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Stereotypic Motor Behavior and Language Ability in Severely Developmentally Disordered Children

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STEREOTYPIC MOTOR BEHAVIOR AND LANGUAGE ABILITY IN SEVERELY DEVELOPMENTALLY DISORDERED CHILDREN

by

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VITA

The author, Lorraine D. (Wukitsch) D'Asta was born on July 11, 1954, in Chicago, Illinois, the youngest of four children of Frank and Dorothy (Schlesser) Wukitsch. Lorraine's natural mother died in 1958, and her father married Grace LaBanco later that year. Lorraine's father died in 1965. In August, 1975, Lorraine married Nicholas A. D'Asta, C.P.A.

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INTRODUCTION

Stereotypic motor behaviors are repetitious, functionally maladaptive, topographically invariant motor sequences for which reinforcing or controlling stimuli are not obvious (Baumeister & Forehand, 1973). These behaviors are among the most pervasive characteristics observed among moderately to profoundly retarded individuals, particularly those residing in institutions. Such behaviors as rhythmic rocking, hand-flapping, mouthing, and twirling self or objects are prevalent in as many as two-thirds of the institutionalized retarded population (Berkson & Davenport, 1962; Hutt & Hutt, 1970; Kaufman & Levitt, 1965). These behavior patterns are also common in persons diagnosed as autistic, brain-damaged, and those persons with specific sensory deficits (e.g., blindness, deafness). Included among these stereotypies are many forms of repetitive self-injurious behaviors (Baumeister & Rollings, 1976; DeCatanzaro & Baldwin, 1968). In fact, some investigators (Phillips & Alkan, 1961; Frankel & Simmons, 1976) estimate self-injurious behaviors to be present in four to five per cent of institutionalized populations.

The frequency and intensity of these behaviors may pose critical problems for the clinician or educator, in that the first step in meaningful behavioral programming often involves the control or

elimination of these high-frequency and apparently maladaptive responses (Azrin, Kaplan & Foxx, 1973; Kent, 1974; Lovaas, 1977; Murphy, Nunes, & Hutchings-Ruprecht, 1977). Yet these behaviors, by their very nature, are highly resistant to change.

Previous research and theoretical orientations have attempted to account for the occurrence of stereotypic motor behaviors by reference to either internal subject variables or external environmental variables. Neither of these approaches have proven sufficient in and of itself to explain this phenomena. A great many variables have been explored, including the general intellectual ability, age, and environmental responsiveness of subjects and the amount and kind of environmental stimuli available to them. One aspect which has not been examined is the specific language capabilities of the stereotyper, especially with respect to his responses to environmental demands. The purpose of this study is to explore the relationship between language ability and stereotypic motor behaviors in severely developmentally disordered children. It is proposed that those children with the most primitive communicative abilities will be most likely to exhibit stereotypic behaviors at those times when the environment is placing social demands upon them.

CHAPTER II

REVIEW OF RELATED LITERATURE

The literature regarding stereotypic motor behaviors is somewhat confusing and contradictory. Some of this confusion undoubtedly arises out of problems of diagnosis and classification among developmentally disordered populations. Additionally, there are essential differences in theoretical perspective and conceptualization which color the research and writings on this topic. The common controversy regarding internal versus external causality of behavior extends into the study of stereotypic motor behaviors. Stereotypies have been conceived of as being determined primarily by internal control mechanisms (subject variables) or environmental stimuli (antecedents and consequences).

Stereotypies as Primarily Internally Determined Behaviors

The very rhythmicity and unchanging nature of these behaviors across time has been cited as support for primarily internal determinants of these behaviors. Photographic techniques have shown that stereotypic rocking behavior occurs at a constant rate within and across episodes of rocking behavior (Ritvo, Ornitz, & LaFranchi, 1968). Measured under constant environmental conditions, the average duration of stereotypic motor behavior per minute was extremely

variable, but the average amount of stereotypic behavior emitted over prolonged periods of time (6 hours) was relatively constant (Sorosky, Ornitz, Brown, & Ritvo, 1968). Peaks in stereotyping occurred at random intervals, with no cyclic patterns to these behaviors. Pohl (1976, 1977), on the other hand, found evidence of variance in rate of body rocking over long time periods, even under constant environmental conditions. He measured the commonly observed acceleration and deceleration between bursts of rocking and proposed that the spontaneous changes in rate point to internal control in at least some cases of stereotyped rocking.

It has been suggested (Hutt & Hutt, 1965; Sorosky, Ornitz, Brown & Ritvo, 1968) that there is some, as yet unspecified physiological basis for stereotypic motor behaviors. Lewis and Baumeister (1979) propose that the underlying process is the result of neurochemical imbalances. Rimland (1964) has suggested that stereotypers have a predisposition to early brain stem damage. Animal analog studies are cited as supporting evidence, especially with regard to the effects of drug-induced neurochemical imbalances and their effects on stereotyping. (For a more complete discussion of this issue, see Lewis and Baumeister, 1979.) Those who put forth the theory of physiological bases to stereotyping point to findings that stereotyped behaviors are more likely to occur in those populations exhibiting central nervous system disorders (Baumeister, 1978) and low grade EEG abnormalities (Ritvo, Ornitz & LaFranchi, 1968).

However, stereotypic behaviors occur in both normal and abnormal populations. In fact, a developmental theory of stereotypies holds that some forms of rhythmic behavior are essential to normal early development. Thus, the stereotypies exhibited in older abnormal populations are seen as an exaggeration and extension of more primitive normal behaviors (Brassell & Dunst, 1975; Kravitz & Boehm, 1971). Ilg and Ames (1955) noted the likelihood of rocking, hair pulling and headbanging within the normal developmental sequence. DeLissovoy (1961) found the incidence of headbanging in 19-32 month old normal infants to be 15.2%. In a study of over 140 normal infants, Kravitz and Boehm (1971) consistently found multiple stereotypies. Hand sucking was seen in 100% of their sample within a few hours of birth. Foot kicking was observed in 89% and lip sucking in 93%, with median onsets of 2.7 and 5.3 months respectively. Median onset was 6.1 months in 91% of this group for body rocking. Head rolling occurred in 10% (onset > 12 months) and head banging in 7% (onset > 12 months) of this group of normal infants. Fifty-six percent were teeth grinders, with an average onset of 10.5 months. Sallustro and Atwell (1978) studied body rocking, head banging, and head rolling in 525 normal children. Body rocking was the most prevalent of the three behaviors under study and was engaged in by 19.1% of their sample (mean onset, 6.4 months). Head banging occurred in 5.1% of these children with a mean onset of 9.4 months. Head rolling was done by 6.3% of the children, beginning at a mean age of 9.7 months. In fact, Sallustro and Atwell report that body rockers

and head bangers were developmentally advanced when compared to non-rockers and non-bangers. It is clear that rhythmic motor behaviors play an important role in normal infant development and are not simply the result of "bad genes" or "faulty wiring" in abnormal populations.

But when such repetitious behaviors are the primary components of the behavioral repetoire beyond early developmental stages, they are considered maladaptive and pathological (Schroeder, 1970). It should be noted that the incidence of stereotyping has not been found to be related to chronological age within retarded populations (Balthazar, 1977; Moseley, Faust & Reardon, 1970). That is, stereotypies do not "drop out" of the behavioral patterns of retarded children as they do in normal children. Perhaps these behaviors are the motor component of the generalized developmental delays of retardation.

If that is the case, then the occurrence of stereotyping within the retarded population should be correlated with the degree of developmental delay: the more primitive the mental development, the more likely should be the probability of stereotyping. Indeed, the incidence of stereotyped motor behaviors has been found to be negatively correlated ($r=-.31, p< .05$) with measured IQ within the general population (Berkson & Davenport, 1962). However, this relationship has not been supported by research employing retarded populations within a limited range of IQ (Baumeister, 1978). Within the range of retardation (IQ 11-69) in their institutionalized group, Moseley,

Faust, and Reardon (1970) found no significant correlations between stereotyped motor behaviors and IQ. Balthazar (1977) also reports no relationship between stereotyped motor behavior and mental age in his population of severe and profound retardates. Thus, generally retarded developmental level, in and of itself, does not account for the presence of stereotypic motor behaviors in some retarded persons.

Berkson (1966) has suggested that this may be because the tests used to measure the capabilities of developmentally delayed persons and the categories by which they are classified are too gross. These measures and categories, he proposes, fail to recognize the difference between those who are truly "retarded" in their development, exhibiting slow but normally-patterened development, and those who are "deficient", exhibiting defective or abnormal patterns of development. In this frame, "true retardation" stems from primarily physiological causes, though the causes may not always be immediately evident. "Deficient development" would include those persons who are not functioning at age-appropriate levels, but whose retardation seems uneven (e.g., autistics, childhood schizophrenics, etc.). Such defective patterns of development are viewed as the result of faulty interactions between the developing individual and his environment (Berkson, 1964, 1973). In terms of psychoanalytic theory, this "pathology of object relations" is the result of inappropriate mothering and an underdeveloped sense of self (Davis, 1940, 1946; Freedman & Brown, 1968; Mahler, 1945). Behavioral approaches

explain deficient development in terms of atypical reinforcement patterns (Baumeister & Forehand, 1973). Theoretically, the behavioral patterns of "retarded persons" should be quite different than those of persons whose development is "deficient". There is no research reported to specifically test this set of propositions.

IQ or any general measure of mental age or developmental level may, indeed, fail to recognize important differences in the actual skills and behavioral patterns of those persons classified as retarded. It has long been recognized that the relative contributions of various factors on IQ tests are variable both within and among diagnostic categories of mental retardation (Alper, 1967; Newman & Loos, 1955). Thus, persons who score within a given range on standard IQ tests may exhibit widely differing levels of perceptual-motor coordination, social skills, and language ability.

The language issue is particularly problematic in the retarded population. Retardates within the same diagnostic classification may exhibit language capabilities ranging from a total absence of speech, writing or signing, with cries, grunts and pointing as the only forms of communication, to spoken words and simple sentences. Nor do retardates within the same diagnostic categories have the same ability to perform on language learning tasks (Baumeister, 1964). Furthermore, retarded children of a given mental age do not necessarily exhibit levels of language ability the same as those of normal children of the same mental age (Naor & Balthazar, 1975; Scheifelbusch,

1974). Research on the motor patterns of retarded children with matched language capabilities is non-existent.

Interactive Bases for Stereotypies

Of course language does not exist in a vacuum. Language ability appears to be related in a positive way to social involvement (Snyder & McLean, 1976). Retardates who enjoy peer interaction exhibit greater linguistic proficiency than those who are withdrawn (Naor & Balthazar, 1975). This is not difficult to understand: those who possess greater language abilities are better able to interact and their enjoyment will be greater, leading to further social interaction. On the other hand, those persons who withdraw engage in less of that social interaction necessary for communicative development.

This interface of language and social engagement could be important to the understanding of the bases of stereotypic motor behaviors. Lovaas (1977) sees language as a self-stimulating behavior which arises originally out of social interactions. Those persons who are nonverbal have never learned to self-stimulate with language. Lovaas suggests that children who have not learned to self-stimulate appropriately (i.e., with language) may self-stimulate motorically. Thus, we should expect to see a great deal of motoric self-stimulation (stereotyping) in nonverbal individuals. The only connective evidence in this regard is reported by Balthazar (1977). Retardates in his "stereopathic" group were seen to be socially withdrawn and

engaged less frequently in meaningful verbal communications. He reports no tests of communicative ability per se.

There has, however, been a great deal of research exploring the relationship between stereotypic motor behaviors and social and environmental engagement. Retardates who engage in stereotypic motor behaviors characteristically exhibit a low level of general responsivity to the environment (Baumeister & Forehand, 1973). They exhibit fewer adaptive behaviors and initiate fewer social contacts when compared with other retardates (Berkson & Davenport, 1962). In observing the response of retardates to novel objects (a doll, two types of balls, and a block), Davenport and Berkson (1963) found that those subjects with higher baseline rates of stereotypic behaviors manipulated objects less frequently than those subjects whose baseline rates of stereotyping were lower ($r=-.45$, $p< .05$). Davenport and Berkson's analyses point to a reciprocal relationship between stereotypic behaviors and responses directed toward the environment. It is possible that the very nature of the stereotyping interferes with more appropriate environmentally-directed actions. Davenport and Mason (1964a, 1964b) found that the rate of object manipulation was lower in stereotypers than in non-stereotypers only while they were engaged in stereotypic acts which precluded the performance of object manipulations. Thus, those subjects who engaged in primarily posturing and complex hand movements manipulated objects less than subjects who primarily rocked and swayed. It should be noted, however, that neither Davenport and Berkson (1963) nor

Berkson and Mason (1964a, 1964b) differentiate between appropriate and inappropriate object manipulations. It is, therefore, possible (and even likely) that they have included stereotypic object manipulations in this class of object manipulations. Nonetheless, there seems to be some value in noting the differentiation between self-directed and environmentally-directed actions. This difference in the level of environmental responsiveness of stereotypers versus non-stereotypers in the retarded population is also found in autistics (Hutt & Hutt, 1970). Autistic stereotypers engaged in fewer environmentally-oriented behaviors (manipulation and play with objects, initiation and response to social contact) than did non-stereotyping autistics, especially in situations demanding a social response. Greenbaum (1968) also found that in free play situations autistic children with stereotypies engaged in less social interaction and less appropriate environmental manipulations than their non-stereotyping counterparts. Even when measured by movement from place to place around the ward (Berkson, 1964), stereotypers interact less with the environment. They seem to be oblivious to most environmental stimuli.

Stereotypies as Responses to Environmental Stimuli

Despite this apparent lack of environmental connectedness, environmental manipulations have been shown to decrease the rates of stereotypies (Wolff, 1968). An active adult, whose interaction with the child interferes with stereotyping can temporarily lower the rate of stereotypic behaviors (Moseley, Faust, & Reardon, 1970).

Hollis (1971, 1978) brought body rocking under the control of a variety of reinforcement schedules. High-rate rocking was decelerated by differentially reinforcing low rates of rocking, while differential reinforcement of other behaviors (e.g., pulling on a suspended ball) eliminated high-rate rocking. Murphy, Nunes, and Hutchings-Ruprecht (1977) were also able to bring stereotypic behaviors under the control of differential reinforcement, using kinesthetic stimulation as the reinforcer. These results suggest that stereotyped motor behaviors may be maintained by the reinforcement patterns established by the social consequences (e.g., attention) they produce (Carr, 1977; Lovaas, Freitag, Gold & Kassorla, 1965; Romanczyk & Goren, 1975). In fact, Baumeister & Forehand (1973) have proposed that stereotyped motor behaviors are instrumental in avoiding the aversive aspects of social contact or a failure to perform even simple tasks.

This line of reasoning has led to the hypothesis that those children who engage in fewer environmentally-oriented behaviors (the stereotypers) do so because they lack the specific appropriate skills necessary to successfully engage with the environment. Hutt and Hutt (1965) note an increase in stereotypic movements as general environmental complexity increases. Hollis (1971, 1978) found that rates of body rocking increase in the presence of strong auditory stimulation (95 dB). When retardates are tense or uncomfortable (hungry, cold, wet), the rate of stereotyping increases (Klaber & Butterfield, 1968). Even being in an unfamiliar surrounding (as opposed to a

familiar dining room or dayroom) tends to increase the rate of stereotypic behaviors (Baumeister & Forehand, 1973; Berkson & Mason, 1964a). In general, persons who do not exhibit the relatively complicated response repetoires required by their environments seem more likely to engage in stereotypic motor behaviors. It should also be noted that the blocking of goal-directed behavior (sudden removal of food or stopping previously functional lever-pressing) has been shown to cause an increase in the rate of stereotyping (Forehand & Baumeister, 1970a, 1971).

Further evidence for this "skills deficit" explanation of stereotypies can be found in intervention studies. Berkson (1964) has noted that attempts to reduce stereotyped motor behaviors are most likely to be successful if approached through the development of alternate environmentally-directed activities. It is important to "fill in the gap" left in the behavioral repetoire when self-directed undesirable behaviors are eliminated, or these stereotypies are likely to recur (Measel and Alfieri, 1977). Again, the level of general ability and the relative development of specific skills seems to play an important part in stereotyping. This would seem to be a very simple explanation (based within the subjects) for the occurrence of stereotypic motor behaviors in developmentally disordered populations: stereotypers have no other more appropriate responses available to them.

This simple explanation does not, however, account for the observation that stereotypic behaviors often increase during periods of low environmental stimulation (Kaufman & Levitt, 1965; Klaber & Butterfield, 1968). Additionally, the presentation of complex visual stimuli (pictures) has been shown to lead to a decrease in the occurrence of stereotypic rocking (Baumeister & Forehand, 1970b; Maris, 1971). Perhaps stereotypers have a very narrow range of optimal environmental stimulation.

In fact, Greenbaum sees stereotypers as highly susceptible to fluctuations in environmental arousal. In light of the homeostatic theory of stereotypies, stereotypic motor behaviors are part of a process whereby the organism seeks to maintain an optimal level of stimulation, minimizing frustration (Baumeister & Forehand, 1973; Dollard, Miller, Doob, Mowrer & Sears, 1939), tension (Lourie, 1959), fear (Stroh & Buick, 1968), or arousal (Berkson, 1967). Essentially, stereotyped motor behaviors are seen as modulation behaviors (Leuba, 1955): when overall stimulation is high, the organism seeks to block external stimulation through "self-stimulating behaviors"; when the overall stimulation is low, the organism seeks to increase stimulation, e.g., through proprioceptive and tactile inputs (Bachman, 1972; Guess, 1966; Lovaas, Litrownik & Mann, 1971).

The research regarding stereotypic motor behaviors raises a great many questions. No single theoretical position (physiological, developmental, skills-deficit, homeostatic) can comfortably embrace

all of the findings. It is clear that stereotypies can be affected by environmental manipulations. It is also clear that changes in environmental stimuli do not account for all of the variance seen in stereotypic motor behaviors. There seem to be some uncharted differences within the retarded population which contribute to the variance in the patterns of response to the environment. Stereotypers seem to be less engaged in their environment: they spend less time interacting with other people and things than do non-stereotypers. The exact nature of this relationship is unclear, but it seems as though stereotypers may not be able to approach the environment in a successful manner. Yet, general developmental level does not account for the presence of stereotyping. It seems as though stereotypic behaviors might be tied to the development of specific skills, especially those skills necessary for successful environmental and social engagement. It has been suggested that language ability is an important environmentally-oriented skill to explore with relationship to stereotypic behaviors.

Thus, it is the general theoretical perspective of this paper that there are variables within the stereotyper which account for a large proportion of the differences between the responses of stereotypers and non-stereotypers to environmental stimuli. At this point in the exploration of the phenomena, the etiology of such subject variables is best left unspecified.

Purpose of This Study

The occurrence of stereotypic motor behaviors cannot be accounted for strictly on the basis of environmental stimuli. Nor does the generally retarded developmental level (i.e., IQ) account for the presence of stereotypies within the retarded population. It has been suggested that an examination of the retardate's development of more specific skills, particularly those skills required for successful environmental and social engagement, might shed some light on the question of the basis of stereotypic motor patterns.

This paper proposes to explore the nature of the relationship between stereotypic motor behavior and language ability in severely developmentally disordered children. It is suggested that those children at the most primitive stages of communicative development will exhibit the highest rates of stereotypic motor behaviors.

Furthermore, it is proposed that these stereotypies are most likely to emerge at times when these children experience a dearth of appropriate responses. Since language is an important aspect of social behavior, it is hypothesized that those children with the most profoundly impaired language capabilities are likely to increase their rate of stereotypic behavior when they are faced with social stimuli.

CHAPTER III

METHOD

The methodology of this study involves three distinct phases: (1) the selection, pretesting and grouping of subjects, (2) the filming of subjects in various treatment conditions, and (3) the scoring of the films.

Subjects

Subjects included in this study were 15 severely developmentally disordered children (8 males, 7 females), ranging in age from 3 years, 6 months to 7 years, 10 months.

Selection Criteria. Subjects were selected from the populations of three day schools belonging to the Chicago Association for Retarded Children. Every school was represented in each subject group (see Groups below). All children in these schools have been excluded from public schools and have been judged to be within the severe/profound range of mental retardation. Children were selected for pretesting if they were between the ages of three and eight years, had been in school for less than two years (mean length of schooling, eight months) and had (according to teachers' reports) recently exhibited some form of stereotypic motor behaviors. Children were excluded from this study if they exhibited significant physical deficits which

interfered with mobility, frequent uncontrolled seizures, or severe self-injurious behaviors. Children were also excluded if they had previously been in residential institutions or if English was not the primary language of the child's family.

Parents of those children who met the above criteria were sent a letter informing them of the nature of the research and asking them to sign and return consent slips (see Appendix). A total of twenty-four consent slips were returned. These twenty-four children were further screened and placed in the appropriate language groups through the following pretest procedures.

Pretesting. The Denver Developmental Screening Test ("Denver", Frankenburg, Dodds, and Fandal, 1970) was used as a measure of general developmental level. The Denver consists of four subscales: Personal-Social, Fine Motor-Adaptive, Language, and Gross Motor. A normal child is expected to master the 105 tasks in all areas by six years of age. Children were judged to exhibit significant delays in a given area at the age level at which they failed two items normally passed by 90% of the children of that age level. (This is the standard defined in the test manual.)

The Sequenced Inventory for Communication Development ("SICD", Hedrick, Prather and Tobin, 1975) yields age level scores for both receptive and expressive language. Receptive capabilities are measured by 34 multi-part tasks focusing on awareness, discrimination, and

understanding. Expressive capabilities are sampled by 46 multi-part items emphasizing imitation, initiation, and responsiveness.

Testing procedures took approximately thirty minutes per child. Recording of responses and scoring of these tests was done by the primary researcher, while the research assistants presented test items and interacted with the children. Assistants throughout this research were three undergraduate female psychology majors who had at least two years volunteer experience with severely developmentally disordered children. Assistants had been carefully trained and had rehearsed the administration of the tests several times with both normal and developmentally disordered children. Testing standards required for the validity of scores were upheld by all three assistants.

Twenty-two children were tested. Five children were eliminated at the point of testing procedures: three children were unable to perform even the most basic tasks of the screening procedures, so no standard levels could be assessed; two children exhibited very well-developed sign language vocabularies for which the testing protocols could not account. The remaining seventeen children were classified into three groups. Table 1 presents the results of this pre-testing and grouping.

Groups. Group I was a nonverbal group composed of seven children who used no functional words, either verbally or manually (signing). (It is important to note that two children were later dropped

Table 1: Group Means--Denver, SICD, Chronological Age

	Mean Chronological Age	Denver-Mean Scores				SICD-Mean Scores	
		Language	Personal-Social	Fine Motor	Gross Motor	RCA	ECA
Group I	4yr. 11mo.	11mo.	22.4mo.	23mo.	23.6mo.	10.4mo.	≤4mo.
Group II	6yr. 0mo.	11mo.	31.8mo.	35.4mo.	30.8mo.	14.4mo.	12.2mo
Group III	5yr. 10mo.	33.4mo.	35.6mo.	40.8mo.	35.8mo.	22.4mo.	12.8mo.

from this group because they were unable to be present for the completion of the filming, so the analyses were calculated on the basis of five children in this group.) On the Denver, all of these children exhibited significant Language delays at the 11 month level (the age level at which meaningful verbal responses are required); Personal-Social scores ranged from 20-24 months ($\bar{X}$=22.4); Fine Motor, 20 to 27 months ($\bar{X}$=23); Gross Motor, 22 to 24 months ($\bar{X}$=23.6). On the SICD, the mean Receptive Communication Age (RCA) for this group was 10.4 months (range, 4 to 16 months). All children in this group received an Expressive Communication Age $\leq$ 4 months (lowest possible scores). Chronological ages of Group I ranged from 3 years 6 months to 7 years 10 months ($\bar{X}$=4 years, 11 months).

Group II consisted of five children who were observed to have some verbal language and whose sign language was limited to fewer than five signs, only in the presence of the requested object. These children exhibited communication skills grossly below their general developmental levels. On the Denver, the children in this group all exhibited significant delays in the Language area at the 11 month level; Personal-Social ranged from 20 to 51 months ($\bar{X}$=31.8); Fine Motor, 27 to 42 months ($\bar{X}$=35.4); Gross Motor, 22 to 36 months ($\bar{X}$= 30.8). Both RCA and ECA yielded depressed scores, with no significant difference between the RCA and ECA (i.e., difference $\leq$ 4 months). The mean RCA equalled 14.4 months (range, 12 to 24 months); the mean ECA was 12.2 (range, 8 to 24 months). Chronological ages ranged from 5 years

1 month to 7 years 10 months ($\bar{X}$=6 years).

The five children in Group III also exhibited some verbal language and used fewer than five signs. However, for this group, testing indicated that language levels were appropriate to general developmental levels (though both were retarded compared to chronological age). Language scores on the Denver ranged from 21 to 48 months ($\bar{X}$=33.4); Personal-Social, 22 to 51 months ($\bar{X}$=35.6); Fine Motor, 24 to 54 months ($\bar{X}$=40.8); Gross Motor, 22 to 60 months ($\bar{X}$=35.8). All children in Group III exhibited significant differences (as defined by the SICD testing manual) between RCA and ECA on the SICD (differences > 4 months). The mean RCA for this group was 22.4 months (range, 16 to 32 months); the mean ECA was 12.8 months (range, 4 to 20 months). The mean difference between RCA and ECA was 9.6 months (range of difference, 8 to 12 months). Chronological ages ranged from 3 years 6 months to 6 years 9 months ($\bar{X}$=5 years 10 months).

Experimental Conditions and Filming

Each child was videotaped for four fifteen-minute sessions over a period of several days. Typically, the taping was done on four days over a two-week period. However, subject absences caused three children to be filmed in three days (over two weeks); and in two cases, the four filming days were spread over three weeks. Videotaping was done during school hours in a familiar room of the school. At two schools, filming was done in the speech/language therapy room. In the third school, filming was done in an extra tutoring classroom.

The rooms were quite small, averaging around 60 square feet. For purposes of the experiment, these rooms were stripped of toys and most equipment. Cabinets were locked, materials covered, etc. A chair and table were left in each room. During pre- and post-stimulus measures and the Non-Social stimulus condition, the researcher observed the filming from behind a one-way glass. Videotaping was done with a Sony Betamax portable camera and recorder.

Each taping session included a five-minute pre-stimulus period, a five-minute stimulus presentation, and a five-minute post-stimulus period. At the beginning of each five-minute period, the child was seated in the chair, away from the table. The child was asked to wait in the room and told that the researcher would return soon. During pre- and post-stimulus periods, there were no toys available for play and no one interacted with the child. In some cases, adult intervention was required during pre- or post-stimulus periods (e.g., a child was in danger of hurting himself or permanently damaging the environment). When such intervention was necessary, the observation period was completely retaped. No single child needed to be retrained more than twice during the entire filming process.

Two distinct stimulus conditions were presented, and each subject was exposed to each condition twice. The initial treatment presentation was counterbalanced randomly across subjects. After the initial treatment period, treatments were alternated across filming sessions. Thus, one-half of the subjects were exposed to the Social

condition in the first filming session, the Non-Social condition in the second filming session, Social third, and Non-Social fourth. The other half received these treatments in the reverse order.

The Non-Social stimulus condition involved the placement of several colorful, attractive toys (soft plastic blocks, stacking rings, a furry stuffed animal, a toy truck) within the visual field of the child. There was no social interaction with the child during the Non-Social stimulus condition.

In the Social stimulus condition, the primary researcher attempted to engage the child in play by talking, gesturing, tickling, etc. The adult did not restrain the child or physically shape any behaviors such as looking, playing, sitting, etc. Thus, the adult encouraged, but did not force, social contact.

Scoring

Scoring criteria were adopted from those definitions used by Berkson (1964) and Berkson and Davenport (1962). Nine categories of scorable behaviors were identified:

(1) Body rocking--repetitive movement of torso back and forward or side to side

(2) Pill rolling--repetitive rolling movements of thumb in opposition to fingers

(3) Complex hand movements--repetitive movements of hands in contact with each other or with nothing

(4) Body twirling--more than one continuous full turn around the body axis in any body position

(5) Manipulate objects--slap/pat (momentary contact with flat of hand), scratch/tap/pick (any contact with ends of fingers), and rub (continuous moving contact with flat of hand)

(6) Mouthing objects--any action including object contact with mouth (e.g., suck, lip, bite, lick, etc.)

(7) Mouthing self--any action including mouth contact with another part of the body (e.g., suck, lip, bite, lick, etc.)

(8) Manipulate self--slap/pat (momentary contact with flat of hand), scratch/tap/pick (any contact with ends of fingers), and rub (continued moving contact with flat of hand)

(9) Head banging--repetitive contact with head with environment or some other body part.

All behaviors were allotted one point for each five second interval during which the child engaged in that behavior. Functional behaviors (e.g., appropriate play with toys or moving a chair to a desired position) were not scored. Points were recorded on grids marked off in five-second intervals (see Figure A).

In order to standardize the procedures for the scoring of the videotapes, all three assistants underwent the following training program. The operational definitions of the scorable behaviors were discussed and the assistants viewed a two-minute film, with the primary researcher

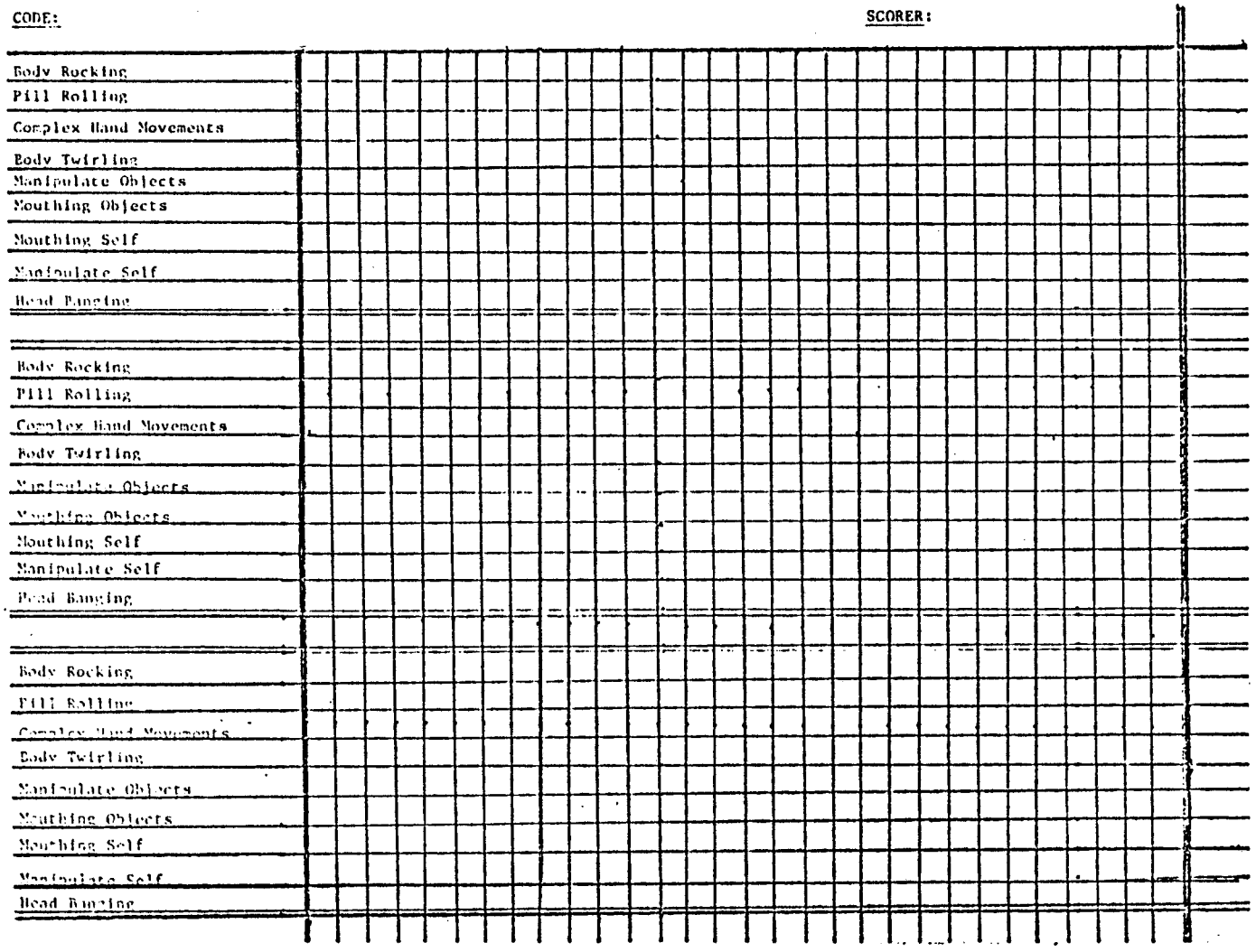

Figure A Scoring Sheet

pointing out examples of specific behaviors. Each assistant then independently scored a five-minute film of the same child and discussed their scoring among themselves and with the primary researcher. This procedure was repeated three times over a period of two weeks. At the end of this time, the raters independently scored five-minute films of each of four different children, using the experimental scoring procedures. None of the children in the reliability procedure were subjects in the primary research project.

Reliability coefficients were found to be quite high, ranging between .97 and 1.00. Table 2 reports the mean levels of agreement among the three raters for the total of nine behaviors scored for four subjects in five consecutive one-minute periods. These results support the conclusion that the raters were seeing the stereotypic behaviors in the same children at the same time. To further establish the degree of reliability across raters, an analysis of variance (3 Raters X 5 Times X 4 Subjects) was performed in order to test whether the raters were seeing the same individual behaviors at the same time (See Table 3). No significant results were found for the effects of Raters, Time, Subjects, or any interaction of these variables. The raters were agreed on the scoring of these nine different behaviors in different children (i.e., no main effects or interactions of Raters and Subjects). Furthermore, the raters saw the same stereotypies in the same child at the same point in time (i.e., no Raters X Time X Subjects effects).

Table 2: Mean (n=3) Interrater Reliability Coefficients by Subject for Sequential Five-Minute Periods

	Time: 1	2	3	4	5
Subjects: 1	1.00	1.00	.994	.996	1.00
2	1.00	.998	.994	1.00	1.00
3	.997	.989	.998	.986	1.00
4	1.00	.998	1.00	1.00	1.00

Table 3: Within Subject ANOVA of Observed Frequencies of Behaviors as a Function of Raters (3) and Sequential Five-Minute Periods (5)

Source of Variance	Degrees of Freedom	Body Rocking MS	Body Rocking F	Pill Rolling MS	Pill Rolling F	Complex Hand Movements MS	Complex Hand Movements F	Body Twirling MS	Body Twirling F	Man. Objects MS	Man. Objects F
Between Subjects	3	27.39		7.71		29.69		1.00		.86	
Within Subjects	56	12.05		3.34		5.83		3.68		3.51	
Raters	2	8.52	.33	7.62	.70	10.47	.52	3.65	.29	13.65	3.63
Raters x Subjects	6	25.96		10.91		20.15		12.65		3.76	
Time	4	6.27	.73	.86	.36	3.14	2.16	3.05	1.66	.54	.18
Time x Subjects	12	8.59		2.36		1.45		1.85		2.99	
Raters x Time	8	13.52	1.22	.78	.27	6.59	1.55	2.92	1.07	2.13	.56
Raters x Time x Subjects	24	11.07		2.85		4.25		2.73		3.82	
Total	59										

Table 3: (cont'd) Within Subject ANOVA of Observed Frequencies of Behaviors as a Function of Raters (3) and Sequential Five-Minute Periods (5)

Source of Variance	Degrees of Freedom	Mouthing Objects MS	Mouthing Objects F	Mouthing Self MS	Mouthing Self F	Manipulate Self MS	Manipulate Self F	Head Banging MS	Head Banging F
Between Subjects	3	41.47		14.89		9.47		14.42	
Within Subjects	56	24.92		2.52		3.81		3.95	
Raters	2	33.1	4.69	7.47	1.38	6.61	.92	1.52	.15
Raters x Subjects	6	6.66		5.42		7.22		10.38	
Time	4	7.68	.32	.35	.32	.64	.21	.21	.14
Time x Subjects	12	24.38		1.08		3.06		1.49	
Raters x Time	8	19.23	.57	1.30	.45	1.05	.23	.56	.17
Raters x Time x Subjects	24	33.83		2.87		4.54		3.20	
Total	59								

In view of the high levels of interrater reliability, each experimental videotape was reviewed for scoring by two of the three trained raters. The raters were blind to the language capabilities of the children. The audio portion of each tape was erased, and an audio tape marking off sixty-five second intervals was dubbed over each five-minute videotape. Several days after the first scoring, the same raters blindly rescored each tape twice. A behavior was judged to have been scored positively and was allotted 1 point per five-second interval if the rater scored that behavior in at least two reviews of the film. The score of each subject for each behavior in each one-minute period was the sum of points allotted to that behavior by both raters. Thus, the score for each behavior in each one-minute period ranged between 0 and 24. Points were tallied on a minute-by-minute basis by the primary researcher.

CHAPTER IV

RESULTS

The design of this study calls for the comparison of the frequencies of a number of different behaviors across four trials of three sequential five-minute periods, encompassing two different conditions (two treatment trials apiece) and pre- and post-stimulus measures. Each trial includes three periods: pre-stimulus, stimulus, and post-stimulus periods. In general, this study demonstrates minimal effects of verbal ability on most stereotypic motor behaviors. The exception is the behavior "Complex Hand Movements." Furthermore, the type of stimulation provided does not affect the rate of most stereotypies measured (with the exception of Manipulating Objects). There are no significant interactions to be reported. Before these results are reported in detail, it will be useful to examine several preliminary steps to the analyses.

Preliminary Analyses

It should first be noted that the results are tabulated on the basis of eight different stereotypic motor behaviors, rather than the nine behaviors originally presented for scoring. Tabulation of the absolute number of points per behavior revealed that Pill Rolling was scored during only seven five-second periods across all subjects and all conditions (total of 10,800 scoring periods for this behavior).

As a result, Pill Rolling was eliminated from the analyses.

Table 4 reports a summary of the results of a Pearson Product Correlation among the eight remaining dependent variables within five-minute periods across subjects. There was a total of twelve five-minute periods per subject (2 conditions X 2 trials per condition X 3 five-minute periods (pre-, stimulus, post-) per trial) for each behavior. Table 4 shows the number of periods in which correlation between behaviors were significant at the .05, .01, and .005 levels. Note that, for the most part, these behaviors are not intercorrelated. The exception is with respect to Manipulating Objects and Mouthing Objects. It seems as though the mouthing of objects is tied to their manipulation. This is a reasonable coincidence: the act of mouthing (in most cases) necessitates the handling of an object and this act of transportation may be perceived as an inappropriate manipulation. There is also a slight tendency for Complex Hand Movements and Body Rocking to occur simultaneously. The remaining behaviors occur independently of each other. The independence of these behaviors is important as a basis for the later analyses. Because virtually all behaviors were independent of each other, univariate analyses of variance were used to examine differences in the dependent variables across groups and conditions.

It is important to note that while $p < .05$ is generally considered an indicator of statistical significance, the large number of analyses conducted in this investigation warrant the use of a more

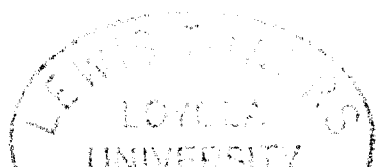

Table 4: Frequencies of Significant Intercorrelations Among Behavioral Occurrences Over Twelve Five-Minute Periods

	# of cases(to 12) significant	Body Rocking	Complex Hand Movements	Baby Twirling	Manipulate Objects	Mouthing Objects	Mouthing Self	Manipulate Self	Head Banging
Body Rocking	p<.05	---							
	p<.01								
	p<.005								
Complex Hand Movements	p<.05	3	---						
	p<.01	0							
	p<.005	2							
Body Twirling	p<.05	0	1	---					
	p<.01	0	1						
	p<.005	1	0						
Manipulate Objects	p<.05	0	0	0	---				
	p<.01	0	0	0					
	p<.005	0	0	0					
Mouthing Objects	p<.05	0	0	0	1	---			
	p<.01	0	0	0	4				
	p<.005	0	0	0	6				
Mouthing Self	p<.05	1	1	0	0	1	---		
	p<.01	0	0	0	0	0			
	p<.005	0	0	0	0	0			
Manipulate Self	p<.05	0	0	0	0	0	3	---	
	p<.01	0	0	0	0	0	0		
	p<.005	0	0	0	0	0	1		
Head Banging	p<.05	0	0	0	0	0	0	0	---
	p<.01	0	0	0	0	0	0	0	
	p<.005	2	0	0	0	0	1	0	

conservative approach. Therefore, $p < .05$ will be considered to be indicative of statistical trends, and only those results with $p < .01$ will be considered statistically sound.

Principal Analyses

In attempting to test the differential effects of the two conditions, it is important to first test the effect of change in and of itself on the behaviors of subjects within different groups. That is, the effects of generalized treatment on subjects' behaviors need to be examined in order to fully understand any effects of specific treatments. Table 5 reports the results of analyses of variance testing the frequencies of each of the eight stereotypic behaviors as a function of Groups, Treatment Trial, and Periods (3X4X3). The most significant effect of Periods is seen in the observed frequencies of Manipulating Self ($p < .01$). The change from pre-stimulus to stimulus to post-stimulus periods had a significant effect on the rate of this behavior. Table 6 shows the mean observed frequency of Manipulating Self as a function of sequential five-minute periods. Subjects generally Manipulate Self more frequently in both pre- and post-stimulus periods than during treatment periods. There are no significant interaction effects for the Manipulating Self.

In Table 5, Mouthing Self also shows a trend toward significance for Periods ($p < .05$). Table 7 reports the mean observed frequencies of this behavior as a function of Periods. Once again, subjects are more likely to engage in this stereotypic behavior in pre- and

Table 5: ANOVA of Observed Frequencies of Behaviors as a Function of Groups (3), Treatment Trials (4), and Sequential Five-Minute Periods (3)

Source of Variance	Degrees of Freedom	Body Rocking MS	Body Rocking F	Complex Hand Movements MS	Complex Hand Movements F	Body Twirling MS	Body Twirling F	Manipulate Objects MS	Manipulate Objects F
Groups	2	544.05	.79	12671.17	4.19*	1.82	.98	7240.95	1.57
Subjects(Groups)	12	688.13		3021.09		1.86		4626.43	
Treatment Trials	3	51.6	.75	498.59	1.68	.61	.58	1096.01	1.97
Treatment Trials x Groups	6	75.18	1.09	296.85	1.00	.69	.66	372.13	.67
Treatment Trials x Subject(Groups)	36	68.71		296.41		1.05		556.94	
Periods	2	43.72	1.28	888.09	2.62	.60	.74	494.17	1.29
Periods x Groups	4	17.19	.36	381.68	1.12	1.17	1.44	737.68	1.93
Periods x Subject(Groups)	24	34.2		339.47		.81		382.19	
Treatment Trials x Periods	6	125.18	1.05	105.84	.89	1.45	1.32	823.01	2.82*
Treatment Trials x Periods x Groups	12	63.43	.53	87.51	.73	.60	.54	350.30	1.20
Treatment Trials x Periods x Subjects (Groups)	72	119.79		119.41		1.10		292.07	

*p<.05 **p<.01

Table 5: (cont'd) ANOVA of Observed Frequencies of Behaviors as a Function of Groups (3), Treatment Trials (4), and Sequential Five-Minute Periods (3)

Source of Variance	Degrees of Freedom	Mouthing Objects MS	F	Mouthing Self MS	F	Manipulate Self MS	F	Head Banging MS	F
Groups	2	3006.54	.89	1102.62	2.44	2180.34	.78	.87	.30
Subjects(Groups)	12	3378.13		452.61		2787.18		2.87	
Treatment Trials	3	102.01	.87	56.93	.18	278.21	.54	1.93	1.36
Treatment Trials x Groups	6	182.57	1.55	339.03	1.06	302.90	.59	1.10	.78
Treatment Trials x Subjects(Groups)	36	117.78		320.00		516.82		1.41	
Periods	2	345.44	3.36	897.82	3.56*	774.96	6.57**	.47	.48
Periods x Groups	4	40.04	.39	182.11	.72	78.22	.66	1.13	1.17
Periods x Subject(Groups)	24	102.87		252.30		117.87		.97	
Treatment Trials x Periods	6	81.45	.37	55.48	.51	38.94	.85	.97	1.55
Treatment Trials x Periods x Groups	12	111.46	.51	170.22	1.58	39.32	.85	.48	.77
Treatment Trials x Periods x Subjects (Groups)	72	218.48		107.86		46.05		.62	

*p<.05 **p<.01

Table 6: Mean Observed Frequency of Manipulating Self per Five-Minute Interval as a Function of "Pre-, Treatment, Post-" Periods

	Social 1	Social 2	Non-Social 1	Non-Social 2
Pre-Stimulus	14.13	8.27	10.4	12.8
Treatment	5.73	2.6	4.93	8.2
Post-Stimulus	12.53	6.0	14.53	13.2

Table 7: Mean Observed Frequency of Mouthing Self per Five-Minute Interval as a Function of "Pre-, Treatment, Post-" Periods

	Social 1	Social 2	Non-Social 1	Non-Social 2
Pre-Stimulus	12.93	10.07	13.53	9.40
Treatment	5.47	6.27	5.07	2.27
Post-Stimulus	12.93	8.73	11.20	12.93

post-stimulus periods than in stimulus periods.

Table 5 also shows a trend toward significance of the interaction of Periods X Treatment of Manipulating Objects ($p < .05$). This becomes more understandable by reference to Table 8, which shows the mean observed frequency of Manipulating Objects per five-minute period. The introduction of the Social Treatment tends to decrease the amount of Object Manipulation. When the Social Treatment is removed, subjects do not return to the higher pre-stimulus rate of object manipulation. On the other hand, the Non-Social Treatment promotes a slight increase in the rate of Object Manipulation. Once, again, recovery is poor. In the case of Non-Social Treatment trials, the post-stimulus rate of Manipulating Objects is higher than the pre-stimulus rate. Thus, the Social Treatment causes a drop in the rate of Object Manipulation which remains in effect for at least five minutes thereafter. The introduction of toys alone (Non-Social Treatment) has the opposite effect: subjects (regardless of Group) tend to stereotypically manipulate the objects available to them. And, even after the removal of the toys, subjects seem to find some objects to manipulate at a higher than pre-stimulus rate.

In the analysis reported in Table 5, Complex Hand Movements shows a trend towards the significance of an effect of Groups ($p < .05$). The cell means of groups across Periods and Treatments are quite revealing in this regard (Table 9). During the five-minute intervals, subjects in Group I engaged in Complex Hand Movements a mean of 59.97

Table 8: Mean Observed Frequency of Manipulating Objects per Five-Minute Interval as a Function of "Pre-, Treatment, Post-" Periods

	Social 1	Social 2	Non-Social 1	Non-Social 2
Pre-Stimulus	30.8	24.4	20.67	22.73
Treatment	11.73	10.4	29.07	28.0
Post-Stimulus	19.2	17.93	27.73	34.67

Table 9: Mean Observed Frequency of Behavior per Five-Minute Interval as a Function of Groups

	Body Rocking	Complex Hand Movements	Body Twirling	Manipulate Objects	Mouthing Objects	Mouthing Self	Manipulate Self	Head Banging
Group I	15.07	59.97	.17	51.4	13.17	9.1	27.77	.27
Group II	4.7	26.8	.47	67.83	31.33	20.13	11.13	.67
Group III	3.7	8.67	.03	18.77	7.7	13.4	7.63	.4

times; the mean for Group II is 26.8; for Group III the mean is 8.67. Clearly, the language grouping of subjects is correlated with the amount of Complex Hand Movements observed

A 3 (Groups) X 3 (Social, Non-Social, and Control Conditions) repeated measures analysis of variance supports this effect of Groups (Table 10). Once again, there is a trend toward significance ($p < .05$) for the effect of Groups with Complex Hand Movements. This main effect of Groups does not hold true for any other stereotypic behavior under investigation.

In this second of the principal analyses, the Pre- and Post-Stimulus Periods have been collapsed into the Control Condition. This was deemed a reasonable simplification of the analyses because only a single behavior (Object Manipulation) demonstrated a significant pre-treatment/post-treatment differential.

In fact, the analyses reported in Table 10 do show a strong effect for the variable Conditions for Manipulating Objects ($p < .01$). The effect of Conditions seen here for Manipulating Objects supports the Periods X Treatment effect reported above (Table 5) for this same stereotypic behavior. By reference to Table 11, it is once again clear that objects are most frequently manipulated in Non-Social and Control Conditions. The rate of Object Manipulation drops dramatically in the Social Stimulus Condition. This is consistent with the Period X Treatment effect reported above for this behavior: Object Manipulation decreased during the Social Treatment and remained depressed for at least

Table 10: Repeated Measures ANOVA of Observed Frequencies of Behaviors as a Function of Groups (3), and Conditions (3)

Source of Variance	Degrees of Freedom	Body Rocking MS	Body Rocking F	Complex Hand Movements MS	Complex Hand Movements F	Body Twirling MS	Body Twirling F	Manipulate Objects MS	Manipulate Objects F
Groups	2	596.24	.84	8929.34	3.95*	.74	1.09	9356.32	1.93
Subjects(Groups)	12	707.57		2258.22		.68		4855.68	
Conditions	2	188.07	1.82	610.01	1.02	.16	.33	6419.47	5.46**
Conditions x Groups	4	58.46	.57	193.09	.32	.22	.47	1703.53	1.45
Conditions x Subjects(Groups)	24	103.16		505.52		.48		1176.11	

*p<.05 **p<.01 ***p<.005

Table 10: (Cont'd) Repeated Measures ANOVA of Observed Frequencies of Behaviors as a Function of Groups (3), and Conditions (3)

Source of Variance	Degrees of Freedom	Mouthing Objects MS	F	Mouthing Self MS	F	Manipulate Self MS	F	Head Banging MS	F
Groups	2	2296.12	.73	463.91	2.37	1735.67	.78	.8	.30
Subjects(Groups)	12	3150.73		195.67		2212.05		2.71	
Conditions	2	118.87	.17	1057.27	7.01***	1113.62	2.92	.8	.88
Conditions x Groups	4	562.28	.79	147.17	.98	257.39	.67	.8	.88
Conditions x Subjects(Groups)	24	707.81		150.73		382.02		.91	

*p<.05 **p<.01 ***p<.005

five minutes thereafter. Non-Social Treatment increased the rate of Object Manipulation, which, again, held through the five-minute post-stimulus period.

The effect of Conditions reported in Table 10 for Mouthing Self ($p < .005$) needs to be considered in light of the analysis reported in Table 5. Earlier, Mouthing Self had been reported to show a Periods effect. That is, the act of intervention, in and of itself, affects the rate of Mouthing Self. The pre- and post-stimulus conditions (Control) show a higher rate of Mouthing Self than either Treatment Condition (Table 11). Thus, the effect here seems to be more a function of differences between the rates of Mouthing Self in Control versus Treatment periods, rather than any real differences between Social versus Non-Social Stimulus Conditions.

Table 11: Mean Observed Frequency of Behavior per Five-Minute Interval as a Function of Conditions

	Body Rocking	Complex Hand Movements	Body Twirling	Manipulate Objects	Mouthing Objects	Mouthing Self	Manipulate Self	Head Banging
Non-Social Stimulus	4.53	24.8	.13	57.07	18.0	7.33	13.13	.53
Social Stimulus	7.33	30.13	.13	22.13	14.33	11.73	8.33	.13
Control (Pre/Post)	11.57	37.5	.2	58.5	19.87	23.57	25.07	.53

CHAPTER V

DISCUSSION

This study was designed to explore the relationship of stereotyped motor behaviors to language ability in severely developmentally disordered children. It was proposed that the rates of various stereotypies would be observed to be greatest in those subjects with the least developed communicative abilities. It was further suggested that these stereotypic behaviors would occur with the greatest frequency during times when language ability would be most important, i.e., during times when the child is faced with social stimuli.

The design of this study allowed for the analysis of the patterns of several different stereotyped motor behaviors under different conditions (Social and Non-Social Stimuli, and Pre- and Post-Treatment Trials) in different subject groups (mentally retarded children with varying degrees of language ability). The use of videotape equipment permitted reviews of each subject's behavior and a high standard of reliability across raters for simultaneous scoring of nine different behaviors. This approach yielded a much richer picture than is seen in previous studies which focused on only one or two stereotypies or a generalized class of stereotypic movements. In fact, after studying a wide variety of stereotypic motor acts, Baumeister and Forehand (1973) proposed that different classes of stereotypies should be viewed

as the result of (and maintained by) different circumstances and that these different stereotypies might have different functional significance. The various patterns of effects seen in the nine stereotypic motor behaviors observed for this study seem to shed some light on the contradictory and equivocal results found in previous research.

The hypothesis regarding the correlation of language ability and stereotypic motor behavior found minimal support for only one of the eight behaviors included in the analyses. The frequency of Complex Hand Movements was found to be related to the language ability of subjects. This trend ($p < .05$) is patterned in the predicted manner, with decreasing rates of stereotyping across Groups I, II, and III. As predicted, those developmentally disordered children with the most primitive communication skills exhibited the highest rate of Complex Hand Movements. In this case, a subject variable, specific language abilities, above and beyond the general level of developmental retardation, was predictive of a particular pattern of inappropriate motor behaviors. The fact that this effect occurred for only one of the eight behaviors included in the analyses should not diminish its importance: Complex Hand Movements had one of the highest frequencies of occurrence in this study. The mechanism underlying this effect is still unexplored. Perhaps, as Lovaas (1977) proposed, language and thought are socially acceptable self-stimulatory activities which are supplanted by inappropriate stereotypic motor behaviors in those persons whose communication skills are undeveloped. On the other hand,

both a lack of language and the stereotypic Complex Hand Movements might have some common underlying physiological cause which is, as yet, undiscovered.

The proposition that those children with the most impaired language capabilities would exhibit the most stereotypic behaviors during periods of social stimulation did not find support in the results of this study. These groups did not respond differentially to the Social versus Non-Social Treatments. This tends to raise doubts about a skills deficit theory of stereotypic motor behaviors. If the lack of appropriate responses, in and of itself, were the primary cause of stereotypies in developmentally disordered populations, there should have been a higher rate of stereotypies at times when social skills (such as language) were required of "non-skilled" persons.

In fact, for Manipulating Objects the main effect of Conditions ($p < .01$) shows a very different pattern. Regardless of language ability, the presentation of the Social Stimulus caused a decrease in the rate of Object Manipulations. Furthermore, subjects did not show an immediate recovery to higher pre-stimulus rates of stereotypic manipulations. It is quite possible that the talking and touching of the experimenter during the Social Treatment distracted the children from their stereotypies. As such, this may be more of a measure of social distractibility rather than strictly a response to a social stimulus, per se. In future studies it would be useful to review the demand effects of this type of social stimulus and to more closely guard the

children's own "natural responses." This could be accomplished by looking at subjects' differential responses to an active versus a passive social stimulus person.

On the other hand, the opportunities for stereotypic manipulation presented in a situation in which the only stimuli available are non-social (toys) caused an increase in Object Manipulation. This is not surprising, and could be explained by the fact that there are simply more objects available. What is noteworthy, however, is the fact that this increase in rate of stereotypic manipulation of objects remained in effect even after the toys had been removed. A study of the duration of this effect might yield valuable information regarding program planning for developmentally disordered persons. Previously reported studies of Berkson and Mason (1964a, 1964b) and Davenport and Berkson (1963), in which these authors did not differentiate between appropriate and inappropriate (stereotypic) object manipulations, noted that those children with higher baseline rates of environmentally-oriented responses (in which they include any manipulation of objects) increased the rate of those activities when presented with a variety of toys. These studies may, in fact, have recorded the same phenomena seen in the current study. However, the interpretation of the data is quite different. The earlier studies saw this increase in "environmentally-directed acitivities" in a positive light when compared to the self-direction of other stereotypies (e.g., rocking). But if one were to look closely at the quality of the object

manipulations in these earlier studies, this positive interpretation might be diminished. That the rate of Object Manipulation should show such divergent effects as the result of different treatments supports the notion that, indeed, stereotypers are sensitive to environmental circumstances. This finding holds some implications for the treatment and elimination of such behaviors. Simply providing an "enriched" (in terms of toys and equipment) environment for some stereotypers--the object manipulators--might, in fact, increase the rate of stereotyping! It is suggested that any program with the aim of eliminating stereotypic object manipulations might effectively include some non-directive, but active social interaction with a friendly, playful adult. Indeed, this is the basis for such treatments as developmental play therapy or "theraplay." Again, the importance of this result is strengthened by the high frequency with which stereotypic Object Manipulation was observed to occur.

Mouthing Self also seemed to be affected by experimental conditions, but on closer examination, this was found to be an effect of generalized treatment. As such, it can be discussed in conjunction with the Periods effect shown for Manipulating Self. In the cases of Mouthing Self and Manipulating Self, an increase in environmental stimulation, regardless of the type of stimulation presented, resulted in a decrease of the stereotypic behaviors. This must be understood in view of the fact that of all the stereotypic behaviors under study, these two--Mouthing Self and Manipulating Self--are most clearly self-directed behaviors. Yet, these behaviors are strongly influenced by

environmental stimuli. Clearly, these stereotypies are not completely internally controlled. This points to a fact which is often forgotten in research on stereotypic behaviors: the orientation of the observed behavior does not necessarily describe the determinants of that behavior.

These data on Mouthing Self and Manipulating Self can also be seen as supporting the results of Klaber and Butterfield (1968) who found that, in general, stereotypic behaviors decreased as the opportunities for other more adaptive behaviors increased. In fact, they proposed that the amount of stereotypic motor behaviors observed among retarded persons in residential settings be used as a measure of ward program effectiveness. They suggest that enrichment of any kind will lead to decreased stereotypies. The results of the present study support this--but only for two of eight behaviors. This, again, implies different treatment programs for different types of stereotypies.

In looking at the effects of Social versus Non-Social Stimulus conditions and varying degrees of language capabilities, this study has explored both environmental and subject variables in seeking to understand stereotypic motor behaviors. In light of previous research, a simple answer would have been a great surprise. Instead, this study found that for some of the behaviors under study (Mouthing Self and Manipulating Self), any increase in environmental stimulation led to a decrease in the stereotypic act. For a different behavior (Object

Manipulation), the direction in the change of rate of the stereotypy was the result of the type of environmental input presented. Still another behavior (Complex Hand Movements) yielded a trend toward the effect of a subject variable (language), regardless of environmental conditions. It seems as though the various forms of stereotypic motor behaviors might indeed, be under different mechanisms of control, as Baumeister and Forehand (1973) have suggested. In this light, the discrepancies among the outcomes of the analyses for the various stereotypic behaviors observed are, in and of themselves, important experimental findings.

The separate examination of the patterns of eight different stereotypies across groups and conditions brought a great deal of depth to this study. But the very designation of the dependent variables has a limiting effect on the outcome. Pill Rolling was eliminated from the analyses because it occurred too infrequently. Body Twirling and Head Banging were also rare in this sample. Yet there were other stereotypic behaviors which were observed but were unscorable in this study. Several children, for example, bounced or jumped when they walked; others paced to and fro. These behaviors were certainly contributing to the overall activity level of the child, but they did not meet the defined scoring criteria. There is also a question of the intensity of the behaviors which were scored. For instance, one child might lightly tap a block on the table, while another bangs the block against the wall; yet both behaviors would be

scored as Object Manipulations. Behavioral scoring criteria could be made more precise. Intensity of rocking, for example, could be defined by the speed or distance travelled in each rocking motion. Maris (1971) has, in fact, developed a mechanical "rockometer" to record this type of intensity measure for rocking behavior. Unfortunately, this device severely limits the freedom of movement of the subjects and may, therefore, change the rate of stereotyping. While there are practical problems inherent in the measurement of the quality and intensity of these behaviors, such information would surely increase the potency of the dependent variables.

This study has yielded some promising data on the nature of the variables contributing to the presence of stereotypic motor behaviors in developmentally disordered populations. The prevalence of these behaviors among such persons warrants the continued attention of researchers. Stereotypies can be physically damaging, and their presence often interferes with the acquisition of other, more appropriate behavior patterns. Basic research isolating antecedent and correlative factors can lead to better programming of treatment for the retarded, autistic, and severely emotionally disturbed. It is hoped that the questions raised by this study will provide fuel for a wide range of studies attempting to delineate the determinants of specific stereotypic motor behaviors.

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APPENDIX

LOYOLA UNIVERSITY OF CHICAGO

6525 North Sheridan Road, Chicago, Illinois 60626 * (312) 274-3000

Dear Parent:

I am currently engaged in a study investigating the relationship between stereotyped motor behaviors (such as, rocking, finger twiddling, tapping or patting objects, etc.) and language ability. Through this study, I am hoping to find out more about what causes these behaviors in some children who are developmentally delayed. I am asking your permission to include your child in this study.

Involvement in this project will mean that your child will be videotaped for four 15 minute periods (during school hours) over the course of several days at his (her) school. During the videotaping, I will be watching your child play, both alone and with an adult. I will also test your child's language ability, both receptive and expressive. At no time will your child be subjected to any risk or physical discomfort. The video tapes will be viewed only by the researchers involved in this study. After the children's behavior has been carefully studied, the tapes will be destroyed.

I ask that you do not tell your child about the purpose of this study. It might change his (her) behavior if he (she) understood why he (she) was being videotaped. The children will be told that I want to see how they play.

The results of the study will, of course, be available to you after it is completed. At that time, I will be happy to discuss my findings with you. If you have any questions now, please feel free to call me at my office (274-3000, ext. 573).

I sincerely hope that you will permit you child to take part in this project. Projects like this help us to understand and serve your children better. Please indicate your consent by signing the enclosed form.

Thank you for your cooperation.

Sincerely,

Lorraine D. D'Asta
Psychology Department

This project has been approved by the review boards of Loyola University of Chicago and the Chicago Association for Retarded Citizens.

Jeanne Foley, PhD
Chairperson, Psychology Department

Timothy Monahan
Director of Children's Services
Chicago Association for
Retarded Citizens

Parental Consent Form

I, the parent of/guardian of _____ ,
(child's name)
age_____, agree to his/her participation in a program of research being conducted by Lorraine D. D'Asta.

I have read the letter explaining this research. I understand that no risk is involved and that I may withdraw my child from participation at any time. I further understand that my agreement or refusal to allow my child to participate in this study will in no way affect the quality of services offered to my child at school.

Signature: _____

Date: _____

APPROVAL SHEET

The dissertation submitted by Lorraine D. D'Asta has been read and approved by the following committee:

Dr. Deborah L. Holmes, Director
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Dr. Jill N. Nagy
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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Nov 21, 1980
Date

Deborah L. Holmes, PhD
Director's Signature