health prior to the onset of a refractory upper respiratory infection. He was treated without success for symptoms which included alexia, abnormal gait described as "ataxic", general malaise, and "sadness", whereupon he was referred to the Pediatric Neurology Service of a tertiary care facility for further evaluation. A comprehensive medical work-up including an evaluation by a neuro-ophthalmologist was unremarkable; yet, the patient reported he was unable to read. He

complained that letters seemed to be "blurry" and "moving back and forth" in front of his eyes, although he showed no difficulty discriminating the minute images required to play a hand-held computer game skillfully and evidenced no other visual deficits of any kind. While it was possible that the onset of his visual complaints may have been associated with pathophysiological changes related to his respiratory infection, these factors were no longer evident at the time of his admission. It appeared likely that Adam's visual symptoms were maintained by environmental contingencies as commonly occurs in many complex medical conditions (Fordyce, 1976).

A mental status examination conducted at admission suggested his cognitive status was unimpaired. However, because of symptoms of decreased appetite, paucity of speech, psychomotor retardation and easily induced episodes of crying an anti-depressant trial was initiated shortly after admission, approximately one month prior to his referral for behavioral intervention. During the course of the present intervention medication was maintained at 100 mg imipramine at bedtime. This regimen was continued for approximately two months post-discharge, at which time it was discontinued.

A preliminary reinforcer assessment suggested that several ostensible positive reinforcement procedures [e.g. the availability of (a) praise, (b) game playing, (c) hospital passes, and (d) family visits contingent upon the occurrence of components of independent ambulation] had little impact on this patient's target behaviors, although he was observed to engage in these behaviors and to seek out non-contingent opportunities to obtain those same reinforcers. It was also frequently noted by staff that verbal praise, in particular, often resulted in decreased functional performance. His failure to respond in a therapeutic way to ostensibly positively reinforcing events suggested that negative reinforcement procedures might be of therapeutic benefit. Therefore, an intervention based upon escape/avoidance procedures was developed to treat Adam.

### *Materials*

*Test stimuli.* A large sample of 3rd and 4th grade-level four-letter words (Dolch, 1942) was used. Ten word lists of 10 words each were constructed for each of three print sizes (i.e. small 2.5 mm × 7.0 mm, medium 3.5 mm × 8.0 mm and large 4.0 mm × 10 mm). Words from these lists were used as test stimuli for each reading trial.

*Focusing stimuli.* Focusing stimuli consisted of large black-on-white geometric shapes (circles, squares, triangles and crosses) approximately 10 cm × 10 cm in diameter. These stimuli were used within the context of therapeutic exercises described below.

### *Therapeutic exercise sequence*

Exercise sequences consisted of (a) looking up, down, left and right 10 times in succession, followed by (b) identifying 20 randomly ordered focusing stimuli at a distance of 35 cm. The patient was required to participate in exercises contingent upon his performance on reading trials.

### *Procedure*

*Baseline sessions.* Adam participated in two sessions daily. Five brief (15–20 min) baseline sessions of 30 trials each were conducted. Each trial provided a 5-second opportunity for Adam to read one word from a word list. One list of small, medium or large print size, was presented at each of three distances (i.e. 35 cm, 25 cm, and 15 cm) from the patient. This permitted him, over a brief series of sessions, many trials of each print size at each distance.

During some baseline sessions Adam was observed by another staff member experienced in visual disorders and described as an “expert” in visual disabilities. At the conclusion of the

baseline phase he informed the patient that his visual difficulty resulted from an eye weakness due to his recent illness. Adam was informed that he could improve his vision by engaging in eye focusing exercises and a therapeutic exercise regimen was prescribed for him.

*Treatment sessions.* Sessions ranged in duration from 45 minutes to 2 hours depending upon patient performance and staff scheduling requirements. The patient was not told how much time was allocated for each session. Sessions were designed to be exceedingly tedious and boring and were conducted in small (approximately 2.0 m × 3.0 m) treatment rooms with a minimum of interaction with Adam.

Each session began with one to three *avoidance* reading trials. Words were presented at a distance of 15 cm. Type size was randomly determined with all three sizes represented over the first three trials. Criterion reading performance resulted in cancellation of eye exercises for that session. The patient’s success was met with nonchalant comments by therapists that his exercises were apparently effective, indicating that further exercise that session was unnecessary. Patient was not provided verbal praise for reading success in keeping with his previous history of decreased performance contingent upon such consequences. Additional trials were presented, however, to evaluate his progress with respect to print size and distance from him.

Failure to meet reading criterion resulted in a contingent therapeutic exercise period. Following these exercises Adam was provided an *escape* trial at 15 cm. If he correctly read a word on this trial the session was terminated, as above. If he failed to identify the word on this trial he engaged in another period of therapeutic exercise, etc.

*Method of evaluation.* A multiple baseline design (Hersen and Barlow, 1976) was used to evaluate the effectiveness of treatment. Contingencies were introduced across print sizes in multiple baseline fashion. Initial contingencies

required the patient to read one word of any size. Subsequent contingencies required him to next: (a) read at least three words of any size, then (b) read at least three words including one medium size (i.e. 3.5 mm × 8.0 mm) word and finally, (c) read at least three words including one small size (i.e. 2.5 mm × 7.0 mm) word.

## RESULTS

### *Reliability*

Reliability data were obtained for approximately 23% of all sessions. Trial by trial agreement for occurrence/nonoccurrence of reading was 100%.

### *Treatment effects*

Adam did not read any words during baseline sessions (i.e. sessions 1–5). After intervention was initiated in session 6, he participated in four sessions (i.e. sessions 6–9) of contingent eye exercise without improvement in reading performance (see Fig. 1). In session 10 he read one large (4.0 mm × 10.0 mm) word at a distance of 15 cm and escaped the therapeutic exercise situation. During session 11 he read one large word during initial trials and avoided therapeutic exercise. His performance did not improve beyond reading one large word (at 15 cm) per session, thus satisfying the minimal avoidance requirement, until the criterion was raised to three words of any size in session 14, at which point his performance immediately increased to meet criterion.

Patient's performance continued to improve during avoidance trials but was confined to large words only. Patient's reading of medium (3.5 mm × 8.0 mm) and small (2.5 mm × 7.0 mm) words remained at zero levels until escape/avoidance contingencies were applied specifically to those dimensions. At session 20 avoidance was made contingent upon reading at least one word of medium print size, included within the then current three-word criterion. Imposition of this contingency resulted in immediate criterion performance and

Adam avoided exercise therapy. Similar results were obtained when avoidance contingencies were applied to small print size in session 25. Patient's performance continued to improve after his initial success at each print size without the necessity of increasing the required number of words read to meet criterion and without programming formal positive reinforcement contingencies for increased performance. Coincidentally, Adam read words only at a distance of 15 cm until the criterion was increased from one to three words (session 14), at which time he began to read large words at 25 cm as well as 15 cm. The patient did not begin to read words at a distance of 35 cm until he was required to read words with medium size print (session 20). He progressed to 100% correct word identification approximately three weeks after treatment began.

Weekend passes home made it possible to evaluate generalization of treatment effects across individuals and settings outside the hospital. The patient's parents collected data (see unfilled circles, Fig. 1) during sessions with 30 trials under baseline contingencies. These data were consistent with hospital data and provide support for the effectiveness and external validity of treatment.

Two-week, four-week and three-month follow-up data indicate the patient maintained 100% correct reading performance across all print sizes and distances. Additionally, post-treatment (4 week) performance on a standardized measure of academic achievement (Peabody Individual Achievement test; Dunn and Markwardt, 1970) which requires the ability to read letters, words and numbers, fell above the mean for his age and grade level (i.e. age equivalent of 13 years 5 months, grade equivalent of 8 years 4 months). Adam was discharged home and resumed his place at school without incident. Additional follow-up data were collected by telephone. At six months post-discharge he was promoted to the sixth grade. At one-year follow-up he was reported by his parents and school officials to be doing above average school work relative to

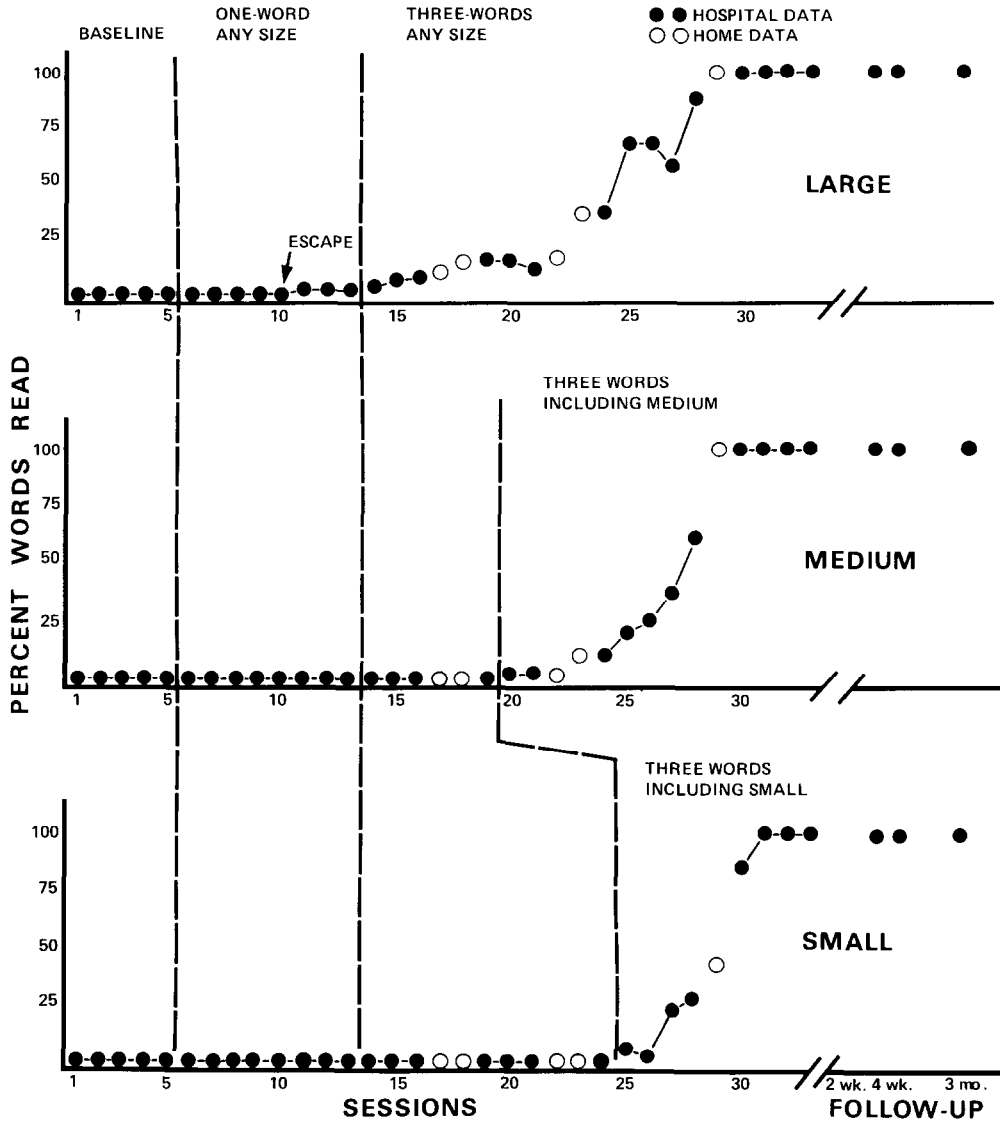


Fig. 1. Percentage of words read across sessions as a function of print size (i.e. large, medium and small) contingencies. Initial contingencies regarding the number of words read were imposed at sessions 6 and 14, with the imposition of print size contingencies at sessions 20 (medium) and 25 (small).

other children his age and grade. He reports no visual difficulties and none have been observed by his parents or school officials.

DISCUSSION

The present study employed a multiple

baseline design to evaluate the effectiveness of contingent escape/avoidance procedures to remediate functional alexia. The study represents one of the few investigations of functional disorders to demonstrate a functional relationship between intervention and behavior change and to program generalization to extra-

therapeutic settings and individuals. The intervention was rapid and efficient. Few contacts with negative reinforcement contingencies were required before reading performance consistently increased to meet increased response requirements. This suggests that Adam's deficits were functional in nature.

Alexic behavior appeared before hospitalization and was eliminated before discharge indicating it was not directly tied to the context of hospitalization. In addition, reading behavior improved while other symptoms of illness, such as ataxic ambulation, remained impaired suggesting that improvement was not simply related to a generalized recovery from a physical illness. Since reading was a favorite activity before the onset of his alexia, it is likely that the natural reinforcement this patient experienced when reading served to maintain reading behavior once he again made contact with that contingency. In that regard, it is interesting to note Adam's reading performance improved most markedly when contingencies required he read words of small print size, in keeping with typical reading material.

An additional explanation for patient's recovery might appeal to the specific therapeutic effects of anti-depressant medication. It may be that medication was necessary but not sufficient to produce the therapeutic changes observed. However, no dramatic improvement in mood over sessions was noted; rather, changes in the patient's performance were entirely consistent with the imposition of reinforcement contingencies.

Contrary to previous efforts to deal with functional deficits using negative reinforcement procedures, the aversive stimuli of the present study, while not unique (see for example, Alexander *et al.*, 1973; Walton and Black, 1959), were non-invasive and akin to time out procedures rather than physically aversive (see for example, Ohno *et al.*, 1974). They were acceptable both to Adam's parents and to the hospital staff who coordinated his care. Moreover, they were presented to the patient within a therapeutic context which evoked very little

apparent overt emotional behavior which might have been incompatible with the goal of treatment, an important consideration in view of the collateral effects the presentation of aversive stimuli often has upon ongoing behavior (Skinner, 1953).

The results of the present study suggest that negative reinforcement procedures such as those described here should be considered in treating functional deficits if typical positive reinforcement strategies prove difficult to implement. Indeed, following the success of this intervention, a conceptually similar intervention was designed to treat patient's functional gait disorder. This intervention involved evaluation by an expert and prescribed therapeutic exercise routines which the patient might escape/avoid by meeting criteria on several walking-related behaviors. After several weeks the patient was discharged with a walker and a reduced home-based exercise regimen. A deadline was established at which time comprehensive contingent exercises were to be implemented should the patient not evidence totally independent ambulation. Approximately two days before this deadline the patient walked independently and continued to walk independently throughout follow-up.

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