

INDUCING VARIABILITY IN COMMUNICATIVE GESTURES USED BY SEVERELY RETARDED INDIVIDUALS

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Handicapped individuals who have been taught spontaneous gesture requests often use only a small part of their vocabulary. Procedures to recover the unused part of this vocabulary have not been documented. This study was designed to identify procedures for increasing the proportion of gestures used spontaneously. Six mentally handicapped individuals served as subjects. After a baseline phase during which spontaneous gesture requests were reinforced, consequences were withheld for high-rate gesture requests. This led to an increase in different gesture requests. Although gesture requests did not return to baseline levels during a reversal condition, functional control was demonstrated by way of a multiple baseline across subjects. The absence of a reversal effect suggests enduring effects of the procedure.

DESCRIPTORS: gestural communication, mentally retarded

Gestural communication is a nonvocal approach often used with developmentally disabled individuals who do not speak. Procedures have been developed for establishing stimulus control over communicative gestures (e.g., Carr, Binkoff, Kologinsky, & Eddy, 1978; Duker & Morsink, 1984) and transferring stimulus control from the trainer's verbal instructions to the question "what do you want?" (Coonen & Duker, 1985). Inducing individuals to make gestures spontaneously can be pursued by teaching staff and parents to identify appropriate opportunities to evoke gestures by questioning (Duker & Moonen, 1985) and by manipulating requested referents (Duker & Moonen, 1986). Training can be considered complete if individuals display a vocabulary of gestures that they use spontaneously.

One problem often seen with severely and profoundly mentally handicapped students is the use of only a small portion of their vocabulary. Low variation in gesture use is especially alarming when individuals show interest in referents of the unused vocabulary but fail to emit the appropriate gesture. Reinforcing gestures, by providing the requested

referents, not only differentially reinforces some specific gestures but may also simultaneously extinguish others.

One potential strategy is to extinguish high-rate gestures to induce the occurrence of previously taught low-rate gestures. Procedures to induce variability in responding have received little attention in the applied literature, although extinction has been shown to increase the variability of operant topographies (Karen, 1974). Carr and Kologinsky (1983) reinforced only the first two instances of a gesture made by autistic children, thereby ignoring additional instances of the same gesture. Although their procedure was effective in increasing the number of different gestures, it is hard to attribute this result to the procedure alone. Extinction was only part of an intervention package in which spontaneous gesturing was being taught through differential reinforcement, fading, and prompting.

In an attempt to remedy low variation in spontaneous gestures with severely and profoundly mentally handicapped individuals, we assessed the effectiveness of having a teacher not reinforce individuals' high-rate gesture requests.

METHOD

Subjects and Setting

One male and 5 female residents of a facility for mentally handicapped individuals participated.

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Table 1
Spontaneous Communicative Gestures Across Subjects

Label ^a	Sjalida	Erna	Rosita	Jose	Yashenka	Willy
Inflate a balloon		+				
String beads		+	+	+		
Play with bricks	+	+	+	+		+
clay			+	+		
comb	+		+	+	+	+
doll	+	+	+	+	+	+
drum					+	
Draw/write		+	+	+		
Look in a glass/mirror	+		+	+		
Play with a humming top	+		+	+	+	+
a jigsaw puzzle	+	+	+	+		+
See/read a magazine/book	+	+	+	+		
Play a mouthorgan		+				
Listen to music		+	+	+	+	+
Open/close	+	+	+	+	+	+
Paste		+	+	+		
Play with a pegboard	+	+	+	+		

^a Because the gestures are mands, "I want to . . ." has to be placed before each label.

They were selected on the basis of their low variation in gesture use. All individuals were involved in an ongoing research program on gestural communication and were able to use gestures spontaneously. Table 1 lists the gestural vocabulary of each subject.

All individuals functioned in the severe to profound range of mental retardation. None suffered from seizures or were on medication. All subjects had been institutionalized since the first years of their lives. Speech training had been tried unsuccessfully with each of the hearing individuals.

Sjalida was 13 years of age. She was deaf and showed a high rate of self-stimulatory responses (e.g., head turning). Erna was 28 years old, and Rosita was 30 years old. Jose was 29 years old and showed a high rate of hair twisting, presumably as self-stimulatory behavior. The cause of retardation of these individuals was unknown. Yashenka's age was 12, and her diagnosis was mental retardation due to brain damage. Willy, an 18-year-old boy, was diagnosed as microcephalic. Apart from Sjalida, none of the individuals had any sensory disabilities. Erna, Rosita, and Jose were living in the same group, whereas the other individuals were living in

different living groups. Each of the individuals was enrolled in a special classroom several hours a day, and Yashenka and Willy received advanced one-to-one training in gestural communication. For purposes of the present study, two small groups of 3 individuals each were formed on the basis of comparable age levels and extent of gestural vocabulary: one group consisted of Sjalida, Yashenka, and Willy, and one group consisted of the remaining 3 individuals. Data were collected during three and two sessions per week for the two groups, respectively. Guardian consent and approval by an ethics committee were obtained.

Sessions were conducted in a classroom (6 m by 4 m) equipped with a soundproof one-way vision screen. Three small tables with chairs stood in a semicircle. The individuals were expected to gesture spontaneously; the teacher asked no questions nor used any other sort of prompting, and the objects that referred to individuals' gestural vocabulary were not visible to the subjects. At the end of each 30-min session the individuals were asked to go to a corner in the classroom where drinks and cookies were offered in response to individuals' gestural requests. The teacher of the classroom was a 25-

year-old female student in special education who had prior experience in gestural communication with mentally handicapped individuals.

Procedure

Reinforcer selection. Although individuals had been taught only gestures for referents in which they had shown interest, a comprehensive reinforcer assessment was conducted. For this purpose, the procedure described by Carr, Newsom, and Binkoff (1980) was used. We also assessed whether the individuals could make the appropriate gesture when given the verbal label (or the corresponding object for Sjalida). The above procedure was repeated halfway through data collection.

Baseline 1. This phase was in effect for 3, 5, 7, 9, 15, and 18 sessions, respectively, for the 6 individuals. During baseline, each spontaneous gesture request was reinforced with the appropriate referent. If a gesture request was made, the teacher verbalized the individual's request (e.g., "Good Erna, I want to string beads") and handed the referent object to the individual. Two types of gesture referents were used: (a) objects that could be completed (e.g., stringing beads, making a jigsaw puzzle, putting pegs in a pegboard) and (b) objects that did not have this characteristic (e.g., playing with clay, listening to music, playing with a buzz top). Access to the requested objects could be kept approximately fixed across sessions by assisting the individuals. In case of the gesture request, "I want to listen to music," the individual was given a rattle if the tape recorder had been turned on. If 2 or 3 individuals requested the music simultaneously or closely in succession, only one tape recorder was turned on, but the requesters were given different rattles. Because the individuals were all involved in a comprehensive curriculum for establishing spontaneous and generalized gesturing (see Duker, 1988), the following rule was in effect: Each gesture request was reinforced, unless the same gesture was made three times in a row. The third occurrence of the same gesture request was followed by the teacher's verbal response: "No, now something else," accompanied by the teacher making a redi-

recting gesture. After having made a dissimilar gesture, the individual had to make at least one more dissimilar gesture request before the first one was again reinforced. Due to her relatively small vocabulary, this rule was different for Yashenka in that she was required to make only one dissimilar gesture request before the first one was again reinforced.

Treatment 1. This phase was in effect for 3 weeks for each of the individuals, with six sessions for Erna, Rosita, and Jose and nine sessions for Sjalida, Yashenka, and Willy. Treatment was identical to baseline with the following exception: Each individual's gesture requests were ranked according to their frequency of occurrence. Then, consequences were withheld for two or three of the high-rate gestures. All other gesture requests were reinforced according to the baseline rules. In this phase, consequences were withheld for Sjalida when she requested "I want to play with bricks" and "... play with a doll." For Erna, we withheld consequences for "I want to play with a jigsaw puzzle," "... open/close," and "... inflate a balloon." For Rosita, we withheld the consequences for "I want to play with a pegboard" and "... play with a jigsaw puzzle." For Jose, consequences were withheld for the following gesture requests: "I want to play with a jigsaw puzzle," "... open/close," and "... play with bricks." For Yashenka, consequences were withheld when she requested "I want to play with a humming top" and "... listen to music." Finally, for Willy we withheld consequences for "I want to play with a jigsaw puzzle," "... play with a doll," and "... listen to music."

Baseline 2. Procedures during this phase were identical to those in Baseline 1. Erna, Rosita, and Willy had a 1-week baseline phase, with two, two, and three sessions, respectively. Sjalida and Jose had a 3-week baseline phase (nine and six sessions, respectively). Yashenka had a four-session baseline phase.

Treatment 2. This phase was identical to Treatment 1 in terms of the procedure of withholding consequences for high-rate gesture requests. Gesture requests were recorded during six (Erna, Rosi-

ta, and Jose) and nine sessions (Sjalida, Yashenka, and Willy), covering a 3-week period. At the end of the previous phase, individuals' gesture requests were again ranked according to their frequency of occurrence. It was then decided to withhold consequences for particular high-rate gesture requests. In this phase, it was decided to withhold consequences for Sjalida when she requested "I want to play with bricks" and "... play with a jigsaw puzzle." For Erna, withholding of the same consequences as in the first treatment phase was in effect; this was also the case for Rosita. For Jose, consequences were withheld for the following four gesture requests: "I want to play with a jigsaw puzzle," "... play with a pegboard," "... play with bricks," and "... string beads." Withholding the same consequences of gesture requests as in the first treatment phase was in effect for Yashenka. Finally, for Willy the gesture requests "I want to play with a jigsaw puzzle," "... play with a doll," and "... play with bricks" were not reinforced.

Observation Procedures

Data collection. Data were collected by recording each communicative gesture of all individuals during each session. Because individuals were never prompted by the trainer, only spontaneous gestures were made. Recording was carried out from behind the one-way vision screen by one or two observers, who recorded the specific gesture and the resulting object the individual was given. Observers also recorded the exact time of each occurrence of gesturing. If no object was given, the observer(s) noted whether or not the trainer gestured to the individuals that another gesture had to be made. In case of the gesture request "I want to listen to music," the teacher turned on the tape recorder and stuck a small object on the vision screen in order to inform the observer(s) that a listening period had begun. She removed the small object at the end of the 1-min listening period. Gestures made by an individual while an object was visible were not reinforced by the teacher and not recorded by the observer(s).

Observer training was accomplished by (a) handing out a booklet with representations and descrip-

tions of the gestures involved, (b) discussing agreements and disagreements of recording at the end of a number of pilot sessions, and (c) starting formal data collection when a 90% interobserver agreement had been obtained between each of the observers. Four observers were involved and were alternately in charge. Only one observer (the first author), who was in charge as a reliability observer only, was aware of the purpose of the study. He never knew, however, whether a baseline or treatment condition was in effect. At the end of each session the observer(s) delivered their data sheets to the trainer.

Integrity of the independent variable. Reliability checks on teacher behavior were conducted during 33% of the sessions equally often for both groups and equally distributed across the study. This provided data on the integrity of the independent variable (Peterson, Homer, & Wunderlich, 1982). For this purpose, videorecordings of the sessions were taken. These recordings were analyzed with respect to the following aspects of the teacher's behavior: (a) whether she correctly applied the response "No, now something else," verbally, and gestured, if the individual made the same gesture request three times in a row, (b) whether individuals' duration of access to the requested objects remained within limits unaltered across the experimental phases, and (c) whether she withheld reinforcing target gesture requests during treatment. Indices of the integrity of the independent variable for each of these teacher behaviors were calculated by dividing the number of times the teacher had correctly applied the procedure by the sum of times of the teacher's correct plus incorrect applications of the procedure and multiplying by 100. The median of the percentages of agreement for recording the teacher's use of the response "No, now something else" was 100% (range, 90% to 100%). Duration of individuals' access to the requested object remained unaltered across phases of baseline and treatment, $t(134) = 0.20$, $p = .84$. The teacher's withholding consequences for target requests during treatment was correctly administered in all cases.

Interobserver agreement. Reliability of recording was assessed by having a second observer record

simultaneously with a primary observer during 33% of the sessions. These sessions were equally distributed across the study. To ensure independence of recording, a divider was placed between the observers. As reliability would be inflated by observing the teacher giving the reinforcers for gestures (Harris & Ciminero, 1978), the second observer wrote the observed gesture label and the time of occurrence of the gesture on a small note which he or she then dropped in a box in the recording area of the primary observer. This action was facilitated by the teacher, who always inserted a 10-s interval between observing individuals' gesture requests and providing them with the requested object. Two measures were included to prevent observer drift (Kazdin, 1977). First, immediately preceding each session of reliability assessment, the two observers and the teacher discussed the true shape of the gestures. Second, the observers never received feedback on the reliability of their scoring.

Interobserver agreement was assessed on a gesture-by-gesture comparison for each session. A percentage of agreement for each session was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The median of the percentages of agreement for gesture requests was 80% (range, 66% to 92%). Because the distribution of percentages of agreement is skewed towards its upper limit, the median (Meigham, 1977) was chosen as the parameter to be estimated. A separate percentage of agreement between observers was computed for the number of different gesture requests for each session (irrespective of the frequency of their occurrence) and yielded a median of 100% (range, 80% to 100%).

Experimental Design

Data were collected in a combined multiple baseline across individuals and reversal design. Individuals had been randomly assigned to each of the six baseline lengths.

RESULTS

Figure 1 shows individuals' varied gesture requests (in terms of percentage of their vocabulary)

across the phases of baseline and treatment. During initial baseline sessions individuals' requests remained relatively stable. Sequential introduction of the treatment resulted in an increase in different gesture requests, with values ranging from 11 to 83 and an overall mean of 43% for the 6 individuals. Withdrawal of the treatment did not restore baseline responding; gesture variations remained at levels comparable to the previous phase, although differences between individuals can be noted. Reintroduction of the treatment led to further increases of gesture variations. Figure 2 provides information on individuals' specific gesture requests in each session. As can be seen, individuals varied only slightly in their gesture use across sessions, despite the fact that they had a relatively large vocabulary of gesture requests referring to objects and activities attractive to them.

DISCUSSION

The results of the present study suggest that the teacher's nonresponding to high-rate spontaneous gesture requests increased individuals' use of previously taught but unused gesture requests. Between the initial baseline and the final treatment phase, increases in use of different gesture requests were noted, ranging from 41% for Yashenka to 209% for Sjalida, with an overall mean of 84%. This study adds to the growing literature directed at developing an effective technology in the area of training communicative gestures to severely and profoundly mentally handicapped individuals, especially with respect to spontaneous use of gesture requests.

Differences between baseline and treatment phases may have been more substantial if the teacher had reinforced each spontaneous gesture request during baseline, instead of requiring the individuals to make dissimilar gesture requests after having made two similar ones in a row. Also, if consequences had been withheld for more than two or three high-rate gesture requests, differences between phases may have been greater.

One practical finding is that during the reversal conditions individuals' varied gesture requests remained relatively unchanged. This may suggest that

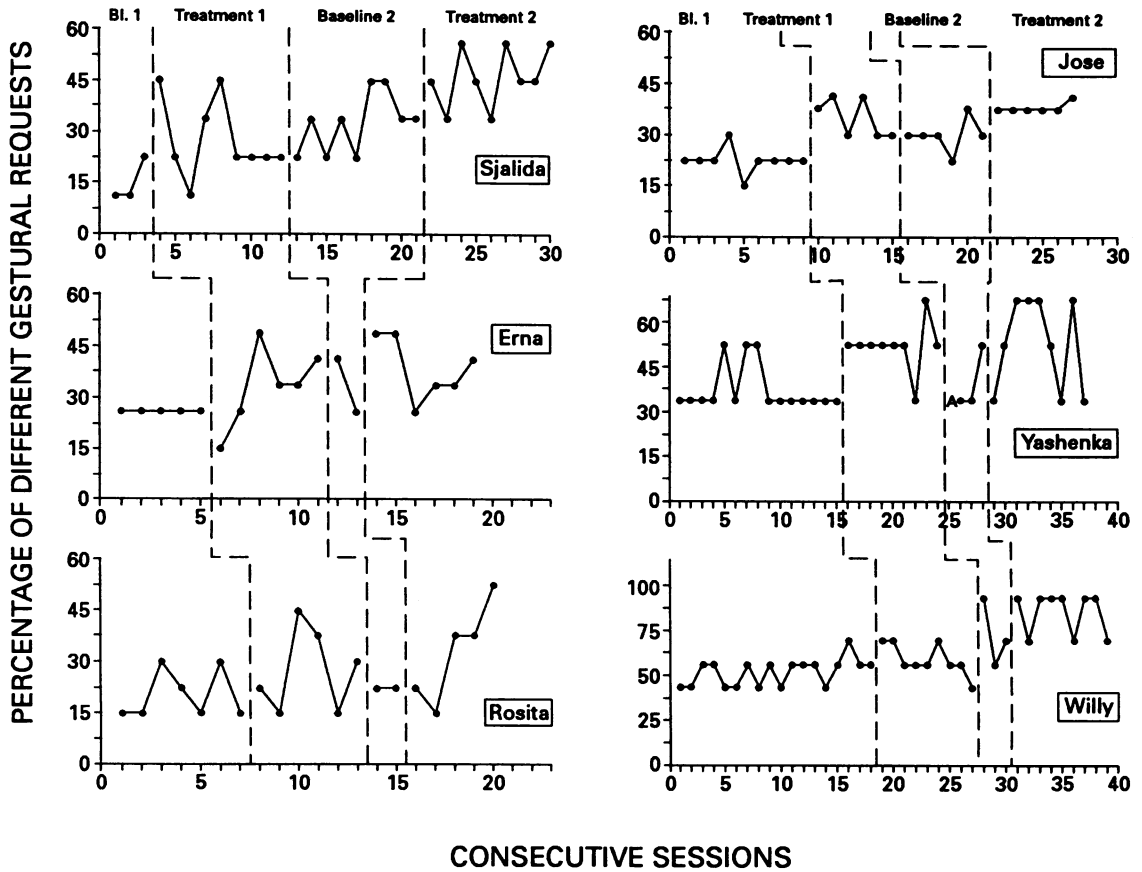


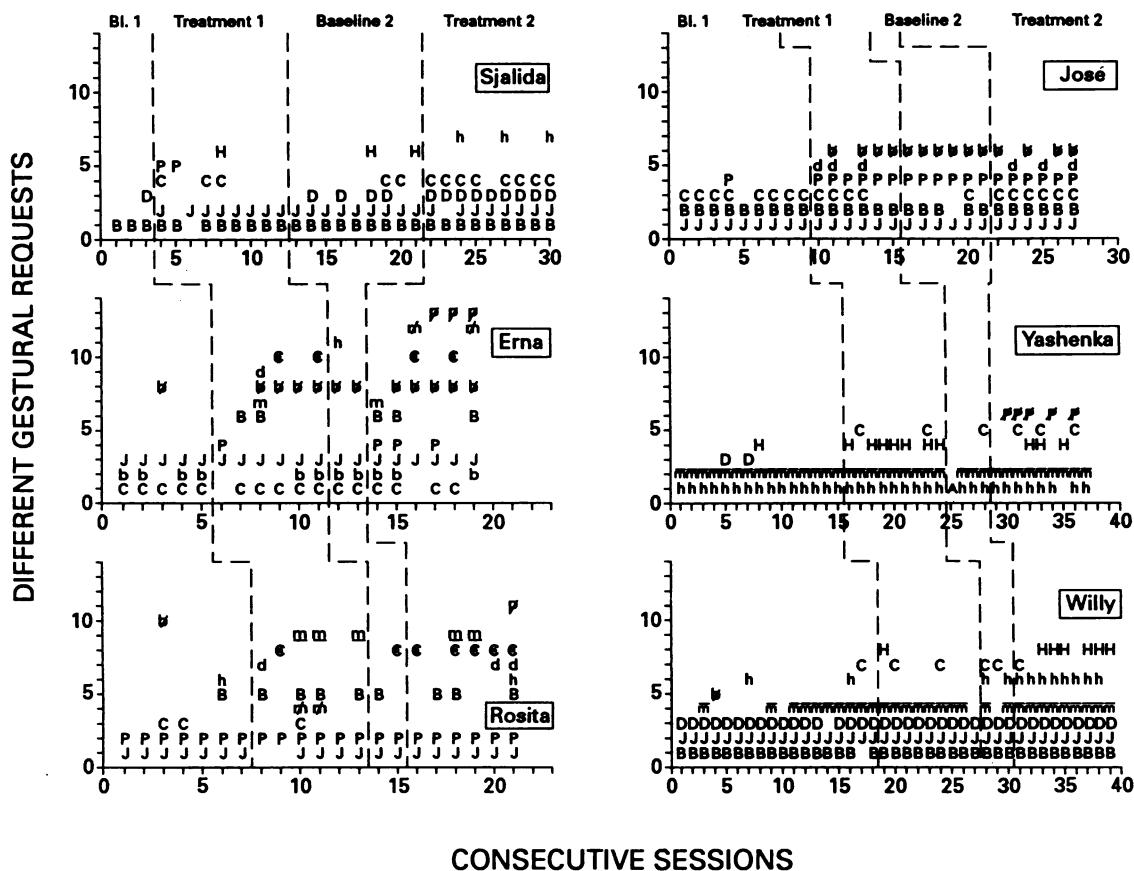
Figure 1. Percentage of different gestural requests for each subject during conditions of baseline and treatment. Note that there were two weekly sessions for Erna, Rosita, and Jose and three weekly sessions for Sjalida, Yashenka, and Willy. An "A" indicates that the subject was absent.

a short-term use of the present procedure has lasting effects for an individual's gestural vocabulary. As a result of this finding, the multiple baseline design was useful in demonstrating a functional relationship between the treatment and spontaneous gestures.

However, several shortcomings should be noted regarding the conclusions of this study. First, due to the requirement of having fixed lengths of phases, no stable initial baseline data were collected for Sjalida and Willy. Second, no data on generality of treatment effects across settings were collected. Third, it is unclear as to what degree the increases in gesture variability are clinically significant, in that they have resulted in individuals' increase of control of their social and physical environment.

Theoretically, the effect of the procedure may be interpreted in terms of making the response topography of the operants more variable. Because gesture requests can be considered to belong to the same response class, it is more probable that individuals emitted other gesture requests instead of emitting operants belonging to other response classes. However, the relevance of the present procedure may be limited if extinction evokes gesture requests unrelated to the individual's original request. For example, if the individual makes a request and is not given permission to go to the bathroom, the induction of a gesture request for eating a cookie can hardly be considered appropriate in extending one's vocabulary.

It may be argued that the individuals' increased



B = play with bricks	e = clay	h = play with a hummingtop	m = watch in a mirror
b = inflate a balloon	D = play with a doll	J = play with a jigsaw-puzzle	Ⓜ = listen to music
Ⓝ = string beads	Ⓕ = drum	M = play with a mouth-organ	P = play with a pegboard
c = close/open	d = draw	Ⓝ = read a magazine	Ⓟ = paste
	H = comb my hair		

Figure 2. Different gestural requests for each subject during conditions of baseline and treatment. Explanations of the symbols are given in the lower part of the graph. Note that there were two weekly sessions for Erna, Rosita, and Jose and three weekly sessions for Sjalida, Yashenka, and Willy. An "A" indicates that the subject was absent.

performance is at least partly due to peer influence. Although a multiple baseline design combined with a reversal seems to control this effect, results might be more readily interpreted if gesture requests had been assessed individually. Future research should assess the effectiveness of the procedure on spontaneous verbal requesting as the target behavior. Also, subject generality must be obtained with individuals of different ability levels.

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