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## TEACHING GEOMETRIC SAMENESS TO A DEAF-BLIND CHILD

Gary Dean Yarnall, Ed.D.

How does a teacher teach the basic concept of "sameness" to a low-functioning child who was born totally blind and deaf? Teaching basic concepts to handicapped children may be very difficult. A *blind* child cannot see all the common environmental stimuli that sighted children use in learning such visual concepts as color, position, size, form, shape, distance, gender, and time. A profoundly *deaf* child cannot hear all the stimuli that are involved in learning such auditory concepts as music, animal sounds, transportation noises, words, names, blends, and sentences. A *low functioning, retarded* child can not readily assimilate, discriminate, or generalize all the environmental stimuli that are used in learning such social skills and concepts as adapting, interacting, grooming, reading, writing, dating, bartering, commuting, and computing. A child who is multiply impaired, who cannot see or hear and does not function at "normal" intellectual levels is, indeed, difficult-to-teach.

There are a few reports about deaf-blind retarded individuals in the literature (Curtis, Donlon, & Wagner, 1970; Salmon & Rusalem, 1966; Vernon, 1969; Wolf & Anderson, 1973). The literature contains additional cases of difficult-to-teach children who had residual sight or hearing and normal tested intelligence, but who behaved as though they were blind or deaf or retarded (Barraga, 1964; Macht, 1971; Singh & Zingg, 19655; Stolz & Wolf, 1969; Yarnall, 1979). Many multiply handicapped children have more residual vision or audition or greater intellect than anyone realizes; they may simply have not

yet learned to use the sight, sound, or processing skills they possess. These children may be called the *unsophisticated* or *untrained* multiply handicapped. Their parents and teachers may be unaware of how much the children actually see or hear or know.

Whether a child has congenital, adventitious, or unknown visual, auditory, or mental impairments, that child needs educational interventions that are very carefully planned and systematically structured. Many of the basic concepts that "normal" seeing, hearing, and thinking children learn are acquired through both indirect and direct social and educational interaction. Normal children learn many intricate, subtle details of basic concepts that are missing or infrequently evidenced by blind, deaf, or low functioning children.

This study was designed to test and report on a plan to teach the concept of geometric sameness to a congenitally deaf-blind retarded girl. Since that time, this same plan has been used to teach the same and related basic concepts to other multiply or severely handicapped children in ten different states.

### METHOD

#### Subject

The subject in this study was a 7½-year-old girl who was congenitally blind and had a profound bilateral hearing loss. She was not toilet trained, would not feed herself, and hit herself in the head approximately 1,000 times per school day. This child had no communication, skills; she did not use gestures, sign language, fingerspelling, speech, writing,

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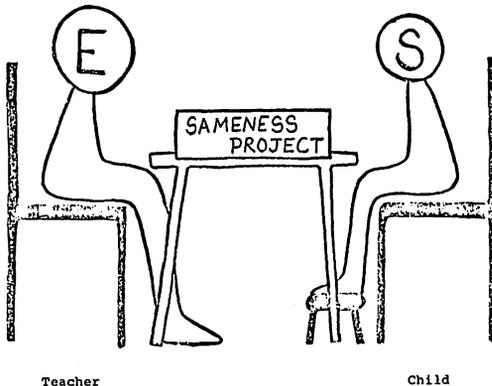
or other means of communicating with others. Her entering communication level was classified as "emotional reactions" by the school diagnosticians; that is, her only means of communication were to cry when upset and smile when happy.

### Setting

The setting for this original study was a large private residential school for the blind in the New England area. The teacher and child were part of the deaf-blind unit within the school system. During the teaching sessions, the child was seated across from the teacher at face level with either a table or a portable work tray between them. The work tray had raised edges to prevent items

**Figure 1. The General Setting of Teacher (E) and Child (S) During the Project**

### GEOMETRIC SAMENESS



from sliding or rolling off the work area. In the large open work tray was placed an open square box containing the 10 solid items to be manipulated.

### Procedures

**Data Recording.** Each intervention session allowed 20 opportunities for correct responding. Data were taken during each session. At this time no reliability checks were taken; however, recent replications with numerous other deaf-blind and multiply handicapped children in different states have included reliability checks. Data recorded

(among other things) the number of correct responses per session. Data were recorded during baseline and during each intervention phrase.

### Prerequisite Behaviors

Before the study began, the behaviors the child would need for this learning activity were determined; those she did not have were taught. The teacher taught the girl to sit quietly in a chair, to attend to tasks for longer periods of time, and to wait appropriately upon command (Yarnall, 1977).

**Baseline.** During baseline the child was given a tray containing 10 solid geometric shapes. Two of the 10 shapes were identical and eight were different from the matched pair, resulting in a matched same-to-different ratio of 2:8. The child was tactually shown one item that was identical to the two matched objects in the tray. She was then immediately given the sign language signal for "same". She was then observed to see if she would complete the expected responses; that is, the teacher noted whether she received the "same" sign, searched through the 10 assorted geometrical shapes, selected two that were geometrically the same, picked them up (one in each hand), and tapped the same objects together. This entire response topography sequence was used as the criterion for a correct response. Each session included 20 response trials. The child was given a time limit of 7 seconds for each of the 20 trials. That is, following the model given and the sign signal for "same", she had 7 seconds in which to respond correctly by completing the entire response sequence. Neither prompts nor reinforcement were used during baseline. The teacher selected 7 seconds as the maximum time limit for two reasons; 1) to decrease the latency between the given signal and the completed response sequence, and 2) to reduce the amount of time available per training session in which the student may emit inappropriate behaviors. A child busy completing a learning task that results in approval and reinforcement is less likely to engage in stereotypic or self-abusive acts that do not.

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*Intervention.* A changing criteria intervention design was implemented during intervention. The steps and sequence employed during baseline were used during intervention except for the following differences:

1. Physical guidance and prompts were used during each step of the intervention. Prompts were faded as the child began to emit independent responses (Sulzer-Azaroff & Mayer, 1977).

2. During the first phase of intervention, the response tray contained nine identical 1-inch wooden cubes and one odd-shaped wooden distractor. As the child began to learn the task (as demonstrated by feeling the sample model shown, searching the tray, locating and picking up two matched items, and then tapping them together), the number of same items (1-inch cubes) was gradually reduced from nine to two as the number of distractors was increased from one to eight. A total of 10 geometric shapes was always present in the selection tray.

3. The decision to increase the number of distractors while reducing the number of same items was based solely on the

child's correct independent responses. The criterion for expected correct responses was increased by raising the ratio of identical items to distractors from 9:1 to 8:2 to 7:3 to 6:4 to 5:5 to 4:6 to 3:7 to 2:8.

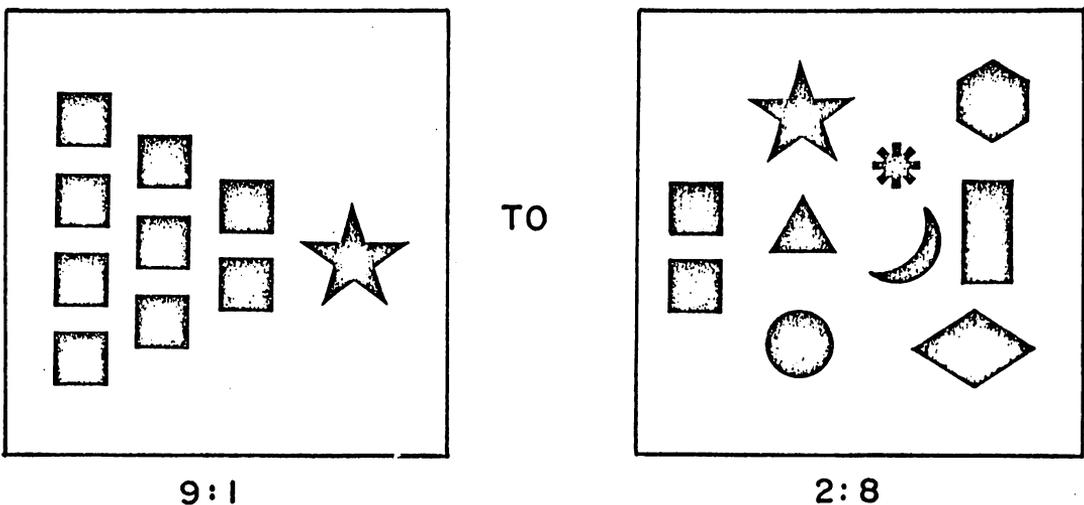
4. Before the ratio of same-to-different was raised, the child had to meet a criterion of at least 80% (16 out of 20) independent responses without prompting for at least three consecutive sessions. This criterion was used throughout each step of the intervention.

5. In several teaching projects that were modeled after this initial study (Louisiana State Department of Education, 1974; Yarnall, 1974, 1975, 1977), reliability checks were taken throughout the baseline and intervention phases; other teachers were taught the value of high, objective interobserver agreement data.

### RESULTS

Data were obtained during each phase of this changing criteria design with this congenitally blind, deaf, low functioning child.

**Figure 2. The Change in Ratio of Matched versus Distractor Items in the Response Tray**



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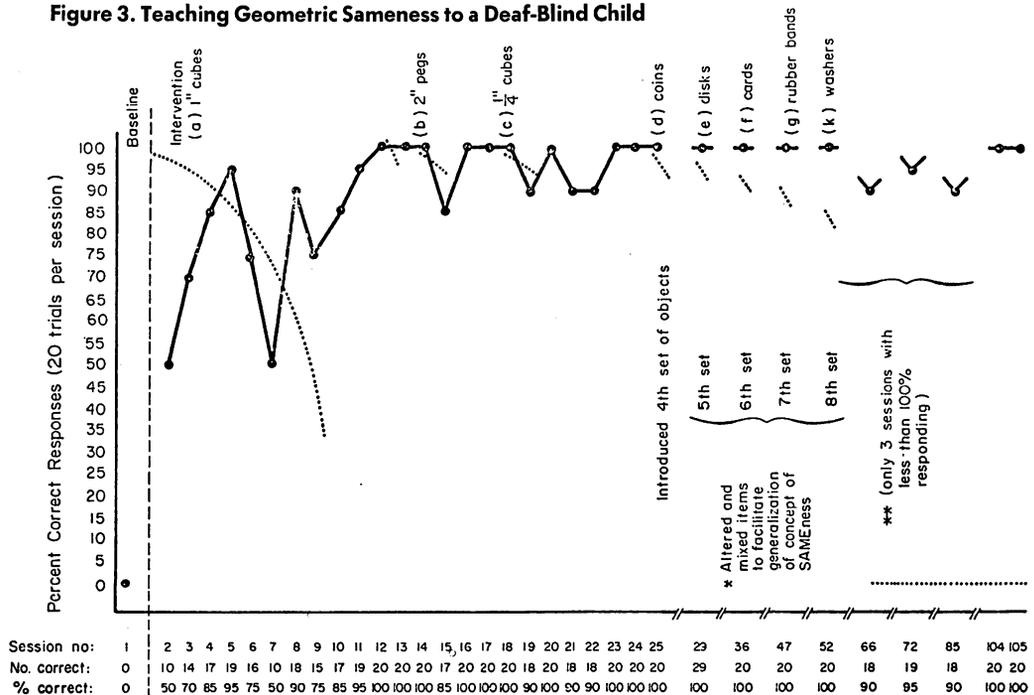
**Baseline.** Based on observations of this child's limited skills, the teacher took only one session of baseline data (20 trials) on the operant level of performance for this new task. Without any physical prompts or reinforcement, the child failed to correctly or independently complete within 7 seconds time any of the 20 opportunities for what the teacher had determined to be an appropriate response. Baseline data were 0-out-of-20 (0%).

**Intervention.** A total of 105 intervention sessions were conducted during 17 weeks of school attendance. In the first intervention session (session #2), the child was provided heavy prompting, but even with help she was able to complete only 50% (10/20) of the expected tasks (following the complete sequence of matching 1" cubes together as described). Initially she required total physi-

cal guidance in order to perform the expected sequence within 7 seconds following each item model and signal to "find two of the same and match". It took 1 week (12 actual sessions) before she was able to achieve 100% (20 out of 20) correct responses. The degree of physical prompting necessary began to decrease but, as might be expected considering the baseline performance, much prompting was necessary at first.

Eight different sets of objects were introduced while teaching and generalizing the concept of "geometric sameness" to this student. Prompting was used each time a new geometric shape was introduced to be matched. In fact, the prompts were faded so carefully by the teacher that there were only 7 sessions following session 12 during which the girl failed to perform 100% on the 20 expected responses.

**Figure 3. Teaching Geometric Sameness to a Deaf-Blind Child**



\* Indicates when new sets of same geometric forms were introduced these sessions  
 \*\* Indicates sessions that had less than 100% correct, independent responding  
 ..... Approximate amount of prompting used

## TEACHING GEOMETRIC SAMENESS TO A DEAF-BLIND CHILD

The eight different sets of geometric objects used in this teaching project were 1-inch wooden cubes, 2-inch dowel pegs,  $\frac{1}{4}$ -inch plastic cubes, large metal coins,  $\frac{1}{4}$ -inch rubber disks, 2-inch square plastic cards, large rubber bands, and common bolt washers. The teacher and aide used an ordinary muffin pan to sort and store the various sets of geometric items to be matched, as well as the numerous different distractors, which were frequently switched throughout the study.

**Figure 4. Container used for Sorting and Storing During Generalization Training**



### DISCUSSION

This study demonstrates that a congenitally deaf-blind child can learn and generalize the basic concept of geometric sameness. However, it should be noted that, as in this case, a severely or multiply impaired child may require much physical prompting, careful fading of physical prompts to achieve independent subject responses, and highly structured and systematic procedures to teach basic concepts. Indeed, some children may be difficult-to-teach, but they *can* learn basic concepts; learning can be data-based and documented. Throughout the project, the basic principles and procedures of reinforcement and applied behavior analysis were used.

### Suggestions

Based on other studies modeled after this study which taught similar deaf-blind, low

functioning, or multiply handicapped children concepts similar to "geometric sameness", the following suggestions and comments that may facilitate attempts to replicate this study are offered.

1. Teach the child to respond correctly, consistently, and independently to one set of geometric items first before introducing other different sets. Even though the child may initially think that the sign signal for "same" means "locate two 1-inch cubes", experience suggests that efforts to teach the child to generalize the concept of SAMEness will be less difficult and confusing after the child has demonstrated an understanding of a first sequence of steps before introducing a second set of items.

2. Record and graph more than just the numbers of correct responses. Note also the number of prompts used each session plus the number of incorrect responses during the given time limit. Depending on the child, the time limit may need to be modified.

3. After a child has been taken through an entire change of ratio from 9:1 to 2:8 with one set of objects and demonstrated that he or she understands the signal and expected performance, it should be easier to move through the ratio, changing steps at a faster pace with new sets of items.

4. Allow the data (child's responses) to tell you how fast you should advance. Impress on the parents and/or co-workers the importance of a high success rate for the child, even if it becomes necessary to do much of the work for the child. Provide positive reinforcement for both the prompted and the independent correct responses.

5. This design and procedure may be used with children who have behavior and sensory characteristics different than those of the deaf-blind child. This design and procedure can also be used to teach preacademic and academic skills other than the concept of sameness.

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The teacher in this project reported some fringe benefits derived from the intensive, systematic interaction with this deaf-blind girl. (a) The girl learned the functional meaning for a manual signed signal. (b) She was reinforced for touching, searching, exploring, and tactually sorting items; appropriate curiosity was reinforced. (c) She had hundreds of opportunities to receive social

and tangible reinforcements for correct (prompted, then independent) responses. (d) She learned to emit appropriate behaviors that were incompatible with head banging and her head banging decreased. (e) She acquired some social and academic skills that would facilitate educational growth in other areas.

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