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Effects of Button Features on Self-Dressing in Young Retarded Children

Abstract: Three button design features (the shape, size, and position of a button on a garment), conceptualized as setting events, were evaluated in terms of their effect on the performance of buttoning skills in four developmentally retarded preschoolers. Utilizing a single-subject multi-element design, the 36 combinations of the three experimental variables (4 shapes, 3 sizes, and 3 positions) were systematically presented to the participants without any formal training. Results indicated that buttons of large size in the top position on the presentation garment maximally encouraged learning this self-dressing skill. Few consistent effects were attributed to the specific shapes examined. Analyses of the events disrupting buttoning performance, the frequency of uncompleted and mismatched button trials, as well as the number of requests for assistance emitted by the subjects, served to support these findings while yielding implications for future training and experimentation.

The inability to dress among the developmentally retarded is a common problem reported by parents, teachers and institutional caretakers (Tavorimina, Henggeler, & Gayton, 1976). Unlike developmentally normal children who learn to dress with minimal instruction, the developmentally delayed typically fail to acquire independent dressing abilities under normally existing environmental contingencies (Azrin, Schaeffer, & Wesolowski, 1976). The formal training of dressing tasks utilizing empirically derived behavioral principles has been the approach followed by most researchers and interventionists interested in ameliorating deficient skills (Adelson-Bernstein & Sandow, 1978; Ball, Seric, & Payne, 1971; Bensberg, Colwell, & Cassel, 1965; Breland, 1965 a, b; Minge & Ball, 1967; Watson, 1972).

In the ABC assessment of dressing skills (Craighead, Kazdin, & Mahoney, 1976), three classes of stimulus events can be identified: *Antecedents* or discriminative stimuli that set the occasion for dressing (environmental conditions, instructions, visual and tactile cues), the dressing *Behaviors* themselves, and *Consequences* (task completion, improved appearance, social approval). In addition, this temporal sequence of events occurs in a given context or *Setting Situation* (Bijou & Baer, 1961; Gewirtz, 1972). Changes in the overall context may also affect the interrelationships among the ABC components. For example, the style of garment (setting factor) might affect the likelihood that an instruction (antecedent) would successfully cue a child to try to dress (behavior) and complete the task unassisted (consequence).

Most of the research concerned with developing dressing abilities has focused on the manipulation of antecedant and consequent events, devoting little attention to setting factors. Some authors (Bensberg & Slominski, 1965; Behrmann, 1972) acknowledge the importance of setting events and make suggestions for the selection of functional garments (e.g., V-neck shirts, bell sleeves). Bartholomew (1976) designed a dressing smock which serves as a learning device to

enhance acquisition of specific fastening skills such as buckling, buttoning, snapping, lacing, and zippering.

Although attending to the importance of setting factors, studies such as Bartholomew (1976) have held these variables constant throughout training. However, the functional aspects of setting factors may be more effectively studied when they are systematically manipulated individually and in interaction with behavioral training procedures. Accordingly, the present experiment was designed to assess how three design features of buttons (shape, size, and position on a garment), conceptualized as setting factors, may differentially affect the acquisition of buttoning skills with developmentally delayed preschool children.

Preliminary observations of children dressing have revealed that many different methods (with varying degrees of efficiency) exist for successful buttoning. In determining how these techniques are affected by design features, a measurement system which taps a wide range of behaviors is desired.

In addition to measures of response time, task completion, and affective behavior, the present experiment employed an observational system based on a task analysis of buttoning. Four component stages of buttoning were revealed from the observation of normal and abnormal preschoolers' attempts at buttoning. They are as follows: (a) grasping the button and fabric with appropriate hands; (b) matching the correct button with the corresponding hole; (c) getting the button into the hole; (d) getting the button out of the hole. The identical four stages were derived independently by Adelson-Bernstein and Sandow (1978), thus supporting this division.

While learning to button, children commonly experience disruptions in progressing from one stage to another (i.e., dropping the button or fabric). Hence the number and order of stages initiated, along with the corresponding frequencies of interruptions, are hypothesized to be sensitive dependent measures. This system may potentially serve as a framework for the examination of specific responses (grasping patterns, motor behaviors) occurring at each task analysis stage in relation to button styles.

Method

Subjects

Four developmentally retarded children (two males and two females), attending preschool classes at the Association for Helping the Retarded Child, Brookville, New York, ranging in age from 5–0 to 5–8, served as subjects. School physicians attributed retardation to Down's syndrome in all cases.

Parental consent, an absence of severe physical disabilities, willingness to participate, and a low ability level in buttoning as determined from informal observations of the child's attempts at dressing a doll were the criteria by which the children were selected.

Apparatus

The experimental garments employed were 12 standard light blue chamois vests designed to be worn over a child's clothing. Upon each vest three white buttons of identical shape and size were mounted (on the left panel) in three equidistant positions: top, middle, and bottom. Because of its proximity to the neck, the top button was not visible to any of the children. Four shapes of buttons (round, square, toggle, and flower) were used in each of three sizes (small, medium, and large) corresponding to manufacturing lignes of 24, 30, and 45. Buttonhole sizes were 19, 22, and 38 mm for small, medium, and large buttons, respectively.

Procedure

Experimental sessions were conducted individually in a partitioned 2 × 3.5 m area of the school's physical therapy workroom. Sessions began with a standard warm-up dialogue between experimenter-manipulated hand puppets. This procedure prompted the child to put on the first vest of the session with the experimenter's assistance in order to ensure a standard presentation of buttons.

The 36 combinations of button shape, size, and position were presented to the participants in a randomized order dictated by a multi-element experimental design (Sulzer-Azaroff & Mayer, 1977). Twelve experimental conditions consisting of four shapes and three sizes (corresponding to the 12 experimental vests) were randomized without replacement. A second randomization process determined the order of presentation for the three buttons on each vest. The resulting 36 conditions were labeled as a "block" with the experiment as a whole comprising six unique blocks, i.e., each child received each condition a total of six times.

Thus in each of the 26 sessions of the experiment, nine buttoning trials (three vests) were scheduled for presentation. The procedure consisted of simply asking the child to button the button pointed to by the experimenter, i.e., "Let me see you button *this* button." No attempt was made to teach the motor skills involved in buttoning. Standard instructions were used, however, to direct the child to the task and to meet requests for assistance. A 5-minute time limit was instituted for each button trial.

At the conclusion of every button, the experimenter immediately directed the child to the next button, repeating the initial instruction. After all three buttons on a vest were completed, the child was reinforced, without regard to performance, with the presentation of a dressing mirror and was praised for his/her appearance. The child was then dressed with the next vest and the procedure was repeated.

Videotaped records of the sessions were analyzed by independent observers according to (a) dressing time, (b) percentage of successfully completed trials, (c) appropriate matching of the button and buttonhole, (d) the number and order of task analysis stages per trial, and (e) the frequency of requests for assistance per trial.

Indices of agreement between observers were assessed on a 20% random sample of button trials. Reliability for the dressing time data, determined by dividing the smaller duration by the larger, was 91%. Similarly, reliability for the stage data was computed by dividing the smaller number of stages by the larger, yielding a reliability quotient of 94%.

Results

Size

Patterns of acquisition of buttoning skills differed in accordance with the various design features, with button size providing the most dramatic illustration. As seen in Figure 1 where mean buttoning times are presented for the three sizes (collapsed across shape and position) by experimental block, small buttons consistently produced the longest buttoning trials while large buttons enhanced the speed of this skill. The statistical significance of this effect is documented by a 3-way analysis of variance ($4\times3\times3$) of buttoning time: F (2,221) = 12.90, $p < .01$ for Subject 1; F (2,212) = 17.70, $p < .01$ for Subject 2; F (2,215) = 14.86, $p < .01$ for Subject 3; F (2,209) = 20.37, $p < .01$ for Subject 4.

Similarly, large buttons were always completed within the 5-minute criterion. In contrast, small- and medium-sized buttons were respectively associated with 77% and 23% of the 36 uncompleted button trials of all subjects. The relative difficulty of these buttons was also expressed by the children as they emitted 45% and 51% of their requests for assistance during trials with small and medium buttons, respectively.

This general hierarchy of large, medium, and small sizes as facilitators of buttoning is further quantified in the frequencies of task analysis stages and interruptions in buttoning engaged in per trial. As these figures closely parallel the data obtained by measuring buttoning time but with less sensitivity (for example, trials of 100 seconds and 5 seconds are not discriminated if each was comprised of four task analysis stages), the exact frequencies will not be presented.

Position

Contrary to initial expectations, the most efficient buttoning was found with buttons *not* visually accessible to the children. The top position generally promoted shorter button trials with time-to-completion increasing progressively in middle and bottom positions. (See Figure 2 where mean buttoning times are displayed for position, collapsed

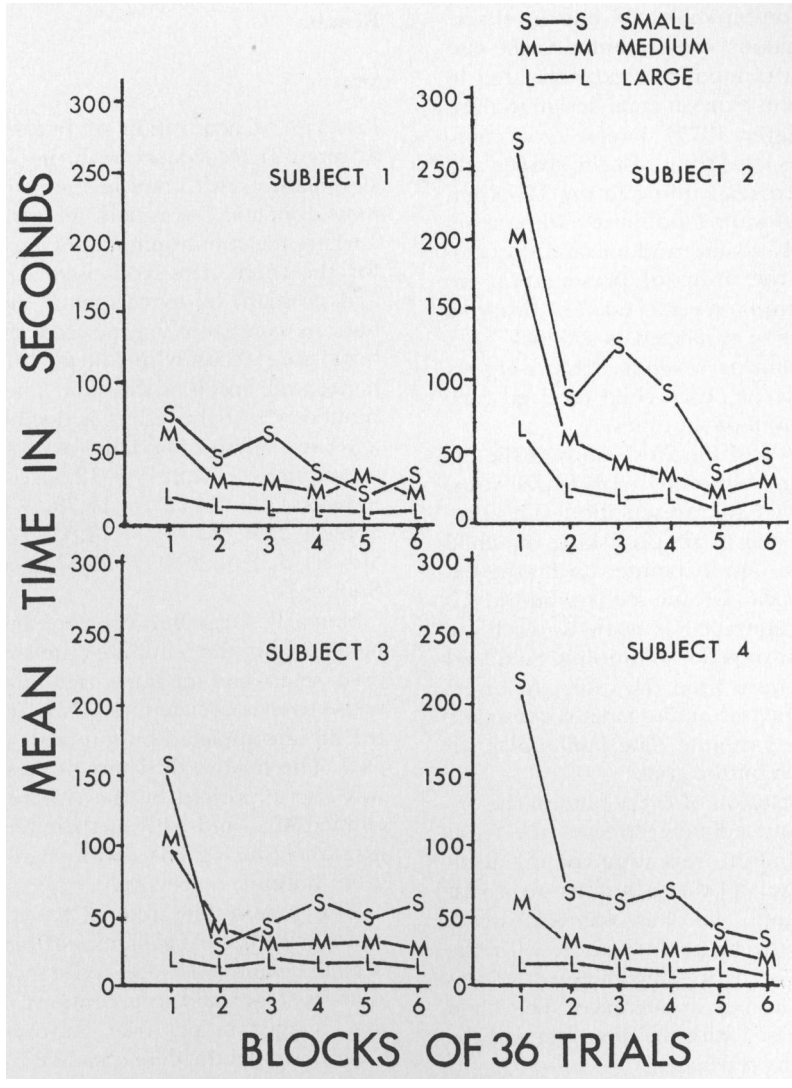

Figure 1. Buttoning times for small, medium, and large sizes collapsed across shape and position for the four Subjects.

across shape and size). The ANOVA confirms the significance of these findings for Subjects 1, 2, and 4: F (2,211) = 5.63, $p <$ .01 for Subject 1; F (2,212) = 3.14, $p < .05$ for Subject 2; and F (2,209) = 4.30, $p < .05$ for Subject 4. Subject 3's data were the exception to the rule, taking longest with the middle button and shortest with the top.

In general, buttons in the top position were also associated with the smallest proportion of uncompleted trials, 19%. Correspondingly, the middle and bottom positions, respectively, accounted for 34% and 47% of the remaining unsuccessful trials.

The analysis of mismatched button trials with regard to position helps to clarify the relative inhibitory effect of the bottom position. Eighty percent of the mismatched trials occurred in the bottom position of the garment. Furthermore, Subject 3, whose

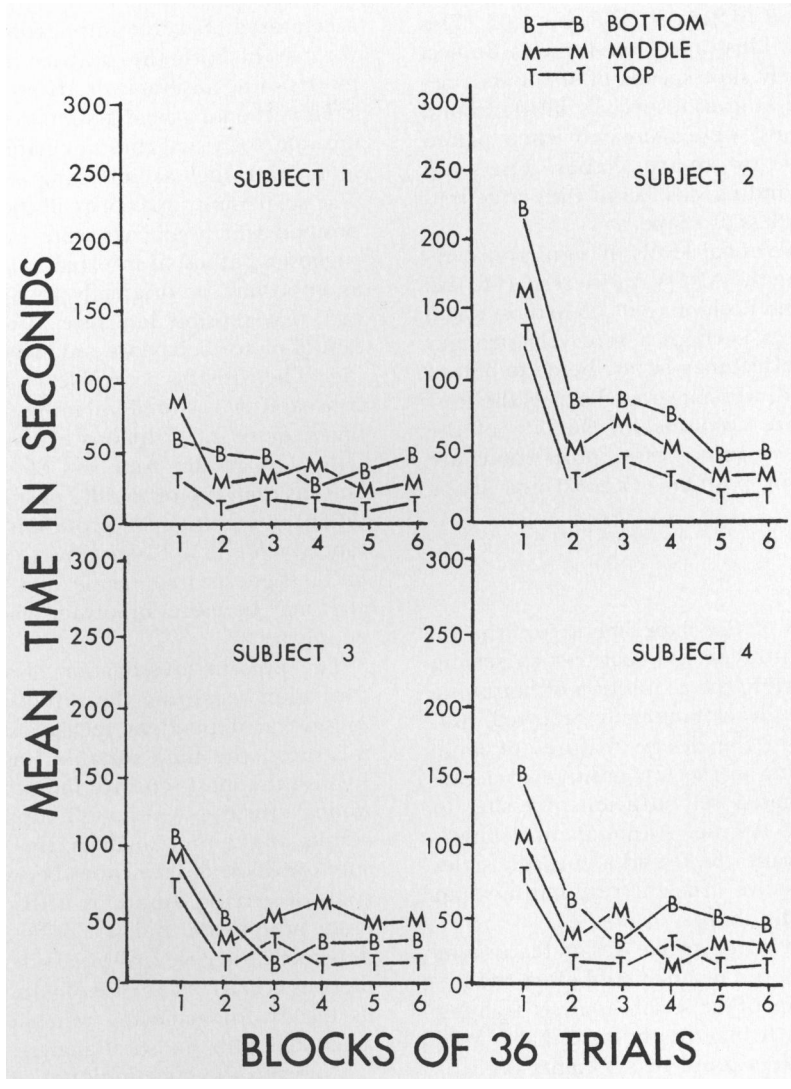

Figure 2. Buttoning times for top, middle, and bottom positions collapsed across size and shape for the four Subjects.

data did not follow the top, middle, and bottom pattern of efficient buttoning did not experience any mismatching throughout the experiment. Corroborating evidence also finds the bottom position to be the site for a majority of the subjects' requests for assistance (59%). Middle and top positions prompted an equal proportion of requests, 20.5%. Finally, data concerning the number of task analysis stages and interruptions in buttoning reinforce these findings.

Shape and Interactive Effects

The effects of button shape were not found to be statistically significant for any subject. Facilitating trends were suggested, however, for the toggle and round shapes as these designs prompted relatively faster buttoning trials.

Only one significant interaction was evident in the data, and occurred between the variables of shape and size for Subject 3's

data only: F (6,215) = 2.38, $p < .05$. This interaction illustrates that for this Subject the relatively slow speeds of small and medium sized buttons (especially in round and flower forms) were increased when paired with toggle or square shapes. The most rapid responding was found with large buttons regardless of shape.

The differential levels of significance resulting from the ANOVA with respect to size ($p < .01$) and position ($p < .05$ in most cases) suggests that perhaps a relatively stronger treatment effect may be attributed to button size. Indeed, when averaged across the four subjects, size accounts for 36.25% of the treatment variance. Lesser proportions are indicated for position (17.25%) and shape (11.25%).

Discussion

The results of this experiment confirm the role of button design features as setting events affecting the acquisition of buttoning skills in the developmentally retarded. Manipulation of the design features of large size occurring in the top position of a garment promoted self-sufficient dressing to the greatest degree. Although not statistically significant, the round and toggle styles prompted more efficient responding than the remaining shapes.

This study suggests that design features of garments should be analyzed before the implementation of behavior analysis training procedures. It may be the case that button design features could be systematically varied to "shape" the acquisition of self-dressing skills to either obviate the need for training, or at least enhance its effectiveness. The most efficacious features (large size, top position, toggle or round shapes) would be recommended to begin the acquisition process and as practice or training continued, the designs would be systematically modified to include increasingly smaller sizes, additional button shapes, appearing in lower positions on a garment.

Although the mere presentation of functional button designs has been shown to be effective in facilitating buttoning, it is expected that with behavior analysis training procedures the speed of acquisition may be accelerated. Several implications valuable for use in both the practice and training modes of acquisition arise from this study.

First, the long-held assumption regarding the value of visual cues in performing a fine motor task such as buttoning is questioned. The surprising superiority of the top button position which subjects were unable to see suggests that visual information may not be as important as originally thought, and in fact, may possibly interfere with the execution of motor behaviors employed in buttoning. The visually accessible bottom button consistently resulted in longer buttoning times, more interruptions in stage progressions and greater numbers of mismatched buttons than top or middle positions. In addition, observation of proficient adult buttoners, who do not typically use visual feedback, suggests that tactile and kinesthetic cues may be more important when training neophytes.

The present investigation also yields information regarding the differential utility of several dependent measures. Of these measures, the time variable was found to furnish the most sensitive indication of buttoning efficiency. Although supporting the results of the time analysis, the stage measure overlooked distinctions between button trials of varying durations if disruptions in stage progression did not occur. The time dependent variable is also considered advantageous because of its ease of administration, its facility for achieving reliability, and its amenability for statistical analysis.

However, the stage indicator of buttoning efficiency holds promise as an assessment and training device as upon this framework a wide variety of buttoning responses may be examined. Information pertaining to the type of grasping patterns utilized, the mode of orienting the fabric and button, motor responses, and affective behaviors prompted by the various button styles is relevant for determining the need and direction for training. The application of such a system can provide (a) a baseline measurement of an individual's abilities before training, (b) an indication of specific functional and malfunctional responses which training may address, and (c) a measure of training effectiveness with supplemental administrations.

Finally, the results call attention to the need for more functional fasteners and garments designed especially for developmentally retarded individuals. With regard to button fasteners, the present analysis indicated that a major problem in acquiring this skill is frequent dropping of the button. The effectiveness of large sized buttons, for example, appears to lie in its facilitation of grasping. Future research will focus on the modification of existing button styles and on the creation of new designs which will hopefully encourage the development of efficient grasping patterns.

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