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BIOFEEDBACK TRAINING WITH A LEARNING DISABLED CHILD[1]

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Summary.—Biofeedback training was used to increase a learning disabled child's ability to control his breathing patterns. The procedure was most effective when the child was permitted to explore freely the correlations between his respiratory movements and feedback from the apparatus. Probe trials showed that increased external and self-directed control over the direction and volume of breathing was achieved. Results were discussed in terms of the relationship between biofeedback technology and learning and behavior problems.

The growing use of electrical and mechanical devices in the treatment of educational and behavioral problems has paralleled rapid technological advances. Various cueing, feedback, sensory substitution, and monitoring devices have facilitated solutions to problems or provided treatment approaches that were previously not possible (see Schwitzgebel & Schwitzgebel, 1973). However, it is only recently that biofeedback techniques, i.e., the immediate feedback of bioelectric responses for the purpose of modifying those responses, have been applied to clinical problems. These have included vascular, neuroelectrical, and neuromuscular difficulties as well as being utilized in a variety of psychotherapeutic efforts (Blanchard & Young, 1974).

The purpose of the present report is to describe an application of biofeedback technology to the respiratory control problems of a learning disabled boy. For unknown reasons, he was not able to exert any noticeable voluntary control over his respiratory movements, although vital reflexive mechanisms were functioning. His breathing was characterized by a shallow pattern and marked by his inability to modify the direction or volume of his inhalations or exhalations or to hold his breath for any consistent period of time. Naturally, these difficulties interfered with speech production patterns and it was hoped that, if voluntary control over his breathing movements could be established, it would also benefit the speech problem.

METHOD

Subject

Paul is a very warm and pleasant 11-yr.-old boy currently enrolled in a school for learning disabled children. He has a history of a wide range of developmental difficulties, especially in the perceptual and motor areas. His inability to control voluntarily his respiratory movements appeared to be another

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instance of a generalized motor coordination dysfunction. The precise etiology of his problems is unknown but thorough diagnostic examinations revealed a number of congenital anomalies. Continuous treatment has brought about steady progress, although a marked lag in the visual motor area is still evident. A recent psychological examination yielded a WISC full scale IQ of 66, with a 23-point discrepancy between the verbal and performance scales.

Apparatus

All treatment sessions were conducted in an insulated and shielded laboratory chamber specially designed for psychophysiological research. Respiration rate was recorded by a Parks (Model 27) mercury strain gauge plethysmograph that was adapted for use in this manner. The output was fed into a Mosley (Model 7100 B) strip chart recorder, providing a permanent record of direction, volume, and rate of the child's breathing. The child was seated comfortably with the recorder approximately 1.5 m. in front of him, at eye level. He had a clear view of the recording pen as well as of the last few seconds of the permanent tracing. The pen-position reference numbers, 0 through 10, were clearly visible in a horizontal alignment at the top of the recording surface. A second marker was used to record the duration of a green pilot light that was positioned above the recorder. This light was used to signal the child when to hold his breath and was controlled by a Lafayette (Model 1431 A) bank timer.

Procedure

Each of the eight treatment sessions lasted approximately thirty minutes. The first two sessions were devoted to familiarizing the child with the apparatus and obtaining baseline data. During the initial training sessions, a "shaping" procedure was employed in an attempt to increase both the depth of inhalations and the duration of holding his breath. In order to increase his depth, a red feedback light was arranged to flash if his depth of breathing exceeded a given value. This value was adjusted by the therapists in accordance with standard shaping procedures. Similarly, in order to increase the duration of his holding his breath, the duration of the green signal light was gradually increased, with social praise being contingent upon his holding his breath to match the time the green light was on.

After obtaining only limited success with these procedures, the structure of the feedback system was removed and the child was asked simply to manipulate the event markers through his breathing in any way he wanted. This took the form of a game with the child setting his own goals, e.g., "I'll move it to 9 this time" or "I'll make it stop moving this time." Probe trials were interspersed through each of the sessions during which the child was asked to attempt to meet the goals of the therapists. These requests included the direction of breathing, holding his breath for the duration of the green light, and varying the depth of inhalations and exhalations to reach specific numbers displayed on the face of the event marker. Finally, in the eighth session (treatment had to be terminated for reasons unrelated to therapy at this point), an attempt was made to transfer breathing control from feedback from the apparatus to tactile cues from his chest movements.

Results and Discussion

Baseline data clearly confirmed informal impressions and parent reports regarding his inability to control his respiration pattern. Instructions to modify his pattern in any form generally resulted in a series of haphazard movements. Fig. 1A illustrates the lack of change when asked to hold his breath for the duration of the green light (duration is noted by length of the horizontal line in the on position). Following treatment involving self-initiated manipulation of the feedback apparatus, he was able to hold his breath with reasonable ease for a period ranging from 5 to 7 sec. Fig. 1B illustrates this for a 5-sec. interval. Note that control was exerted almost immediately following the onset of the green signal light. Most of the preparatory and frequently haphazard movements that had characterized previous efforts were now very minimal.

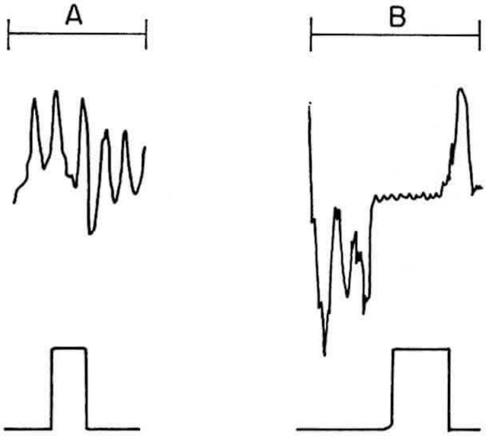

FIG. 1. Changes in respiration as a function of signals to "hold breath" during baseline (A) and following treatment (B). (Pen movement is from right to left.)

Paul's ability to control both the direction and depth of his breathing also increased. He was able to determine which "way the pen would move" and what numbers he would reach. However, although his control of volume and direction increased substantially, he was still very much dependent upon the visual feedback from the apparatus. Accordingly, an attempt was made during the last sessions to transfer control from visual feedback to sensations associated with his chest movements. During this session, Paul held one hand on his chest while watching the event marker. At certain points we gradually removed the visual feedback, asking Paul to tell us which way the event marker was moving. Although there were marked improvements, the response was not yet consistent and additional training was certainly suggested.

It should be noted that the control over his respiratory pattern that was obtained here was the first ever achieved after numerous other attempts. Hopefully this step will pave the way for additional treatments (since it has been demonstrated that control is possible) that will result in meaningful clinical changes. Beyond that, this case study demonstrates the potential usefulness of biofeedback techniques as applied to learning and behavior problems (see also Simpson & Nelson, 1974). This technology may prove to be especially fruitful for such educationally significant areas generally referred to as "attention," since there appear to be relatively well-defined psychophysiological correlates (Haider, 1970). Moreover, biofeedback training in relation to autonomic functions associated with emotional reactivity as well as its expanded use in motor and visual-motor areas may ultimately provide us with a new set of powerful treatment methods.

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