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SENSORY EXTINCTION AND SENSORY REINFORCEMENT PRINCIPLES FOR PROGRAMMING MULTIPLE ADAPTIVE BEHAVIOR CHANGE

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The role of sensory reinforcement was examined in programming multiple treatment gains in self-stimulation and spontaneous play for developmentally disabled children. Two phases were planned. First, we attempted to identify reinforcers maintaining self-stimulation. Sensory Extinction procedures were implemented in which auditory, proprioceptive, or visual sensory consequences of self-stimulatory behavior were systematically removed and reintroduced in a reversal design. When self-stimulation was decreased or eliminated as a result of removing one of these sensory consequences, the functional sensory consequence was designated as a child's preferred sensory reinforcer. In Phase 2, we assessed whether children would play selectively with toys producing the preferred kind of sensory stimulation. The results showed the following. (1) Self-stimulatory behavior was found to be maintained by sensory reinforcement. When the sensory reinforcer was removed, self-stimulation extinguished. (2) The sensory reinforcers identified for self-stimulatory behavior also served as reinforcers for new, appropriate toy play. (3) The multiple treatment gains observed appeared to be relatively durable in the absence of external reinforcers for play or restraints on self-stimulation. These results illustrate one instance in which multiple behavior change may be programmed in a predictable, lawful fashion by using "natural communities of sensory reinforcement."

DESCRIPTORS: self-stimulatory behavior, sensory reinforcement, response generalization, sensory extinction, assessment using sensory extinction, autistic children

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Evaluating the effectiveness of a treatment program requires concern with the possible multiple effects of treatment. When the rate or frequency of a target behavior is manipulated, one may also observe coincident changes in certain other, nontargeted behaviors (e.g., Buell, Stoddard, Harris, & Baer, 1968; Lovaas & Simmons, 1969; Sajwaj, Twardosz, & Burke, 1972; Wahler, 1975; Wahler, Sperling, Thomas, & Tetter, 1970). In fact, both in theory and in practice it may be difficult to conceive of any intervention which does not affect multiple responses. Changes in nontargeted behaviors may be intended or unintended by the investigator, positive or detrimental (Wahler, 1975; Willems, 1974). Because the variables which influence the multiple effects of treatment are not well understood, when nontargeted behaviors have been changed, they have usually been reported as "side effects" of the treatment in question.

Research clarifying the variables which influence multiple behavior change appears to be particularly important in the applied arena. Generating maximal adaptive change for a given amount of treatment is essential for the treatment of severely disturbed populations, such as autistic children. Behavior therapy with autistic

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children, while bringing about significant improvements in social, self-care, and verbal repertoires, has been disappointing in its attempts to normalize their wide range of behavioral excesses and deficits (cf. Lovaas, Koegel, Simmons, & Long, 1973; Rincover & Koegel, 1977). Autistic children do not display single, isolated deficits or scattered absences of skills which can be remediated with a few applications of effective teaching. Rather, autistic children show extreme deficits in language, play, social, and intellectual functioning; they are often untestable on standardized intelligence and social maturity scales; and they frequently exhibit excessive inappropriate or harmful behaviors, such as self-stimulation, tantrums, and self-injurious behavior. Faced with such extensive behavioral deficits and excesses, it would seem of limited value to pursue one-behavior-at-a-time applications of behavioral principles. Alternatively, we may need to develop procedures which produce multiple behavior changes.

The present study examines the variables which influence one type of multiple behavior change, i.e., the apparent inverse relationship between self-stimulation (nonpurposeful, repetitive acts) and play in developmentally disabled children. Studies by Koegel, Firestone, Kramme, & Dunlap (1974) and Epstein, Doke, Sajwaj, Sorrell, & Rimmer (1974) each found that spontaneous appropriate play increased, despite the absence of external reinforcers, when stereotyped, repetitive mannerisms (e.g., handflapping, body rocking) were not permitted. Koegel et al. pointed out, however, that play disappeared and stereotypy returned to its base rate as soon as the restraints were removed.

More recently, a new treatment procedure was described for self-stimulation, which is based on the principle of *sensory extinction* (Rincover, 1978). Sensory extinction procedures were designed to eliminate self-stimulation by removing its auditory, visual, or proprioceptive sensory consequences. For example, a child who would initially spin or twirl objects on a table ceased to engage in that behavior when the auditory consequences were removed by carpeting the table. Similar results were found for other psychotic children, although different sensory extinction procedures were required for the different stereotypic topographies.

While the elimination of self-stimulatory behavior was a major goal of the sensory extinction procedure, it may also have implications for programming multiple adaptive behavior change. In particular, if sensory consequences are able to sustain so much self-stimulatory behavior, then perhaps they can also be used to teach and support appropriate behavior. Hence, the sensory extinction procedure may serve an assessment function. It may identify powerful reinforcers for a particular child, i.e., the sensory reinforcer(s) which maintained self-stimulation might then be used to establish new skills.

This study investigated the role of sensory reinforcement in programming response covariation between self-stimulation and play in four developmentally disabled children. Two experimental phases were planned. In the first, sensory extinction procedures were applied to the self-stimulation of each child in an attempt to identify preferred sensory reinforcer(s). In the second phase, different toys were made available, some providing the preferred sensory stimulation which has been identified and others offering nonpreferred kinds of sensory stimulation, in order to assess whether multiple behavior change may occur as a function of sensory reinforcement.

METHOD

Subjects

Four developmentally disabled children, two males and two females, participated in this experiment, each diagnosed as autistic (299.00, DSM III). These children were selected primarily on the basis of a high rate of self-stimulatory behavior and the absence of appropriate play, assessed by casual observation and verbal reports of others. Each child displayed little, if any, intelligible verbal behavior and minimal responsiveness to verbal questions or instructions. On the Leiter International Performance Scale and/or The Stanford-Binet Intelligence Scale, all three children achieved MA scores below the 3-year level. Some differences among the children, however, were notable. Larry, age 8, was primarily echolalic but showed a good deal of social behavior and several context-related words and phrases, such as providing his name when asked and verbally identifying some objects (particularly edibles) and people (his therapist) on command and sometimes spontaneously. On this basis, we considered Larry the highest functioning of the four children. Reggie, age 9, was severely visually impaired, though not totally blind. He, too, was essentially echolalic, with few context related words. Reggie did respond to some social stimuli (e.g., hugging, crawling toward a voice) and had acquired minimal receptive language skills (e.g., "Come here," tactile discriminations of objects). Karen, age 10, was mute, evidencing only a limited set of vowel sounds. She was responsive to some social events, however, as she responded in kind to hugs and enjoyed being caressed. She also had some receptive language skills; she would sit, stand, walk, or "come here" on command and could discriminate several classroom objects (e.g., crayon, pegboard). Janet, age 8, was considered the lowest functioning of the four children. She was mute and had no social behavior and no apparent receptive language skills.

Setting

All sessions were conducted in a 2.74- by 3.66-m classroom, containing a .76-m- high horseshoe-shaped table at its center. A child was seated at the table for the duration of each 15-min session. The room was bare except for the experimental stimuli. Adjacent to the experimental room was a 1.52- by 2.74-m observation room. These rooms were connected by a .61- by .91-m one-way mirror in the center of their common wall. At the beginning of each session, an undergraduate psychology student brought the child into the classroom, sat him at the table, and then moved to a corner of the room to record self-stimulation and play. Sessions were conducted once per day, usually 4 days per week, for 6 to 10 weeks.

Procedure

Each child participated in two phases of this experiment. In the first phase, we attempted to identify possible sensory reinforcers for each child by applying sensory extinction procedures to his/her self-stimulation. In the second phase, we examined whether appropriate play could be programmed and maintained, without external reinforcers, by using toys which provided the sensory reinforcer identified.

Selection of sensory consequences to be tested. We casually observed each child for 2 days and consulted with teachers in an attempt to identify sensory consequences that might be reinforcing their self-stimulatory behavior. We found that Larry incessantly flapped his hands, apparently producing a great deal of proprioceptive stimulation. He usually held his arms out to his sides, with his fingers, wrists, and arms in constant motion. For Larry, proprioceptive feedback was targeted for testing as his preferred sensory reinforcer. Reggie persistently twirled objects, such as a plate, on a hard surface. When he twirled an object, however, he also leaned toward it, seeming to listen to the object as it was spinning. This suggested that auditory feedback may have been an important consequence of Reggie's self-stimulation and was, therefore, targeted for testing as his preferred sensory reinforcer. Karen incessantly picked feather, lint, or a small string from her own or others' clothing. She then threw it in the air and waved her hands vigorously below it, apparently trying to keep it afloat. If the object fell to the ground, she immediately picked another and repeated the sequence. This suggested that the visual consequences may have reinforced the hand movements, and were therefore targeted for testing. Janet's self-stimulation consisted of finger flapping. She held her hands up before her eyes and rotated her fingers and wrists back and forth in a stereotyped, repetitive manner. For Janet, two sensory consequences were identified for testing, both the visual and the proprioceptive stimulation of her finger manipulations.

On this basis, we constructed three types of sensory extinction procedures for the children in this study: one to eliminate the proprioceptive feedback from finger (Janet) and arm (Larry) movements; a second to remove the auditory stimulation from Reggie's plate spinning; and a third to remove the visual stimulation from finger (Janet) and hand (Karen) movements. No attempt was made in this study to assess the effects of the sensory extinction procedures for each modality with every child because previous research (Rincover, 1978) has shown that decrements in self-stimulation are due to the removal of a particular sensory consequence rather than to sensory deprivation or stimulus change per se.

Phase 1: Sensory extinction procedures. During sensory extinction sessions, we attempted to eliminate a particular sensory consequence of a given self-stimulatory behavior. Three sensory extinction procedures were designed, corresponding to the three types of sensory feedback identified for testing. The first sensory extinction procedure was designed to mask the proprioceptive stimulation from Janet's and Larry's finger and arm movements. For this purpose, a small vibratory mechanism was taped to the back of a child's hand, generating a low intensity, high frequency pulsation. The vibrator (Pollenex Model No. 123927 ND) was cylindrical in shape, approximately .03 m in diameter and .08 m long, and was driven by two small (size "D") batteries. Importantly, this mechanism did not physically restrict self-stimulation. In the second procedure, carpeting was installed atop the table in the classroom in order to eliminate the auditory feedback from Reggie's plate spinning. The carpet was ¼-in. thick, and completely covered the surface of the table. The surface of the carpet was hard and flat so as not to restrict the plate from spinning, and four naive observers all reported that no sound was audible from spinning the plate on the carpeted table. The final sensory extinction procedure involved removing the visual consequences of Janet's and Karen's finger and hand manipulations. For Janet, a blindfold was introduced, consisting of a handkerchief folded once and placed snugly over the child's eyes and tied behind her head. For Karen, the overhead lights (two 40-W fluorescent tubes) were simply turned off at predetermined times. While the room remained sufficiently well lit (from sunlight) for most activities, four observers found it virtually impossible to follow visually a floating feather or string with the lights out.

A within-subject reversal design was used for each child in Phase 1, where baseline and sensory extinction conditions were alternated in an A-B-A-B format. A multiple baseline design was also used across subjects. After sensory reinforcers were identified for each child, via the sensory extinction procedure, children participated in a second phase to investigate the role of sensory reinforcement in programming multiple behavior change.

Phase 2: Assessment of response generalization. To assess the role of sensory reinforcement in programming multiple behavior change, sessions were conducted to determine whether each child would selectively play with the toy which produced the sensory reinforcer previously identified. The following three toys, selected so as to approximate the types of sensory stimulation identified in Phase 1, were used for each child: (a) a music box that could be operated by the child to obtain a variety of auditory stimuli; (b) interlacing building blocks, providing proprioceptive stimulation, that could be fitted together to construct various objects; and (c) beads and string, also providing proprioceptive stimulation, that could be threaded together to make different designs. For Karen, however, a children's bubble-blowing kit was used in place of the music box to approximate the type of (visual) sensory stimulation resulting from floating feathers and string. Floating bubbles could be produced by simply dipping the ring portion of a ring-on-a-stick into the bottle containing the solution, then blowing through the ring to make the bubbles.

Initially, baseline sessions were conducted to assess whether children would play with the toy(s) or engage in self-stimulation. On the table and within arm's reach were the three toys. After baseline sessions, using edible reinforcers and prompt fading, each child was then taught how to play with each toy—first the blocks, then the music box, and finally the beads. Karen, however, received training first on the music box, then on the bubbles. The effective sensory extinction procedure for a given child was employed during toy-play training in order to minimize self-stimulation. For each toy, a child was physically prompted through the topography of the correct response, and the physical guidance was gradually faded over trials. A child was rewarded with edibles on a continuous reinforcement schedule throughout training. Training sessions, lasting 30 min, were conducted twice each day, 5 days per week, and continued until criterion performance was reached; that is, the first occasion of spontaneous (i.e., no prompts) appropriate play with the toy. Every child met criterion on each toy in 1 week (10 sessions) or less.

After training, the toys were reintroduced on the table, and the rates of self-stimulation and play with each toy were again recorded. It is important to note that during the experimental conditions of Phase 2 (baseline and posttraining sessions), there were no sensory extinction procedures in use and no external reinforcers for play.

Follow-up. At various intervals ranging from 1 month to 13 months after the completion of Phase 2, at least two follow-up sessions were conducted for each child to assess whether treatment gains had been maintained. For this purpose, the posttreatment (no intervention) condition was reinstated, and the rates of toy play and self-stimulation were monitored.

Recording and Reliabiliy

Self-stimulatory behavior was defined individually for each child: hand and arm manipulation for Larry, plate spinning for Reggie, finger flapping for Janet, and hand flapping for Karen. Play was defined individually for each toy: Appropriate play with the blocks was recorded if at least one new block was placed adjacent to or over another; bead play was recorded if at least one new bead was threaded on the string; play with the music box was recorded if any music was heard by the observer. A time-sampling recording procedure was used in which an observer alternately watched the child for 5 sec then recorded for 10 sec, resulting in a total of 60 observation intervals per 15-min session. If self-stimulation or play was noted at anytime during a 5-sec observation interval, the observer checked the appropriate box on a precoded data sheet. Play was recorded separately for each toy. After each session, occurrences were totaled, divided by 60, and multiplied by 100 in order to calculate the percentages of self-stimulation and play for that session.

The reliability of recording was assessed in the following manner. Two observers independently recorded self-stimulation and toy play, with one observer in the classroom and the other seated in the adjoining observation room. The latter observer was experimentally naive. Finger movements by one of the observers were used to signal the beginning (thumb up) and end (thumb down) of each 5-sec observation interval. Each observer recorded the presence or absence of self-stimulation and play with each toy (in Phase 2) during each of the 60 observations. A total of 27 reliability sessions were conducted with at least one reliability measure in each condition of this experiment. Reliability was calculated for each session by dividing the total number of agreements by 60, then multiplying by 100. The average reliability for recording self-stimulation was 89% (range: 71% to 100%). Measured separately for occurrences and nonoccurrences, reliability averaged 93% and 87%, respectively. Reliability for toy play (averaged across toys) was high, averaging 97%, and presented minimal variability (range: 91% to 100%).

RESULTS

Reggie

Reggie's data are presented in Figure 1. In the first phase, Sessions 1 through 21, it is apparent that self-stimulation was eliminated when its auditory consequences were removed. During the initial baseline, Reggie maintained a variable but generally high rate of self-stimulation over 11 sessions. In contrast, when auditory sensory feedback was then removed, self-stimulation immediately ceased, and was absent for three consecutive sessions. Subsequent replications of baseline and sensory extinction conditions are shown, in a reversal design, which further implicate the role of auditory reinforcement in the maintenance of Reggie's self-stimulation.

These data suggested that Reggie's self-stimulation was maintained by auditory stimulation and that his self-stimulatory behavior could be extinguished by removing that auditory feedback. In addition, however, the data suggest that auditory stimuli are durable reinforcers for this child because they were capable of sustaining so much self-stimulatory behavior. Therefore, in the second phase, we set out to see if such auditory reinforcers could be used to maintain appropriate behavior.

The results of Phase 2, the assessment of multiple behavior change, are shown in Sessions 22 through 40. During the pretreatment condition, self-stimulation was high, and appropriate play was nonexistent. Subsequently, after training with the toys, self-stimulation decreased to near zero for 17 consecutive sessions. In addition, Reggie consistently played with the music box, and only the music box, during posttreatment sessions. Playing with the music averaged 81%, ranging from 57% to 100% while, at the same time, bead and toy play was at 0%. It is notable that an autoharp replaced the music box is Session 32, at which point auditory play immediately increased to 100% and remained there for the remaining sessions during which self-stimulation and play with other toys was virtually absent. It is noteworthy that, without external reinforcers, both the increase in play and the reduction in self-stimulation were maintained over a number of sessions. Further, follow-up probes conducted after 6 and 13 months, revealed that both the increase in play and the suppression of self-stimulation were maintained with no further intervention.

Larry

The data for Larry, presented in Figure 2, show similar results. First, the results of the sensory extinction phase suggest that Larry's self-stimulation was maintained by its proprioceptive consequences. During baseline, stereotyped finger and arm movements occurred 99% of the time, on the average. Then, when the proprioceptive feedback was masked, self-stimulation was immediately reduced to zero. Within-subject controls showed that the effect of the sensory extinction procedure was reversible and replicable.

Having identified proprioceptive stimulation as a potent reinforcer, we examined in the second phase whether this reinforcer would maintain appropriate play behavior. During the pretreatment baseline, Larry engaged in a great deal of self-stimulation but no play. After learning to play with the toys, however, significant changes were observed. First, Larry consistently played with the toys providing proprioceptive stimulation (blocks and beads), averaging 77%, and did not play with the toy lacking in proprioceptive feedback (music box). Also, self-stimulation was maintained at a very low rate, averaging 18% across 7 sessions. Finally, it is notable that, with no external reinforcers for play and no direct intervention for self-stimulation, the treatment gains were maintained over a 6-month follow-up period.

Karen

Karen's data, presented in Figure 3, further support the role of sensory reinforcement in programming multiple behavior change. Phase 1 revealed that her self-stimulatory behavior was maintained by its visual consequences, as it de-

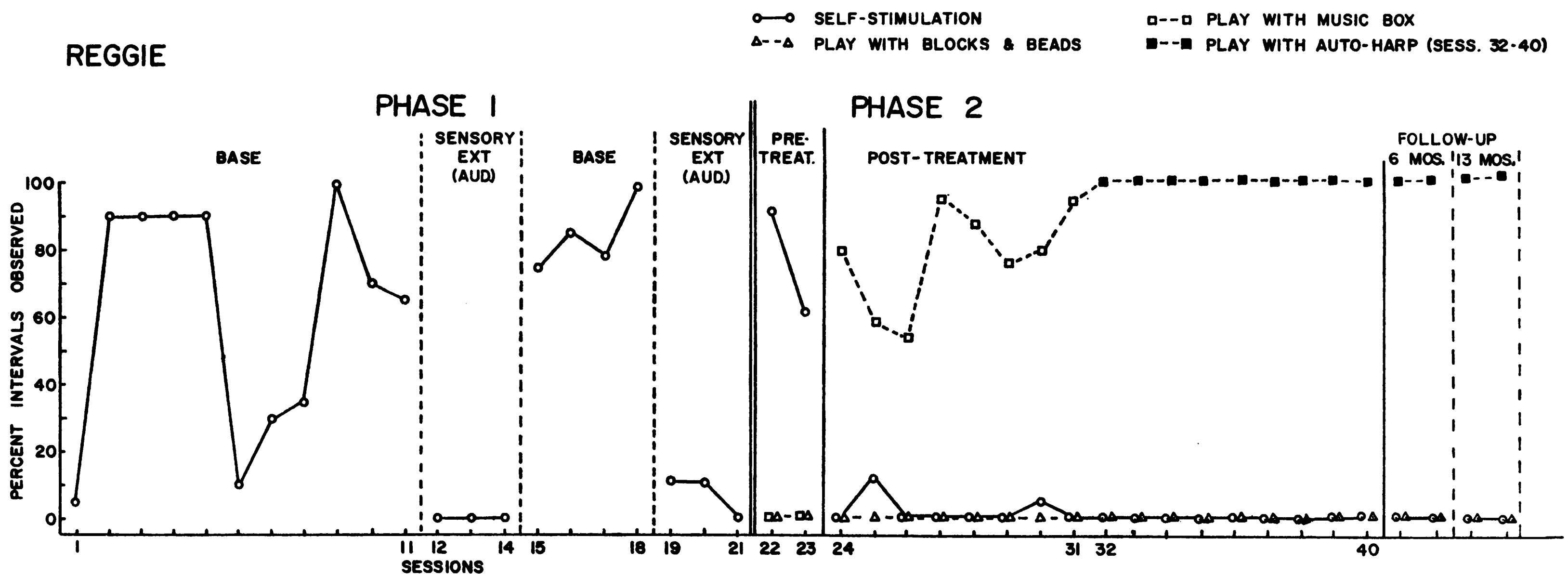

Fig. 1. Phase 1 shows the effect of sensory extinction on Reggie's self-stimulatory behavior. The "Sensory Extinction Auditory" condition presents the percentage of self-stimulation observed during each session in which the auditory consequences were removed. Phase 2 shows the percentage of self-stimulation, play with the auditory toy (music box), and play with the proprioceptive toys (beads and blocks) before ("Pretreatment") and after ("Posttreatment") Reggie was taught to play with each of the toys.

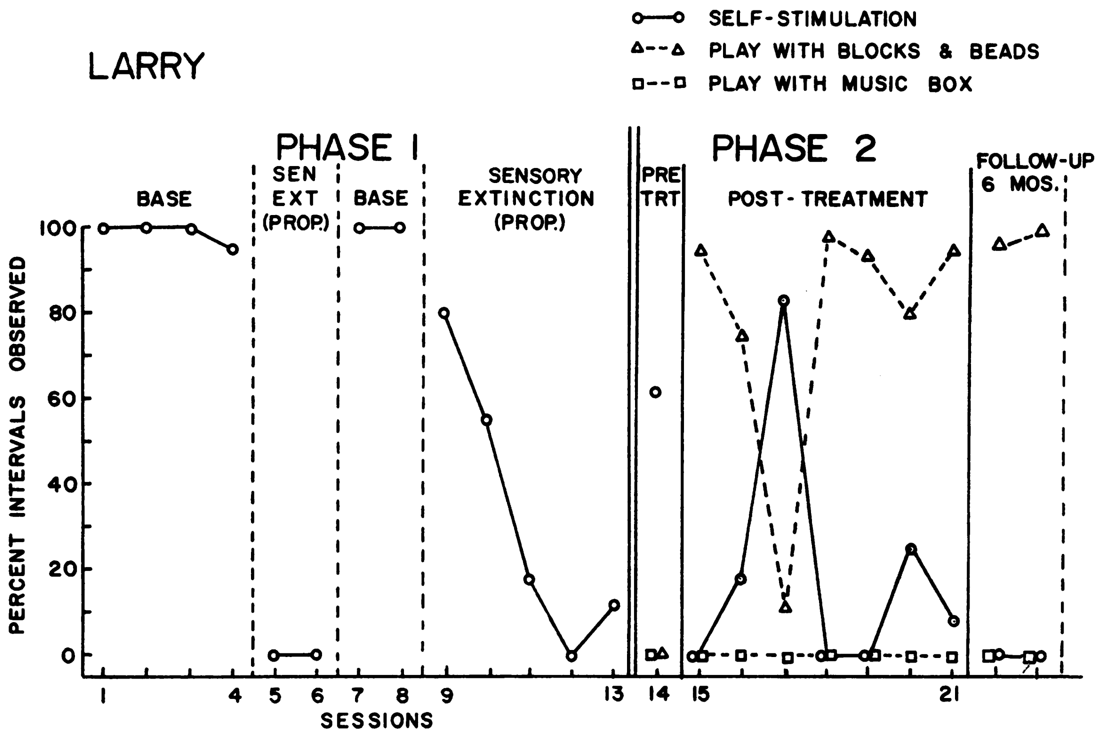

Fig. 2. Phase 1 shows the effect of sensory extinction on Larry's self-stimulatory behavior. The "Sensory Extinction Proprioceptive" condition presents the percentage of self-stimulation observed during each session in which the proprioceptive consequences were masked. Phase 2 shows the percentage of self-stimulation, play with the auditory toy (music box), and play with the proprioceptive toys (beads and blocks) before ("Pretreatment") and after ("Posttreatment") Larry was taught to play with each of the toys.

creased from a mean base rate of 68% to near zero whenever the visual sensory feedback was eliminated. In Phase 2, after learning to play with the toys, Karen played exclusively and at a high rate with the bubbles and virtually ignored the other toys. In addition, self-stimulation remained near zero during this posttreatment condition. Importantly these gains were maintained over a 1-month follow-up period.

Janet

Janet's data are presented in Figure 4. The results of Phase 1 are similar to those of Karen, Reggie, and Larry, showing that sensory reinforcers were maintaining self-stimulation. Janet's data are notable, however, in that her self-stimulatory behavior was apparently maintained by multiple sensory events. When visual feedback was removed, hand flapping initially decreased, from an average of 93% to 17%, but then rose to an average of 80% over the next four sessions. When proprioceptive consequences were prevented for the first time, self-stimulation decreased only a bit, to an average of 77%. When both the visual and the proprioceptive consequences were removed, hand flapping decreased to a mean of 34%, a greater decrement than that produced by either sensory extinction condition alone.

While the decrement observed for Janet was not as substantial as that found for the other three children, the data suggest that proprioceptive and visual feedback were reinforcing her self-stimulation. Consequently, the second phase was conducted to see if she would play selectively with the beads and blocks. The pretreatment baseline revealed 100% self-stimulation

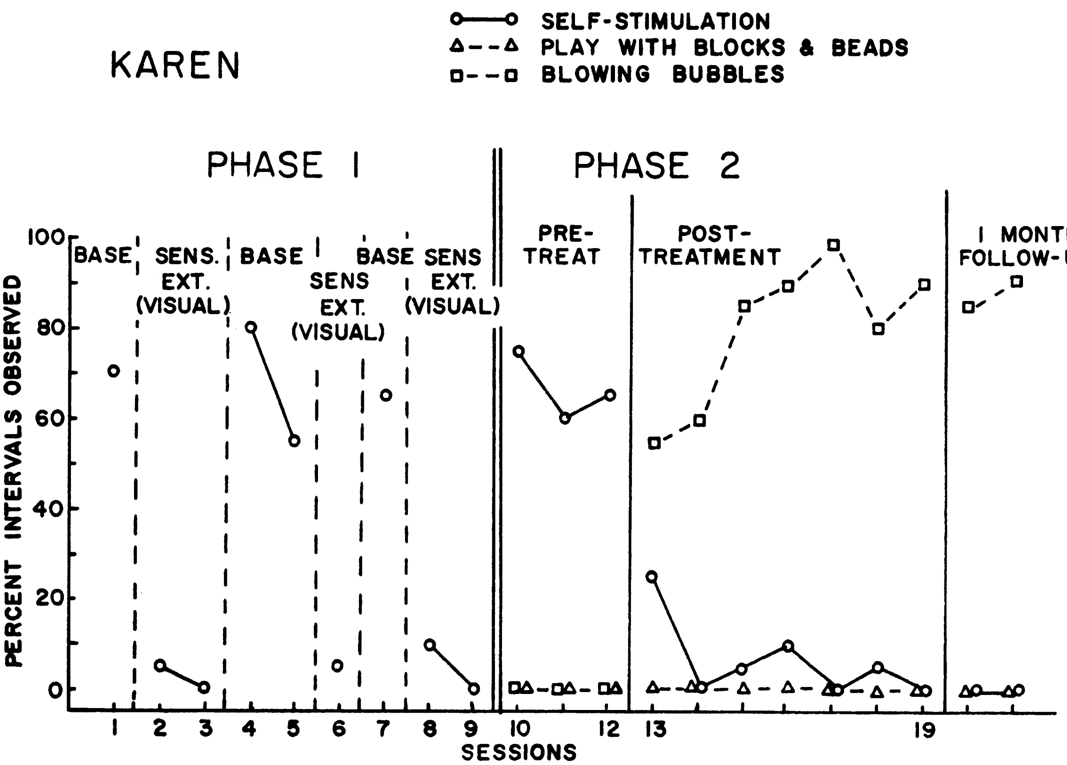

Fig. 3. Phase 1 shows the effect of "Visual Sensory Extinction" on Karen's self-stimulatory behavior. Phase 2 shows the percentage of self-stimulation, play with the visual toy (bubbles), and play with the proprioceptive toys (beads and blocks) before ("Pretreatment") and after ("Posttreatment") she was taught to play with each of the three toys.

and zero play. After training, self-stimulation initially decreased to 53%, then gradually rose to 79%. At the same time, some appropriate play was observed. Importantly, Janet played only with the beads and blocks and not at all with the music box.

In short, these data suggest, first, that Janet's self-stimulation was maintained by its sensory consequences, although this remains somewhat tentative as they were not all identified. Second, the data from Phase 2 partially support a relationship between sensory reinforcement and response covariation in the respect that she selectively played with the toys producing the reinforcers identified in Phase 1, and an inverse relationship was found between self-stimulation and play. Clinically speaking, however, Janet's data are disappointing in that self-stimulation clearly rose and play decreased: The treatment gains were not as durable as those found for the other three children.

DISCUSSION

The results of this study suggest that multiple adaptive behavior change in self-stimulation and appropriate play can be programmed on the basis of sensory reinforcement. First, for each child, self-stimulatory behavior was found to be maintained by sensory reinforcement. When the sensory reinforcer(s) was removed, self-stimulatory behavior extinguished. Second, the sensory reinforcers identified for self-stimulatory behavior also served as reinforcers for new, appropriate toy play. Finally, the behavior gains observed appeared to be relatively durable over a period of several months with no external reinforcers for play or restraints on self-stimulation.

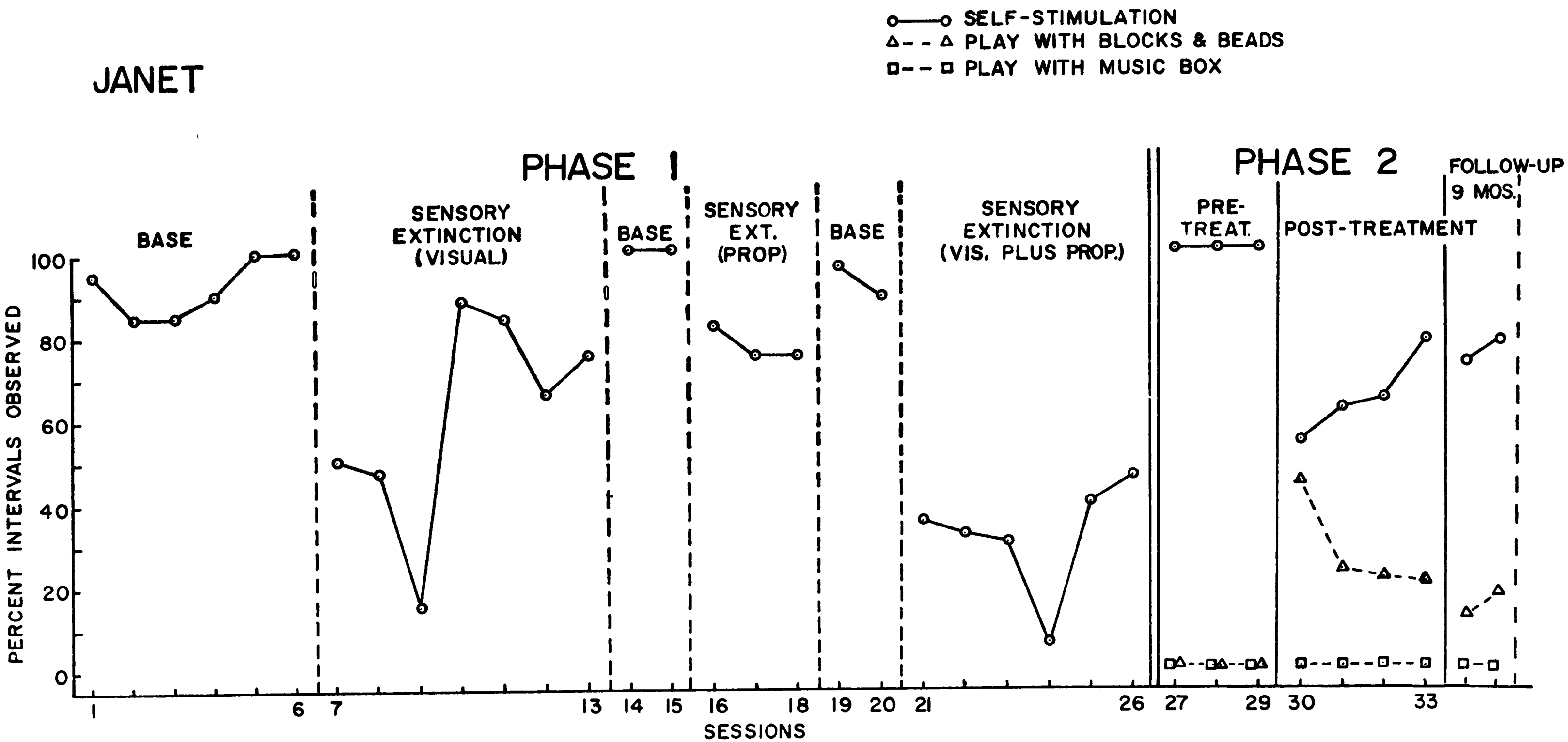

Fig. 4. Phase 1 shows the effect of sensory extinction on Janet's self-stimulatory behavior. The "Sensory Extinction Visual" condition denotes that the visual feedback from self-stimulation was not permitted; the "Sensory Extinction Proprioceptive" condition signifies that its proprioceptive consequences were masked; and in the "Sensory Extinction Visual plus Proprioceptive" condition both consequences were removed simultaneously. Phase 2 shows the percentage of self-stimulation, play with the auditory toy (music box), and play with the proprioceptive toys (beads plus blocks) before ("Pretreatment") and after ("Posttreatment") she was taught to play with each of the toys.

The durability of treatment gains in this study seems particularly noteworthy. We suspect that the sensory stimulation produced by the toys was more reinforcing than that produced by self-stimulation, and this in several ways may have contributed to the maintenance observed. First, in other settings, children sampled and played with a variety of toys which produced the preferred type of sensory stimulation. Further, Reggie and Larry spontaneously engaged in new verbal and social behaviors to solicit such stimulation. Reggie, for example, began very soon after treatment to vocalize toy-related words and phrases as well as to seek out people and gesture for toys and other objects. In short, new verbal, social, and play behaviors were developed which apparently replaced self-stimulation.

Several limitations should, however, be imposed on these results. First, the gains observed for one child, Janet, were less dramatic than those obtained for the other three children. Such cases may have multiple sensory determinants, thereby requiring a more elaborate sensory extinction procedure. Alternatively, some instances of self-stimulation may be otherwise determined (Forehand & Baumeister, 1971; Ritvo, Ornitz, & LaFranchi, 1968; Sroufe, Steucher, & Stutzer, 1973) and not amenable to sensory extinction. Second, it is notable that the data for the effective sensory extinction conditions did not always approximate an extinction curve. The introduction of treatment often produced immediate and dramatic reductions in responding, a result which may suggest that in some instances stimulus control was also at work. It is clear, however, that such stimulus control, if operating, was reliably established and extinguished in this study as a function of the presence versus absence of sensory reinforcers. Finally, in the present study, naive observers were exposed to each sensory extinction procedure in an attempt to determine whether the intervention did in fact mask or remove the sensory consequences targeted. It would of course be more informative to have an independent assessment which directly measures the degree of masking. Additional research addressing these and other issues is needed to clarify both the generality of sensory extinction and its functional components.

A sensory reinforcement view of self-stimulation and play has several interesting implications for treatment. First, these results support previous research (Rincover, 1978) showing that sensory extinction can be an effective treatment for self-stimulation. Because sensory extinction requires virtually no staff training or child surveillance, because the effects are immediate, and because no serious ethical concerns have yet been raised by parents or staff, it may be a relatively convenient procedure when compared to punishment via shock or slaps (Bucher & Lovaas, 1967), overcorrection (Azrin, Kaplan, & Foxx, 1973; Epstein et al., 1974; Foxx & Azrin, 1973), or differential reinforcement of alternative behavior (Mulhern & Baumeister, 1969; Repp, Dietz, & Spier, 1974).

A second implication of these data is that appropriate play can apparently be maintained without using external reinforcers. The prevalence of play is in many quarters considered to be an important prognostic indicator, often predicting children's future progress and placement (Brown, 1960). Previous work has, therefore, attempted to teach appropriate play, typically by providing experimental reinforcers, such as edibles and praise, contingent on play (Hamblin, Buckholdt, Ferritor, Kozloff, and Blackwell, 1971; Lovaas, Freitas, Nelson, & Whalen, 1967). The generalization and maintenance of treatment gains, however, have often been difficult to obtain (Epstein et al., 1974; Koegel et al., 1974; Koegel & Rincover, 1977; Lovaas et al., 1973; Rincover & Koegel, 1975). One approach to programming maintenance, discussed by Baer & Wolf (1970) and Ferster (1967), is to teach behaviors which lead to "natural communities of reinforcement." The present study used such "natural" reinforcers and found that the behavior change was relatively durable. However, while Baer & Wolf were primarily speaking of social reinforcement from peers and others, the present study extends the natural community of reinforcement to include the sensory environment.

Third, and foremost, the data illustrate one instance in which multiple behavior changes can be programmed in a predictable, lawful fashion. In this experiment, we were able to increase appropriate play and decrease self-stimulation simultaneously by first identifying potent sensory reinforcers for each child and then making accessible certain toys which provide those sensory stimuli. The children chose to play and not engage in self-stimulation, presumably because the toys provided a richer source of the preferred sensory feedback. Previous research has also reported that play may become prominent when self-stimulatory behavior is suppressed. This has been referred to as a "side effect" of treatment, presumably because no external reinforcers for play were evident and the variables underlying its rise to prominence were not clear. The present results suggest that this relationship may be explained by readily available principles of operant conditioning, in this case "sensory reinforcement" (Fowler, 1971; Kish, 1966; Rincover, Newsom, Lovaas, & Koegel, 1977). Perhaps, then, there are no such phenomena as "side effects," but only "effects." Our task, then, would be to measure multiple behavior changes for each intervention and investigate the variables which control and predict them.

Despite our current capabilities in treating many autistic behaviors, we apparently need to investigate more efficient procedures which produce multiple or widespread changes in behavior in order to increase the socialization of developmentally disabled children. The present data are viewed as encouraging in that two clinically relevant target behaviors—self-stimulation and toy play—were changed simultaneously, although experimental contingencies were applied only to toy play. Further, these gains were maintained by their natural communities of sensory reinforcement when the experimental contingency was removed. These results suggest that investigations of multiple behavior change may be a profitable direction of future research inasmuch as new discoveries may facilitate the design of more efficient and productive educational programs.

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