8-1994

The Effects of Sensory Integrative Therapy and Functional Communication Training on Stereotypic Behavior

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THE EFFECTS OF SENSORY INTEGRATIVE THERAPY AND FUNCTIONAL COMMUNICATION TRAINING ON STEREOTYPIC BEHAVIOR

by

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A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
August 1994

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Western Michigan University, 1994

Three developmentally delayed individuals who exhibited self-stimulatory behaviors were exposed to sensory-integrative therapy. Prior to treatment, a Motivation Assessment Scale was completed and a functional analysis baseline was conducted to identify the maintaining variables of the self-stimulatory behavior. Each subject displayed a pattern of responding suggesting that stereotypic behaviors were maintained by automatic reinforcement. Results show that sensory-integrative therapy had no effect on self-stimulatory behaviors. The stereotypic behaviors of Subject 1 and Subject 2 were later reduced when functional communication plus response interruption was applied. The self-stimulatory behavior of Subject 3 was not affected by the implementation of functional communication procedures.

ACKNOWLEDGMENTS

It is impossible to acknowledge the many people who contributed to the fulfillment of my goal. The following are just a few who played a significant part in the completion of this thesis. First, to the members of my committee, Dick Malott, Al Poling and Wayne Fuqua, I extend my sincere appreciation for their guidance and support, and more importantly for "not giving up on me."

Second, to Amy and A.J. Starzynski who continually provided support and encouragement, I owe a debt of gratitude. I thank Heidi Olson who willingly shared frustrating times and never relented in her counsel to persist.

Finally, I dedicate this thesis to the memory of a factory worker, a philosopher, a dreamer, and a teacher, my father, Anthony J. Starzynski.

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INTRODUCTION

Stereotypic behavior is a common form of maladaptive behavior displayed by severely mentally handicapped individuals (LaGrow & Repp, 1984). It is often defined as repetitious body movement without apparent adaptive effects, typically in the form of body rocking, mouthing, or complex hand and finger movements (LaGrow & Repp, 1984). Stereotypic behavior has been reported in approximately two-thirds of observed institutionalized severely mentally retarded persons (Berkson & Davenport, 1962; Kaufman & Levitt, 1965). Repp and Barton (1980) found that institutionalized persons exhibited some form of stereotypy during 7% to 47% of the time they were observed. Similar results were obtained with community-based mentally handicapped individuals who were observed to engage in stereotypy during approximately 13% of the observations (Repp, Barton, & Gottlieb, 1983).

Research to understand, prevent and manage stereotypic behavior is important because high levels of many topographies of stereotypic behavior lessens the opportunity for mentally handicapped individuals to learn from the environment. Such impediments to learning may also interfere with adaptive responding, development of social skills, and successful integration into community settings (Berkson & Mason, 1964; Koegel & Covert, 1972; Varni, Lovaas, Koegel, & Everett, 1979).

To date, most of the effective interventions for stereotypic behavior have been based on operant conditioning principles (Baumiester, 1978; Schroeder, Schroeder, Rozahn, & Mulick, 1980; LaGrow & Repp, 1984). A variety of nonaversive interventions have been used with stereotypy, including differential reinforcement of other behavior (Repp, Deitz, & Deitz, 1976) and differential reinforcement of incompatible behavior (Favell, 1973). These procedures have been generally effective

in reducing the stereotyped behavior of developmentally disabled persons (LaGrow & Repp, 1984).

Recently, a behavioral intervention known as "functional communication training" (Carr & Durand, 1985; Durand & Carr, 1987) has been reported to rapidly reduce problem behavior, including stereotypy, to zero or near zero levels (Durand & Carr, 1987; Wacker, Steege, Northup, Sasso, Berg, Reimers, Cooper, Cigrand, & Donn, 1990). Functional communication interventions require the identification of the "function" of the problem behavior, be it escape or avoidance of aversive situations, or some form of direct positive reinforcement (e.g., attention, sensory stimulation). Then an alternative response with an acceptable topography (a "communication" response) is trained to allow the person to "request" the motivational stimuli that were maintaining the problem behavior. The intervention has many similarities to a differential reinforcement of alternative behavior procedure although the person controls access to reinforcement via emission of the "communication" response and the reinforcement is programmed on a continuous reinforcement schedule with a minimum of delay between response and reinforcement (Carr & Durand, 1985; Carr, 1988).

An alternative conceptual model for the development and treatment of stereotypic behavior emphasizes neurological and developmental variables rather than environmental variables and reinforcement contingencies. Proposed by Ayers (1972, 1974) and Norton (1975), sensory-integration theory emphasizes central nervous system dysfunction as the underlying cause for a variety of developmental problems. Sensory integration theory postulates that vestibular, proprioceptive and tactile stimulation (e.g., massage, rubbing parts of the body with different types of materials) will enhance central nervous system functioning and thereby improve adaptive behaviors and cognitive abilities. According to this theory, the neural reorganization

that takes place should be enduring and not capable of reversal (Arendt, MacLean, & Baumiester, 1988).

Although explicit descriptions of the therapy techniques are difficult to locate (Mason & Iwata, 1990), sensory-integrative therapy relies on the delivery of non-contingent multisensory stimulation through a variety of techniques that can vary across studies (Bright, Bittick, & Fleeman, 1981; Dura, Mulick & Hammer, 1988; Lemke, 1974; Wells & Smith, 1983). Initially proposed for use with learning disabled children (Ayers, 1979; Hinojasa, Anderson, Goldstein & Becker-Lewin, 1982), sensory-integrative therapy has become an accepted method of treatment used by occupational therapists with with mentally retarded clients. In a survey of 625 facilities serving retarded infants and children, Pothier and Cheek (1984) found that approximately one quarter of all sensorimotor programs included sensory-integration. Arendt et al. (1988) cite two reasons for its continued use: (1) occupational therapists are convinced that sensory-integration is an effective treatment for individuals with learning disorders and therefore assume it would be equally effective for retarded persons who also have a number of learning difficulties, and (2) an abundant literature has developed claiming that stereotypic and self-injurious behavior decreases following the application of multiple forms of physiological stimulation.

Early attempts to experimentally validate the effects of sensory integration therapy with a self-injurious subject have been plagued by a number of serious methodology problems as noted by Arendt et al. (1988). For example, three case studies claiming successful results (Bright et al., 1981; Lemke,1974; Norton, 1975) were flawed by the absence of baseline data or excessive variability in the baseline data, changes in subjects' routine, and observer bias. Two studies using a single case experimental design (Sandler & Coren, 1980; Wells & Smith, 1983) lacked adequate inter-observer

agreement data thus calling into question the accuracy of the observational data. Some researchers have reported transient effects of sensory integration therapy (i.e., Wells & Smith, 1983), observations that are incompatible with sensory-integrative theory which states that neural reorganization should be enduring and not capable of reversal.

Another common methodological problem is the confounding of physiological stimulation that characterizes sensory integration therapy with noncontingent social stimulation. Thus raising questions about which variable might be responsible for any observed behavior changes. In one of the better controlled studies, Dura, Mulick, and Hammer (1988) compared the effects of therapist attention plus vestibular stimulation (subject swinging back and forth while seated on a therapist's lap) with a control condition in which a therapist provided attention without vestibular stimulation (played catch, rolled a toy, and took turns at a table top activity). The single subject in this study exhibited no self-injurious behavior (SIB) during sessions containing vestibular stimulation and engaged in lower but variable rates of SIB during the attention control condition. Although, there was no analysis of the function of the SIB, the attention control provided in this study suggested that SIB may be affected by non-contingent attention, a coincidental feature of sensory-integrative therapy. This observation is consistent with prior research showing that non-contingent stimulation of the sensory modality involved in the SIB can reduce levels of SIB, at least temporarily (Bailey & Meyerson, 1970; Favell, McGimsey, & Schell, 1982).

In a well controlled series of three case studies, Mason and Iwata (1990) evaluated the effects of automated sensory stimulation on the SIB of three subjects. The results were mixed, with automated sensory stimulation producing an increase in SIB for one subject, a decrement in SIB for a second subject and, no effect on SIB for a third subject until noncontingent therapist attention was added. These inconsistent

results are not surprising in light of the different maintaining variables for the SIB of each subject. The SIB of all three subjects subsequently proved responsive to interventions derived from an individualized functional analysis of their SIB. Nevertheless, this experiment raises questions about whether the defining feature of sensory integration therapy, repetitive sensory stimulation, is sufficient for the treatment for SIB or other stereotypical behaviors. It also bolsters concerns about confounds between sensory stimulation and noncontingent social attention in earlier studies.

The present study extends prior research in several ways. First, it evaluates the efficacy of sensory integration therapy with self-stimulatory behavior, a topographically different response than the SIB studied in previous controlled trials. Second, it evaluates a version of sensory integration therapy that was developed and approved by a team of experts thus precluding concerns that the intervention being evaluated was not a fair representation of sensory integration therapy. Third, it systematically evaluates sensory integration therapy, with and without noncontingent social attention, with three subjects, all of whose self-stimulatory behavior appeared to be primarily motivated by sensory stimulation rather than socially mediated positive and negative reinforcement.

Because the two variations of sensory integration therapy (with and without social attention) had limited impact on the self-stimulatory behaviors, this study also evaluated the impact of functional communication training (Carr & Durand, 1985; Durand & Carr, 1987) on the self-stimulatory behaviors of interest. This particular intervention was selected because of reports of rapid and pronounced reductions in problem behavior using functional communication training (Wacker et al., 1990). While prior research has documented the effects of functional communication training

on self stimulatory behavior, the number of subjects has been limited (e.g., Durand & Carr, 1987; Wacker et al., 1990) or a functional analysis of the self-stimulatory behavior has revealed the behavior to be controlled by escape from aversive situations (e.g., Durand & Carr, 1987). Thus, this research also provides a replication of the effects of functional communication training on self-stimulatory behavior that was maintained primarily by the sensory stimulation it produced.

METHOD

Subjects

Staff from agencies serving the mentally retarded/developmentally disabled population identified 30 clients who engaged in high rates of stereotypic behavior. A Motivation Assessment Scale (Durand & Crimmons, 1988) was completed for the self-stimulatory behavior of all 30 clients. The 12 clients who obtained the highest scores on the sensory feedback category of this scale were invited to participate in the study. Of the 12 clients invited to participate, three developmentally disabled males who exhibited high rates of stereotypic behavior that appeared to be maintained by sensory reinforcement completed the study.

The research protocol was reviewed and approved by the Western Michigan University Human Subjects Review Board (see Appendix A for a copy of this form) and The Kalamazoo County Recipient Rights Committee. The study was explained to and consent was requested from each subject as well as the subject's parent/guardian.

Subject 1 was a 9 year old male with a seizure disorder and an accompanying diagnosis of neurofibromatosis. Intellectual testing placed him in the severe range of mental retardation (I.Q. of 30 on the Stanford Binet). He was non-verbal with no effective method for expressing needs, and he attended a self-contained school for the mentally retarded. His stereotypic behavior consisted of hand-mouthing.

Subject 2 was a 12 year old male classified as moderately mentally retarded with an I.Q. score of 48 as measured by the WISC-R. He had an accompanying diagnosis of cerebral palsy. He exhibited functional expressive and receptive language skills and attended a local elementary school where he received special education services within a

self-contained classroom. He required minimal supervision to meet basic needs. His stereotypic behavior also consisted of handmouthing. Subject 3 was a 26 year old severely retarded male attending a day program for developmentally disabled adults. His Vineland Social Maturity Scale scores indicated an age equivalence of 3 years 5 months. He was non-verbal and exhibited no effective method for making his needs known to caregivers. His self-stimulatory behavior consisted of applying pressure to his eyeball with his index finger. The intensity of this self-stimulatory behavior did not produce permanent tissue damage or visual problems.

Each subjects' fine and gross motor skills were sufficiently developed to manipulate the sensory stimulating items used in this experiment.

Setting

The study was conducted at three different sites. Sessions with Subject 1 were conducted in an empty classroom approximately 9.5m x 9m. During the interactive sensory-integrative sessions, the subject and the experimenter sat beside each other at a table in the middle of the room. Sensory stimulating items were placed on the table in front of the subject and a rocking chair was placed along side the table. Observers were seated behind a fine-mesh screen, functioning as a one-way mirror, placed 3m from the subject. Similar physical arrangements applied to Subjects 2 and 3 with the exceptions noted below.

Sessions with Subject 2 were conducted in a small room 4m x 3m. A one-way mirror was located to the right of the entrance and was used for observation and reliability purposes. Sessions with Subject 3 were conducted in an empty room 9m x 10m.

Materials

Objects and activities used for sensory-integration therapy for each subject were based on available literature and recommendations of an occupational therapist who was trained in and an active practitioner of sensory-integration techniques. Two other occupational therapists who were similarly qualified in sensory-integration therapy, provided "expert consensus" (Johnston & Pennypacker, 1980) on the selection of sensory stimuli and the delivery of sensory-integration therapy.

The objects used as sensory stimuli consisted of: (a) a cassette tape recorder that played symphony music, (b) a rocking chair, (c) a surgical brush, (d) a high frequency vibrator (120 cycles per second), and (e) a hand held flashlight.

Materials and activities used in the Demand Condition of the functional analysis baseline were based on input from staff as to which tasks were non-preferred by each subject. A small bucket of various shaped blocks was used in the demand condition for Subject 1; a dust cloth was used for Subject 2; and a peg board was used in the demand condition for Subject 3.

In the Play Condition, the subjects were given access to favored recreational items based on the recommendation of staff familiar with their clients. Subject 1 preferred to sit in a bin of hard plastic balls similar to those seen in the children's play area at McDonalds restaurants; Subject 2 preferred a sticker book with sheets of stickers varying in size and colors; Subject 3 preferred to bounce a regulation size basketball.

During sensory-integrative conditions, the cumulative number of seconds a subject activated each sensory apparatus was recorded. A "preferred" sensory apparatus was identified for each subject based on the largest number of cumulative seconds of interaction (Wacker et al., 1985). As can be seen from Figure 1, Subject 1

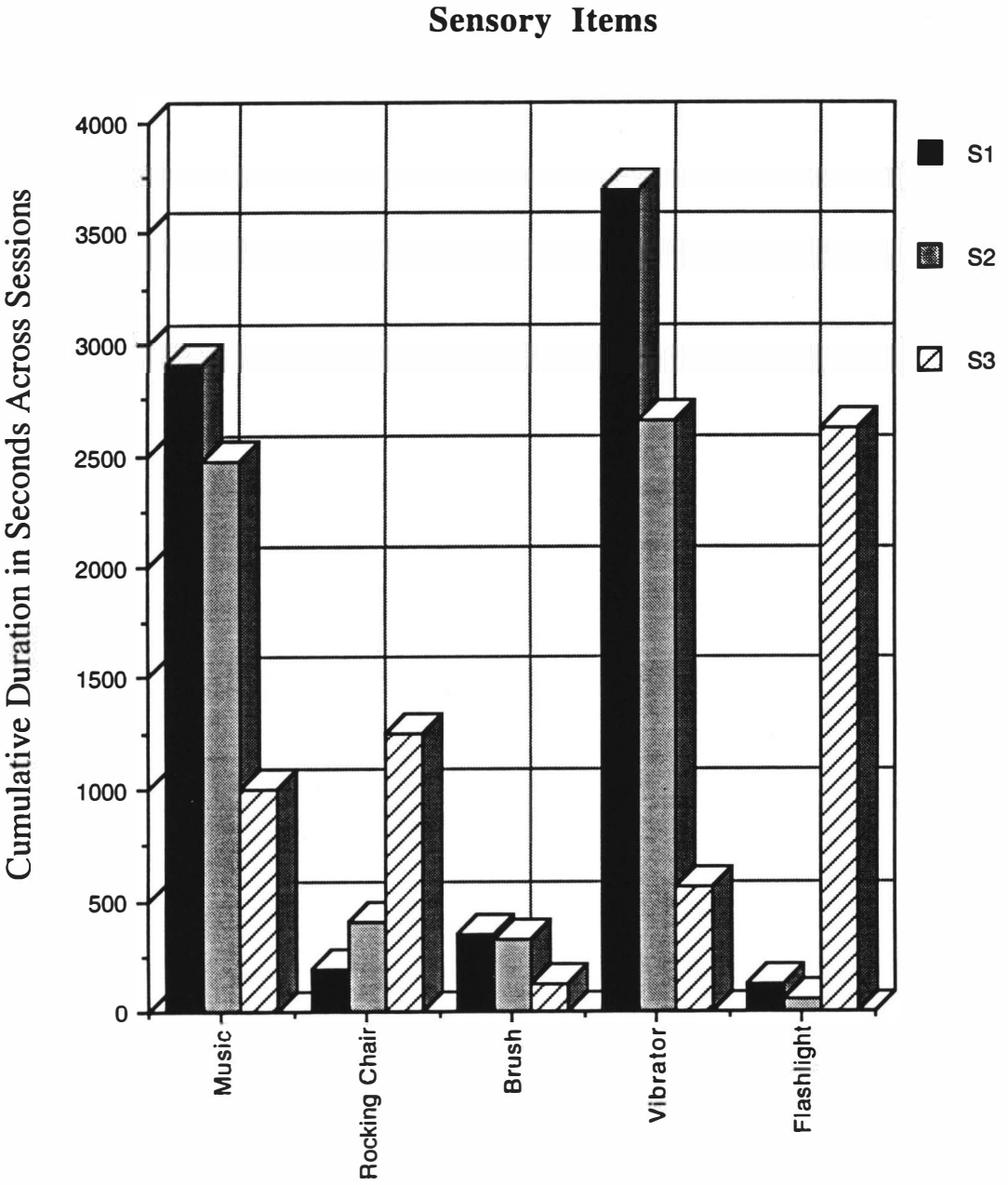

Figure 1. Preferred Sensory Items Based on the Largest Number of Cumulative Seconds of Interaction.

and Subject 2 both preferred a hand held vibrator. Subject 3 favored a hand held flashlight. During the Functional Communication Training sessions, the preferred items were used to facilitate acquisition of communicative responses.

Personnel

The experimenter and three reliability observers conducted the study. Each reliability observer was naive to the specific purposes of the study and was trained by the experimenter in the observational techniques and measurement systems required for accurate collection of data. The observers were familiarized with the specific definitions of: (a) each subject's self-stimulatory behavior; (b) the techniques used to deliver sensory stimulation; and (c) each subject's communicative responses. Observers practiced scoring behaviors until they obtained interobserver agreement scores of 80% or higher.

Selection of Target Behaviors

In addition to the previously described self-stimulatory behavior, a communicative response was identified for each subject that fell within the motor skill capabilities of that subject and also allowed the subject to obtain a preferred sensory stimulating object. None of the communicative responses selected for each subject had been previously trained.

Response Definitions

The communicative responses for Subject 1 and Subject 3 consisted of closure of a contact switch on a cassette tape player that activated a recorded message requesting a

specific sensory stimulating item. Subject 2 verbalized a request for delivery of the vibrator.

The targeted self-stimulatory response for Subjects 1 and 2 were hand mouthing. It was defined as the insertion of finger(s) into the mouth. Subject 3's stereotypic response was eye poking and it was defined as the insertion of any part of the index finger into the eye.

Units of Measurement

To conduct an assessment of the effectiveness of the experimental conditions, two dependent variables were measured on a session-by-session basis. Stereotypic behavior was measured based on the percentage of intervals in which the behavior occurred. Functional communication acquisition was measured using a scoring system based on the percent of independent presses of the microswitch by the subjects and prompts by the experimenter.

Observation and Recording

Stereotypic behavior was measured during 15 minute sessions using a partial interval system in which continuous observations were made for 10 seconds followed by 5 seconds of recording time. The percentage of the intervals in which stereotypic behavior occurred for any portion of the interval was calculated.

Using a stop watch, observers recorded the number of seconds that a subject interacted with each stimulus object. Interaction with the cassette tape player was recorded as long as the subject placed one or both earphones within six inches of either ear. Interaction with the vibrator, flashlight and brush was defined as grasping and

holding the object. Interaction with the rocking chair was defined as the subject sitting in the chair and emitting any back-and-forth movement of the torso.

Interobserver Agreement

Interobserver agreement was obtained by having a second observer simultaneously but independently record occurrence and non-occurrence of self-stimulatory behavior during 38% of Subject 1's sessions, 39% of Subjects 2's sessions and 35% of Subject 3's sessions, with each phase of the study having a minimum of 20% sessions with an interobserver agreement check.

For self stimulatory behavior, agreement percentages were calculated by dividing the number of intervals on which observers agreed on the occurrence or nonoccurrence of a behavior by the sum of agreements plus disagreements and multiplying by 100%. Mean agreement percentages for self-stimulatory behaviors exceeded 95% for all three Subjects.

For length of time interacting with each stimulus, reliability was calculated by dividing the smaller duration by the larger duration and multiplying by 100. Overall reliability averaged 93% for the combined subject length of interactive time with each stimulus.

Procedure

Phase One: Functional Analysis Baseline

A functional analysis, modeled after the protocol described by Iwata et al. (1982) for self-injurious behavior, was implemented to identify the probable controlling variables for the self-stimulatory behavior of each of the three subjects. Each subject was exposed to four sets of response contingencies for self-stimulatory behavior. Four

sessions, lasting 15 minutes per session,were conducted each day. During each session, a subject was exposed to two sets of response contingencies, each lasting for 7.5 minutes, the order of which was randomly determined. The total number of sessions in the Functional Analysis Baseline ranged from 24 to 37 per subject.

During the Demand Condition of the Functional Analysis Baseline, an experimenter presented tasks (selected from the subject's individual education plan) in a discrete-trial format, and delivered praise contingent upon correct responses. When no response or an incorrect response was given, the experimenter provided prompts in a hierarchical fashion e.g., verbal; verbal plus model; verbal plus physical prompt, until the subject responded correctly and independently. Praise was delivered upon correct responding and a 30 second time out was implemented contingent upon the occurrence of self-stimulatory behavior. During this condition, the tasks for Subjects 1, 2, and 3 were placing blocks in a bucket, dusting a small table, and placing plastic pegs into a pegboard, respectively.

During the Attention Condition, the experimenter instructed the subject to play with toys (selected by staff familiar with each subjects' preferred recreational activity) and proceeded to do paperwork. Contingent upon stereotypic behavior, the experimenter said "stop" in a moderately loud voice, expressed concern, and blocked the stereotypic response.

During the Alone Condition, the subject was placed in a room with no access to sensory stimulating activities and given no instructions. Subjects were under constant observation to ensure that no harm would occur to them as a result of any intensive stereotypic behavior. During this condition, experimenters sat behind the wire screen mesh for Subjects 1 and 3 and behind a one-way mirror for Subject 2.

During the Control Condition, the experimenter provided subjects access to age appropriate toys, delivered praise approximately every 30 seconds contingent on the absence of stereotypic behavior, and ignored occurrences of stereotypic behavior.

Phase Two: Sensory-Integrative Therapy

This phase consisted of two experimental conditions, Sensory Integration Therapy Without Social Interaction and Sensory Integration Therapy With Social Interaction.

During Sensory Integration Without Interaction, subjects were provided non-contingent access to apparatus that provided tactile, auditory, vestibular or visual stimulation during each 15 minute session. The apparatus for all subjects were similar and consisted of (a) a cassette tape recorder (with ear phones) that played symphony music, (b) a rocking chair, (c) a surgical brush, (d) a high frequency vibrator, and (e) a hand held flashlight. The tape player, vibrator and flashlight were activated at the beginning of each session and subjects were allowed free access to the stimulating items. The experimenter did not interact with the subjects during this condition.

The Sensory Integration With Social Interaction phase of this condition, contained all elements described under Sensory Integration Without Therapist Interaction. Additionally, if a subject was not interacting with any item, a therapist would direct the subject to engage in a sensory stimulating activity using a verbal prompt; verbal plus model; verbal plus physical prompt until the subject either engaged in the stimulating activity independently or until the subject pulled away from the therapist. If the subject participated in the stimulating activity he was verbally praised on stroked on the back. Stereotypical behavior was ignored unless it was of sufficient

intensity to pose a physical risk to a subject, in which case, it was blocked by the therapist.

The therapist exposed the subject to each of the sensory stimulating activities. For brushing, the therapist gently moved the brush back and forth over the back of the subject's hands, arms, and face as tolerated by the subject. The therapist initiated vestibular stimulation by prompting the subject to sit on the therapists' lap, placing the therapists' arms around the Subject's waist, and beginning to rock. Vibratory stimulation was initiated by the therapist directing the subject to place the vibrator on the back of his hands, arms, and face. After handing each subject a lit flashlight, the therapist encouraged the subject to look at the light or to flash it on the floor, table, wall or his own body parts. The tape player was activated and the subject was prompted to wear the headphones. Subjects were allowed to interact with each item for 60 seconds and then were prompted to go on to the next apparatus. However, if a subject pulled away from the therapist or the stimulating activity, prompting was discontinued and the therapist presented the next activity.

Also, subjects were allowed to continue interacting with a sensory stimulation device for more than 60 seconds, if their verbal and non-verbal behavior indicated such an interest. This experimental condition was judged by the occupational therapists to be a close approximation of the manner in which sensory integration interventions would be administered.

Phase Three: Functional Communication Intervention

Data obtained during the functional analysis baseline (to be presented later), suggested that the stereotypic behavior of each subject was primarily motivated by the sensory stimulation produced by that behavior (i.e., the stereotypic behavior occurred

at higher levels during the alone condition than during other conditions). Preferred sensory stimulating items were identified for each subject based on the duration of contact with items during the sensory integration phase of this experiment. Using a least-to-most intrusive prompting sequence (verbal prompt, verbal prompt plus modelling, verbal prompt plus physical guidance) , subjects were then trained to emit a simple communication response as a request for a preferred sensory stimulating item.

For Subject 1, the communication response consisted of depressing a contact switch (15 cm by 15 cm) on a cassette tape player that activated a continuous loop message, "may I please have the vibrator." Whenever Subject 1 pressed the switch, he was given access to the vibrator for up to 30 seconds. If he engaged in handmouthing, the experimenter interrupted the handmouthing by gently guiding the hand down and away from the mouth and removed the vibrator from the subject's other hand and placed it on the table out of the subject's reach. Following a 10 second delay, he was prompted to once again press the switch. Following training, and during the functional communication phase, only independent, unprompted communication responses produced access to the preferred stimulating activity.

Subject 2 was trained to request the vibrator by saying "May I please have the vibrator". With each verbal request, Subject 2 gained access to the vibrator for 30 seconds. If handmouthing occurred, the same procedure used with Subject 1 was implemented with Subject 2.

The "communication" response for Subject 3 was the same as for Subject 1 except the continuous loop message for Subject 3 was "May I please have the flashlight". If he engaged in eyepoking, the previously described procedure for self-stimulatory behavior was implemented.

Phase Four: Maintenance Probes

Near the end of the functional communication phase, caregivers were trained to implement the previously described functional communication procedure with Subjects 1 and 2. Probes were conducted once per week for one month in the school setting with Subject 1 and in an after school program with Subject 2. Because the functional communication intervention had no effect on Subject 3's stereotypic behavior, no maintenance probe was implemented for Subject 3. During probes, the primary experimenter observed caregivers implement the procedure during randomly selected times and activities.

Experimental Design

The study consisted of five phases: Functional Analysis Baseline, Sensory Integrative Therapy with and without social interaction, Functional Communication, and Maintenance Probes. During the Functional Analysis baseline, subjects were observed during sessions in which the response contingencies for their self-stimulatory behavior alternated in a manner congruent with an alternating treatments design (Kazdin, 1982). After completion of the functional analysis phase, Sensory Integrative sessions were implemented in a time delayed fashion as required for a multiple baseline across subjects design (Kazdin, 1982). Within the Sensory Integration Phase, the effects of social interaction with the therapist was assessed using a reversal design (Kazdin, 1982). After the effects of sensory integration therapy had been evaluated, the Functional Communication Phase was implemented in a multiple baseline across subjects design. A Maintenance Probe was implemented for the two subjects who proved responsive to functional communication training in an effort to determine if the

effects of functional communication training might be extended to other intervention agents and settings.

RESULTS

Motivational Assessment

The results of the Motivation Assessment Scale (Durand & Crimmons, 1988), shown in Table 1, indicate that each subject's stereotypic behavior was maintained by sensory consequences. Subject 1 obtained the highest possible mean score (5.0) under the "sensory consequence category." His next highest mean score of 3.3 was obtained under the "escape from demands" category. Subject 2 received a mean score of 5.0 under "sensory consequences" with the next highest mean score of 2.0 under the "tangible consequence" category. Subject 3 's highest mean score (4.5) was obtained under "sensory consequences" followed by "tangible consequences" with a mean score of 2.5.

Functional Analysis of Stereotypic Behavior

The first experimental phase of this study, depicted in Figure 2, shows the occurrence of stereotypical behavior, expressed as percentage of 10 second intervals, for all subjects during all four baseline conditions. The functional analysis baseline data, shown in Table 2 and graphically depicted in Figure 2, were consistent with the results of the Motivation Assessment Scale in that the highest level of self-stimulatory behavior occurred during the Alone condition. The relatively high level of stereotypic behavior for each subject during the alone condition (relative to the other conditions of the functional analysis), suggests that the self-stimulatory behaviors were automatically reinforced by the sensory stimulation they produced (Baumiester, 1978).

Table 1

Motivation Assessment Scale Results

	Mean Scores			
Subject	Sensory	Escape	Attention	Tangible
#1	5.0	3.3	1.5	1.5
#2	5.0	1.5	1.5	2.0
#3	4.5	1.0	1.5	2.5

Sensory Integration Therapy

Data representing the mean percentage of observation intervals containing self-stimulatory behavior, shown in Table 3, indicate that during sensory-integration therapy sessions, there was no discernable reduction in stereotypic behavior for any subject relative to the levels in the alone condition of the functional analysis baseline data, the condition that occasioned the highest level of behavior. Furthermore, there were only minor differences in the levels of behavior associated with the presence or absence of social interaction with the therapists during sensory integration therapy. Stereotypic behavior occurred at high rates during each part of the sensory integrative intervention with slightly higher rates in the no interaction phase recorded for each subject.

Functional Communication Training

Subjects 1 and 2 acquired their "communication" responses very rapidly and with minimal prompting. As depicted in Figure 3 and summarized in Table 3, the implementation of the functional communication plus response interruption procedure

Table 2

Mean Percentage of Intervals Containing Self-Stimulatory Behavior During Each Functional Analysis Condition

Subject	Alone	Attention	Demand	Play
#1	95.6	70	51	57.5
#2	90.5	41.6	7.4	1.1
#3	80.3	61.7	41.4	6.1

occasioned large decrements in self-stimulatory behavior to very low levels for Subject 1 and the elimination of self-stimulatory behavior for Subject 2.

Subject 3 exhibited agitated behavior (screaming and crying) when the self-stimulatory response was interrupted. After three attempts to interrupt the response, this aspect of the procedure was eliminated due to concerns about the subject's recipient's rights. As a result, only functional communication training was implemented. Subject 3 required 12 trials consisting of prompts ranging from verbal plus physical to verbal plus model before he independently pressed the micro-switch requesting the flash light across three consecutive trials. During the functional communication phase, Subject 3 engaged in a mean of 83% (range of 80% to 90%) stereotypic behavior. Figure 3 shows no visible reductions in stereotypic behavior associated with the implementation of the modified functional communication training procedure.

Maintenance Probes

Care takers were trained in the use of the functional communication plus response interruption intervention through demonstration and practice. Maintenance probes were

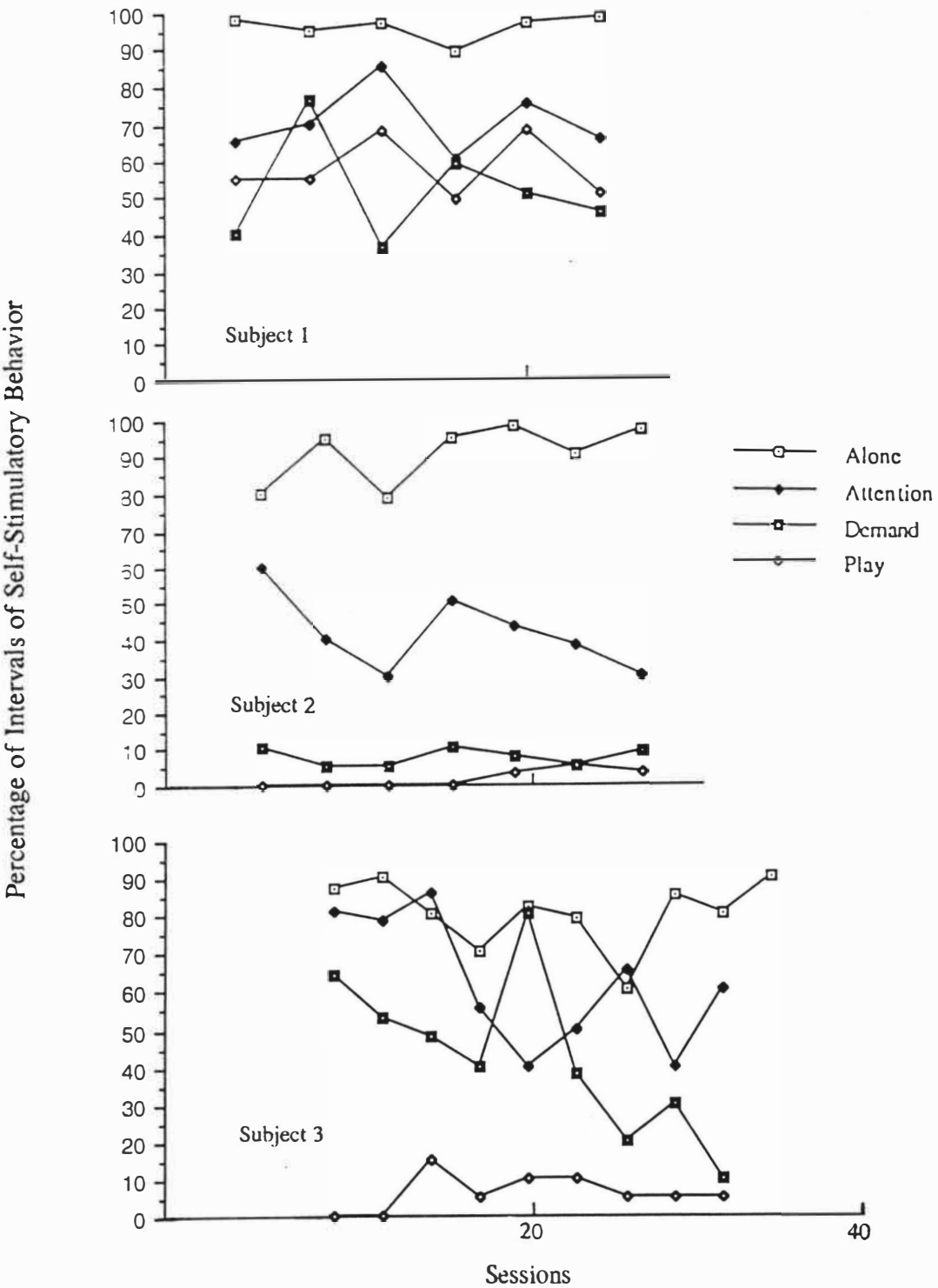

Figure 2. Functional Analysis Data Expressed as 10 Second Intervals.

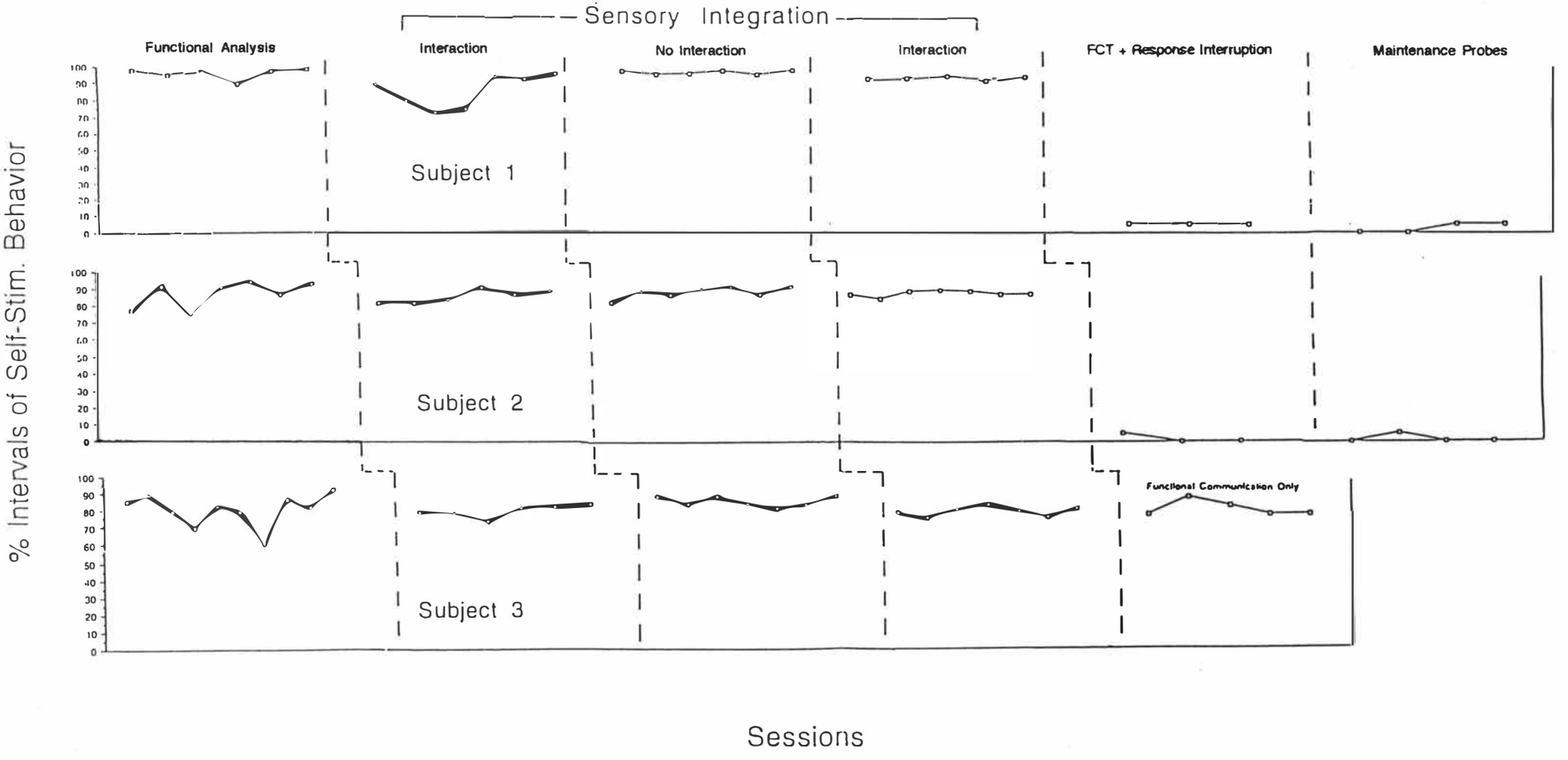

Figure 3. Percentage of Intervals in Which Self-Stimulatory Behavior Occurred.

Table 3

Mean Percentage of Observation Intervals Containing Self-Stimulatory Behavior During Various Experimental Conditions

Subject	SI With Interaction	SI Without Interaction	SI With Interaction	FCT Plus Interrupt	Maintenance
#1	86	97.5	93.8	5.0	2.5
#2	89.2	91.8	90.7	1.7	1.3
#3	81.2	87.1	83.6		

Note. SI equals sensory interaction; FCT equals functional communication training.

conducted once per week for four weeks at Subject 1's school setting and at Subject 2's respite setting. As depicted in Figure 3 and summarized in Table 3, self-stimulatory behavior was observed in a very small number of intervals for both subjects with several observations for both subjects revealing zero levels of self-stimulatory behavior.

DISCUSSION

The results of the Motivation Assessment Scale were congruent with the results of the Functional Analysis Phase in identifying sensory consequences as the primary factor maintaining each subject's stereotypic behavior. Thus, these subjects should have been ideal candidates for sensory integration therapy in that their self-stimulatory behavior was maintained by something other than socially mediated reinforcement (see Mason & Iwata, 1990). Implementation of sensory integration therapy, designed by experts in this version of therapy, produced no reduction in the levels of self-stimulatory behavior when compared with the Alone Condition of the Functional Analysis Baseline. Thus, the most generous conclusion is that sensory integration therapy had no effect on the self-stimulatory behavior of the three subjects in this experiment. If, however, the levels of self-stimulation during sensory integration therapy are compared to the levels observed during the other three conditions of the Functional Analysis Phase, then Sensory Integration Therapy would be judged to have a detrimental effect on the levels of self-stimulatory behavior. Furthermore, the addition or removal of social interaction with the therapist during sensory integration therapy had little or no effect on observed levels of self-stimulation. This perhaps is not surprising in that the self-stimulatory behaviors of these subjects were maintained primarily by sensory consequences rather than by attention. Whether or not therapist attention during the implementation of sensory integration therapy might prove to be an active intervention component with behaviors maintained by different variables (e.g., attention) remains for future research. As such, these data provide support for Mason and Iwata's tentative conclusions that Sensory Integrative Therapy is not generally

effective as an intervention for self-injurious behavior and extend those results to the treatment of self-stimulatory behavior.

In contrast to the absence of treatment effects with Sensory Integration Therapy, Functional Communication plus Response Interruption produced rapid and profound decrements in self-stimulatory behavior for Subjects 1 and 2. In contrast, Functional Communication Training without Response Interruption produced no impact on Subject 3's behavior. Unfortunately, the extreme agitation displayed by Subject 3 with early attempts to interrupt his self-stimulatory behavior, precluded efforts to implement the same Functional Communication Intervention that proved effective for Subject 1 and Subject 2. The results with Functional Communication Training replicate those of previous investigations (Bird, Dores, Moniz, & Robinson, 1989; Carr & Durand, 1985; Durand & Carr, 1987; Steege, Wacker, Berg, Cigrand, & Cooper, 1989) but do suggest the need for further analysis of the active components (i.e., response interruption) of this type of intervention.

These results must be interpreted in light of several limitations of the current study. First, this study included only three subjects raising questions about the generality of the results (or lack thereof) to other subjects. Also, the subjects did not receive neurological assessments to rule out neurological damage, a condition that would, in theory, preclude the maturation effects of sensory-integrative therapy on the central nervous system and interfere with the acquisition of adaptive behaviors and cognitive abilities. Moreover, the self-stimulatory behavior of all of the subjects in this study was maintained primarily by sensory consequences. In many ways, this is a strength of this study in that behavior maintained by sensory consequences is thought to represent the optimal test case for sensory integration therapy. Nevertheless, replication of these results with additional subjects whose behaviors are maintained by

other variables (e.g., social reinforcement, escape from demands) would add generality to these results.

In the absence of standard protocols for the administration of Sensory Integration Therapy, one could raise concerns that the Sensory Integration Therapy was administered by a novice in a manner that preempted a fair assessment of the therapy. It should be noted that the Sensory Integration Therapy protocol was developed in consultation with an occupational therapist with training and experience in Sensory Integration Therapy and the protocol was endorsed by two additional occupational therapists. While the therapist was not blinded to the experimental question and treatment conditions, there is no reason to presume that the version of Sensory Integration Therapy evaluated herein differed from that which would be implemented by an expert. When it comes to claims of therapy efficacy, the onus or responsibility should be on the proponents of Sensory Integration Therapy to document its efficacy with methodologically sound research and to disseminate treatment protocols that permit independent replication efforts. Absent such efforts, this research and that of Mason and Iwata (1990) raise serious reservations about the claims of efficacy for Sensory Integration Therapy.

A further contribution of the present study can be found in the replication of the efficacy of functional communication training (Wacker et al., 1990; Fisher, Piazza, Cataldo, Harrell, Jefferson, & Coner, 1993). Furthermore, the rapid and dramatic change in self-stimulatory behavior for two of the subjects, demonstrates that the behaviors under investigation were amenable to change by some therapy technique. Thus the failure of Sensory Integrative Therapy cannot be attributed to behaviors that were unusually recalcitrant.

It is noteworthy that the self-stimulatory behavior of Subject 3 proved unresponsive to a functional communication intervention that deviated from that of the other two subjects in its absence of a response interruption component. These results are congruent with research indicating that both functional communication training and consequences (e.g., time-out, response interruption) for inappropriate behavior were necessary for maximal impact on aberrant behavior (Wacker et al., 1990). However, the observations of severe agitation by Subject 3 in reaction to response interruption procedures suggests the need to develop a range of alternative consequences for aberrant behavior when one consequence in a functional communication intervention package proves impractical or ineffective.

On an anecdotal basis, the quality of interaction between teachers and service providers and Subject 1 and Subject 2 improved as a result of this study. Prior to this study, statements were made to the experimenters indicating that most experiences with these two subjects were "gross and disgusting" due to their specific forms of stereotypic behavior. Classroom staff working with Subject 1 typically limited their interactions to meeting the subject's physical needs. Following training and implementation of the behavioral intervention, staff initiated positive social interaction with both subjects. Both subjects were observed to smile more frequently and exhibited less agitated behavior.

In conclusion, this research suggests that Sensory Integration Therapy is not an effective treatment for self-stimulatory behavior maintained by sensory consequences. In contrast, Functional Communication Training that included a response interruption component proved highly effective and produced durable reductions in self-stimulatory behavior that were maintained by treatment staff.

Future researchers may want to provide controlled data regarding the therapeutic impact of sensory-integrative therapy on other types of maladaptive behaviors i.e., identify the active components of this intervention and how they might affect behaviors maintained by environmental contingencies. There is also a need to determine if replacement behaviors based on functional analysis are more effective than those selected on the basis of empirical observation

Appendix A

Approval Letter From the Human Subjects Institutional Review Board

WESTERN MICHIGAN UNIVERSITY

Date: July 24, 1992

To: Thomas M. Starzynski

From: Mary Anne Bunda, Chair Mary Anne Bunda

Re: HSIRB Project Number 92-07-02

This letter will serve as confirmation that your research protocol, "The Effects of Sensory Integrative Therapy on Stereotypic Behavior" has been approved after full review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Fuqua, Psychology

Approval Termination: July 24, 1993

Appendix B

Reapproval Letter From the Human Subjects Institutional Review Board

WESTERN MICHIGAN UNIVERSITY

Date: July 28, 1993

To: Thomas Starzynski

From: M. Michele Burnette, Chair M. Michele Burnette

Re: HSIRB Project Number 93-07-08 (92-07-02)

This letter will serve as confirmation that your research project entitled "The effects of Sensory Integrative Therapy on sterotypic behavior" has been **reapproved** by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may continue to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: July 28, 1994

xc: Fuqua, PSY

Appendix C

Interobserver Agreement

Interobserver Agreement

Interobserver agreement was obtained by having a second observer simultaneously but independently record occurrence and non-occurrence of self-stimulatory behavior during 38% of Subject

1's sessions, 39% of Subject 2's sessions and 35% of Subject 3's sessions, with each phase of the study having a minimum of 20% sessions with an interobserver agreement check.

For self-stimulatory behavior, agreement percentages were calculated by dividing the number of intervals on which observers agreed on the occurrence or non-occurrence of a behavior by the sum of agreements plus disagreements and multiplying by 100%. Mean agreement percentages for self-stimulatory behaviors exceeded 95% for all three subjects.

For the length of time interacting with each stimulus, reliability was calculated by dividing the smaller duration by the larger duration and multiplying by 100. Overall reliability averaged 93% for the combined subject length of interactive time with each stimulus.

Appendix D

Informed Consent for Elibility and Possible Participation in a Research Protocol Entitled: "The Effects of Sensory Integrative Therapy on Sterotypic Behaviors"

INFORMED CONSENT FOR ELIGIBILITY AND POSSIBLE PARTICIPATION IN A RESEARCH PROTOCOL ENTITLED: "THE EFFECTS OF SENSORY INTEGRATIVE THERAPY ON STEREOTYPIC BEHAVIORS"

As a consumer attending (name of institution/school), your ward (name of consumer) may be eligible to participate in a research study being conducted by Tom Starzynski, M.S. under the direction of Wayne Fuqua, Ph.D.. department of psychology at Western Michigan University. Students from Western Michigan University will participate in the study as assistants to Mr. Starzynski and Dr. Fuqua. The research study will attempt to determine if repetitive, self-stimulating behaviors, such as body rocking and finger waving, can be decreased or eliminated by teaching someone who engages in such behaviors a new and more socially acceptable method of self-stimulation, e.g., rocking in a rocking chair instead of body rocking.

Eligibility will be based on a review of your ward's records, interviews with (name of institution/school) staff, and an evaluation consisting of observing your ward's reactions to different types of sensory activities such as access to a rocking chair, a television, and various textured materials.

If your ward is selected to participate in the study he/she will experience the following conditions: (1) he/she will have access to activities that match the type of stimulation they are obtaining from their repetitive, self-stimulating behavior such as getting auditory stimulation from listening to the radio; (2) each participant may experience another condition known as functional communication training if condition one does not decrease self-stimulating behavior. In this procedure, each individual will learn how to tell others when they would like to have some form of stimulation such as

rocking in a rocking chair or listening to the radio. Each functional communication session will last 15 minutes. Each person will participate in the session until he/she learns a new way of telling others they would like some type of stimulation by a) turning on a prerecorded message; b) using sign language; c) pointing; or d) stating a short sentence.

The total duration of your ward's participation in the study will not exceed six months. Participation in this study will not adversely impact your ward's training and rehabilitative programming experiences at (name of institution/school). Your decision of whether or not to commence participation or continue this study will in no way influence services that your ward is currently receiving from (name of institution/school).

This research involves no identifiable risk to your ward. The evaluation and treatment procedures involved in the study are not harmful and have no reported negative effects. Each participant's behavior will be observed by Western Michigan University student assistants while sessions are being conducted. In the unlikely event that your ward becomes extremely stressed, the procedure will be immediately terminated. Also, in the unlikely event that your ward's self-stimulatory behavior poses a physical risk, efforts to protect him/her will be taken and he/she will be excused from the study. Involvement is totally voluntary, therefore, as a guardian you may terminate your consent at any time and withdraw your ward from the study without adversely effecting his/her or your relationship with (name of institution/school) and Western Michigan University.

In the highly unlikely event that problems emerge as a result of participation in this study, Mr. Starzynski, and Dr. Fuqua will assist you in obtaining appropriate services for your ward, but neither Mr. Starzynski, Dr, Fuqua, Western Michigan

University nor (name of institution/school) will assume financial responsibility for those services.

Potential benefits of your ward's participation in this study include the reduction and/or elimination of his/her repetitive, self-stimulation behavior that interferes with socialization and the learning of new, positive ways of communicating his/her needs.

All information obtained in this study will be confidential to the experimenters. The identity of participants will not be known except to (name of institution/school) personnel who already have access to this information.

Data indicating your wards' favorite type of self-stimulating behavior, what may be maintaining this behavior, his/her reactions to sensory stimulating activities, and his/her success at both learning a new way of obtaining stimulation and a new way of communicating a desire to obtain stimulation will be collected by Mr. Starzynski, Dr. Fuqua and their student assistants. Only Mr. Starzynski and Dr. Fuqua will have access to the complete set of data. Data will be coded and the code sheet that identifies the relationship between code and individuals will be destroyed within six months of the completion of data collection. Data will be stored by the principal investigator in a locked file for seven years. Data obtained from this research may be used in scientific presentation and publications, however, all identifying information will be removed. No identifiable information about your ward will be published without obtaining your written permission.

Questions or complaints regarding this research or your ward's rights may be directed to Dr. Fuqua at 387-4474. If the solution is unsatisfactory, you may contact the chair person of the Western Michigan University psychology department at 387-4474.

As the guardian of a participant in this study, you will receive a copy of this consent form.

YOUR SIGNATURE BELOW INDICATES THAT 1) YOU HAVE BEEN GIVEN THE OPPORTUNITY TO ASK QUESTIONS AND THESE QUESTIONS HAVE BEEN ANSWERED TO YOUR SATISFACTION; AND 2) YOU UNDERSTAND THE ABOVE STATED INFORMATION AND HAVE GIVEN YOUR PERMISSION FOR YOUR WARD TO BE ASSESSED FOR ELIGIBILITY AND POSSIBLE PARTICIPATION IN THIS STUDY.

Signed_____ Date_____

Guardian

Type of Guardian_____

Signed_____ Date_____

Witness

(The witness to be responsible to ensure that the party who is granting consent has done so willingly, with full knowledge and is the authorized person to grant such consent).

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