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A COMPARISON OF THREE PLAY PROCEDURES IN THE
MANIPULATION OF GAZE BEHAVIOR AND OBJECT USE WITH
AUTISTIC CHILDREN

City University of New York

PH.D.

1979

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by

Ellenmorris Tiegerman

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1979

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ABSTRACT

A COMPARISON OF THREE PLAY PROCEDURES IN THE
MANIPULATION OF GAZE BEHAVIOR AND OBJECT
USE WITH AUTISTIC CHILDREN

by
Ellenmorris Tiegerman

Advisor: Professor James K. Lang

This experiment was undertaken to determine the efficacy of three play interaction procedures in the manipulation of gaze behavior in autistic children and to determine the relationship between gaze behavior and object manipulation performances.

Subjects were six children with symptomatology of infantile autism who ranged in age from four years to six years.

Three experimental procedures, varying in the amount of manipulative control the child exercised over the experimenter, were presented across seventeen sessions. During each procedure, the child was seated opposite the experimenter

at a table with various objects. Duplicate objects were used by the experimenter.

In procedure I, the subject had complete manipulative control of the experimenter's choice of object, object manipulation, and when she started and stopped manipulating the object. In procedure II, the subject had control over the experimenter's choice of object, and when she started and stopped manipulating the object. In procedure III, the subject had no manipulative control over the experimenter's choice of object, action on an object or when she started and stopped manipulating the object.

Two procedures (each fifteen minutes in length) were presented during a thirty minute session. The order of presentation of the experimental procedures was randomized across sessions and within sessions. All six subjects were involved in each experimental procedure. A two factor analysis of variance for repeated measures was computed separately for frequency and duration of gaze behavior, and for frequency and duration of object manipulated performances.

Results were as follows:

1. There was a significant difference among the play procedures in developing gaze behavior and object manipulated performances.

2. Procedure I was most effective in increasing frequency and duration of gaze behavior.

3. Procedure I was most effective in increasing the frequency and duration of object manipulated performances.

4. Procedure II effected less of a frequency and duration change in gaze behavior and object manipulated performances than Procedure I.

5. Procedure III did not effect any changes in gaze behavior and object manipulated performances.

6. Changes in gaze behavior effected changes in object manipulated performances.

The results of this study indicate that the gaze behavior of autistic children is modifiable. They also provide support for the viewpoint that adult imitation of the child establishes and develops interaction (Rees, 1975). The relationship between gaze behavior and object manipulation highlights the importance of the role of gaze interaction as a prerequisite in the learning experience (Ross, 1976; Stern, 1974, Hartung, 1970). In addition, the results support the position that play experiences should be an integral part of the therapy regimen (Reilly, 1974; Vygotsky, 1976; Takata, 1974; Liebergott and Swope, 1976).

One value of this study is that it provided insight into the interactional parameters of three play procedures.

In turn, an analysis of these methodologies revealed valuable information concerning changes in gaze behavior and object manipulation performances. This information can be directly applied to the clinical context for purposes of remediation.

Future research might continue to examine contextual and therapeutic variables which affect gaze behavior in autistic children, as well as in other disordered populations. Longitudinal research might investigate how gaze behavior and object manipulation performances in the autistic child change over time. These data could then be compared to the developmental patterns in the normal child. Finally, future research might investigate gaze patterns in infants with the goal of early diagnosis and/or identification of gaze disorder.

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For their guidance, assistance and support, the writer wishes to express her appreciation to the individual members of the advisory committee, Joel Stark, Ph.D., Harvey Halpern, Ph.D., and James K. Lang, Ph.D. (chairman).

To Dr. Joel Stark I wish to indicate that this dissertation is a product of the Queens College Speech and Hearing Center's spirit and ideal. While working with you, I caught some of the magic and embarked upon this final project. You occupy a place of high professional esteem in my view.

To Ms. Claire Gross, Director of Iris Hill Nursery School, I express gratitude for support of this project. Data of this research were collected in that center with the assistance and cooperation of Ms. Gross.

To my parents, Rita and Morris Jacobs, I wish to indicate with much love that I have achieved this distinction because of your efforts and sacrifices. I owe you both a great deal.

To my loving husband, Sol, who provided the support and affection to make all of this possible, I dedicate

this opus. My accomplishments and achievements are yours as well as mine. Thank you for just being you.

Finally, I turn to my son Jeremy. If your first word is "dissertation," I am sure everyone will understand.

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CHAPTER I

OBJECTIVES OF THE RESEARCH

Introduction

There is a voluminous body of literature dealing with the child who displays deficits in attention (e.g., Douglas, 1972; Douglas, 1974; Dykman, Ackerman, Clements and Peters, 1971; Egeland, 1974; Newsom and Lovaas, 1973; Lovaas and Schrieberman, 1971; Lovaas, Schrieberman, Koegel and Rehm, 1971). Research with autistic children suggests that impaired cognitive, social and emotional development may be related to an attention deficit (Lovaas, 1971). While Ross (1976) recognizes the fact that attention is merely an inferred construct, which can be measured only by observing changes in behavioral performance, descriptive definitions of the term generally allude to a relationship between ongoing behavior and cognitive/perceptual processes. Thus, the term "attention" has been associated with psychological processes based on the presence or absence of often undefined behaviors.

Recognizing that the construct of attention is relatively undefined, a number of researchers have attempted to

describe the role of attention in the therapeutic learning experience (Stern, 1970; Hartung, 1970; Vine, 1973; Sulzbacher and Costello, 1970; Lovaas, Freitas, Nelson and Whalen, 1967; Jaffe, Stern and Peery, 1973; Hutt and Ounsted, 1966). Such researchers suggest that attention involves looking at or listening to one stimulus rather than at another, i.e., stimulus selection. A comparison of studies on looking behavior is complicated by a lack of clarity in the use of terms, concepts and related operations. It is not evident that these researchers were referring to the same behavioral response due to the profusion of terms used: Stern (1970) investigated gaze behavior; Vine (1973) referred to facial-visual signalling; Sulzbacher and Costello (1970) described eye contact; Lovaas, Freitas, Nelson and Whalen (1967) manipulated attending behavior; and Hutt and Ounsted (1966) referred to gaze fixation. In several instances researchers utilized more than one term, as in the following case:

Since nonspeaking autistic children are characterized by an unusually limited span of attention, as well as, an almost complete failure to attend to other people in general, it is imperative that the clinician first establish some control over this behavior. Imitative behavior appears to be partly contingent upon eyecontact and other-directed attention (Hartung, 1970; p. 207).

It should be noted that the same terms might be used for different concepts, or different terms for the same concept and that the underlying concepts were inadequately defined by

observable operations (Von Cranach and Ellgring, 1973).

Since the primary goal of this research was modification of a behavior which operationally falls within the category of attention, a behaviorally definable and measurable response had to be identified. The research of Stern (1974) presented such a term--gaze behavior--as a measurable performance. This term was selected (rather than attention or attending) because it is defined in terms of eye movements and does not necessarily infer the occurrence of psychological processes or other mental operations.

Stern (1974) notes that the study of gaze behavior permits observation of some of the earliest social operations in infants. Mathematical regularities in the gross temporal pattern of infant-adult gaze behavior suggest some universal property of human interaction which predates the onset of speech (Jaffe, Stern and Peery, 1973). By 3.5 months, the visual motor system is functionally mature, permitting fine voluntary control of gaze, which qualifies gaze behavior as prelinguistic social interaction (White, 1964). It is important to stress that control of the eyes is one of the few effective operations that is fully available to the infant during the infantile developmental period.

Stern (1974) reports that normal 3- to 4-month infants exhibit extreme head aversion, which functions to terminate

interaction with an adult. This observation is especially relevant in light of the fact that one of the most consistent features of infantile autism is an exaggerated and persistent form of gaze aversion (Hutt and Ounsted, 1966). The researchers state that gaze aversion (the failure to look directly at another individual) provides clinicians, therapists and teachers with a means of assessing the importance of gaze behavior in social interaction in normal children. Study of abnormal groups is valuable in that deviant behavioral performances are often dramatically displayed thereby providing easier observation of developmental mechanisms in normal children (Hutt and Ounsted, 1966). These researchers also question the commonly accepted diagnostic description of autistic children. The description of these children's behavior as aloof, abnormal, impersonal or detached, results primarily from their lack of gaze interaction with people. The behavioral characteristic--gaze aversion--provides a more clinically useful orientation than terms such as detached or impersonal.

Since little social interaction is possible without gaze interaction, gaze aversion limits the development of social interactions in autistic children. Thus, research oriented toward investigating procedures which modify gaze

behavior in autistic children may serve an important clinical function.

Goals of Research

The first goal of the present research involved the investigation of procedures (Independent Variable: I.V.) which might be effective in modifying the gaze behavior (Dependent Variable: D.V.) of autistic children. The question was whether the experimental procedures (I.V.) would change gaze behaviors. The nature of the experimental procedures was varied in terms of the degree of similarity (I.V.) between adult and child play performances. It was suspected that the similarity between the adult and the child's performances would affect the frequency of the child's gaze behavior with the adult.

The second goal of the research was to measure frequency and duration changes in gaze behavior (D.V.) during the course of intervention across the experimental procedures. The question was whether any of the experimental procedures would affect changes in gaze behavior.

The third goal of the present research was to measure frequency and duration changes in two types of gaze behavior (i.e., gaze to adult's face and gaze to adult's performance) within each experimental procedure during the course of intervention. The question was whether and how these two

types of gaze behavior changed (in frequency and duration) during the course of intervention.

The fourth goal of the present research involved investigation of a possible relationship between frequency and duration changes in gaze behavior (D.V. 1) and frequency and duration changes in the autistic child's manipulations of objects (D.V. 2). Specifically, the experimenter wanted to determine if changes in gaze behavior resulted in corresponding changes in object manipulations. An additional objective was to determine the way in which gaze (D.V. 1) and manipulation (D.V. 2) varied in relation to one another across experimental procedures (I.V.).

Relationship of this Research to Existing Research

The present writer is not aware of any empirical study designed to modify the deviant gaze behavior of autistic children and that is the purpose of this study. There are several factors which have contributed to the difficulty of such an experimental endeavor. First the importance of gaze behavior in normal children has only recently been investigated. Such studies have described the role of gaze behavior in mother-infant interactions and in the development of pre-linguistic social interactions. The implication for impaired populations suggests that deviant gaze behavior severely

limits the development of important social interactions between adult and child.

Perhaps more serious is the difficulty arising from the terminological differences among research investigators. In research involving impaired populations, the relationship between gaze behavior and therapeutic intervention is clouded by a profusion of terms: attention, attending, eye contact, attending skills, attentional deficit, attention skills. The definitions of gaze vary with the clinical orientation of the researchers (i.e., speech pathologist, psychologist, psychiatrist, medical practitioner). The various definitions, as well as methodological differences among investigators used to study gaze behavior, continue in turn to contribute to divergent clinical perceptions. Many researchers describe the need to alter deviant gaze patterns in children but the difficulty arising from the terminological differences among investigators interferes with research progress.

Autistic children are one of several populations described as having deviant gaze behavior. The deviant gaze pattern, known as gaze aversion, is the most conspicuous characteristic of this population of children. The problem of gaze aversion in clinical training makes modification techniques a necessity. It should be obvious that even the

simplest tasks or interactions cannot be presented by a clinician to a child if the child averts his gaze. Thus, gaze interaction with the clinician is a basic prerequisite to the learning situation.

The final factor, which contributes to a research investigation of gaze behavior, concerns the development of a definition which identifies observable, measurable performances. Only such a behavioral definition will yield performances which are amenable to manipulation and modification. The present writer is aware of several studies which describe the development of gaze behavior oriented to an adult's face: i.e., a form of behavior commonly called eye contact (Hartung, 1970; Hewett, 1965; Stark, Giddan and Meisel, 1968). The problem, however, is that much of what a child learns in the therapeutic situation does not occur on the clinician's face. To learn tasks, activities, and nonlinguistic semantic manipulations, the child's gaze must be oriented toward the clinician's hand and body movements more than to the face. There seems to be no available research devoted to the development or manipulation of this type of gaze behavior with impaired populations. The problem is highlighted by the fact that the child who learns to fixate visually on a clinician's face does not suddenly discover the environment. Thus, the establishment of gaze

behavior, which is facially oriented, does not assure the occurrence or development of other types of gaze behavior. The present writer has attempted to investigate the manipulation of two types of gaze behavior (i.e., gaze behavior oriented to the adult's face and gaze behavior oriented to the adult's performance) in a population of children whose most obvious feature is an exaggerated and persistent form of deviant gaze behavior--gaze aversion.

Importance of the Study

The importance of gaze interaction in the development of normal adult/child communication and social skills suggests a need to remediate gaze deficits in autistic children. The communicative function of gaze behavior makes it a necessary part of the therapeutic experience; training and learning cannot occur unless the child looks at the clinician and at the tasks which comprise the training regimen. Thus, from a treatment point of view, it is important to determine procedures which facilitate gaze interactions between the child and the adult.

The present research was designed to explore three kinds of experimenter/child interaction which resulted in changes in gaze behavior. The analyses of these methodologies revealed valuable information concerning contextual

and therapeutic variables which affect gaze behavior. Thus, manipulation of gaze behavior has important implications for clinical remediation techniques, as noted by Ross (1976).

If one could discover techniques to teach these (autistic) children the skill of attending to all relevant aspects of a stimulus in a learning situation, one would contribute significantly to their education (p. 54).

The gaze patterns developed experimentally in autistic children can then be compared to the developmental patterns in normal children.

Another value of the present research is that it was designed to explore the relationship between the changes of gaze behavior and the changes in object manipulation. This clinically relevant information suggests that gaze in autistic children might be a nonlinguistic prerequisite to the therapeutic learning experience. Since autistic children exhibit limited interactional skills, it was significant to find that a by-product of gaze interaction was a change in the frequency of object manipulation.

Finally, it should be noted that research can be judged to be valuable to the degree to which it fosters new researchable questions. The present study has served to stimulate the formulation of questions, relating to the areas investigated, for future research.

CHAPTER II

LITERATURE REVIEW

Introduction

In undertaking the present study, the investigator was concerned with determinants of the characteristics of gaze behaviors which are exhibited by autistic children. In order to carry out such a study, areas of research had to be considered which described the behavior to be studied: normal development, disordered populations and learning contexts. Learning contexts such as play interaction, object interaction and imitative interaction were presented for the following reasons:

- a. to highlight the important role of gaze behavior within these learning contexts;
- b. to describe the importance of these learning contexts for the autistic child;
- c. to highlight the relationship between these learning contexts and the experimental procedures described in the study.

This chapter will organize the discussion of relevant research around the following headings: normal gaze

development, gaze disordered populations, learning contexts, description of methodology and description of data analysis.

Normal Gaze Development

Many researchers have been concerned with the nature of the deficits found in autistic children (Churchill, 1972; Lovaas, 1978; Creak, 1972; Hermelin and O'Connor, 1970; Dalgleish, 1975; Stark, Rosenbaum, Schwartz, and Wisan, 1973). One of the most salient characteristics of infantile autism is gaze aversion (Hutt and Ounsted, 1966; Vine, 1973). Vine (1973) suggests that investigations of gaze behavior, especially between mother and infant, are particularly important for our understanding of the development of communication skills. Thus, to fully understand the implications of gaze aversion in autistic children, normal gaze behavior and development must be considered.

Bloom and Lahey (1978) posit that there are early signs of communication exhibited by the infant, which are precursors to language acquisition. These prelinguistic forms of interaction underlie the development of more complex forms of communication. Infant vocalization and gaze interaction have been observed as prelinguistic acts which constitute communicative interchanges. Interactions such as gazing and vocalizing are two of the earliest behaviors

available to infants that are communicative in nature. Perhaps the most important point is that the behaviors of infancy are precursors to later language skills and "are continuous with the later development of the content/form/use of language" (Bloom and Lahey, 1978, p. 76). Thus, the origins of language use begin in the infant's earliest gazing and vocalizing exchanges with caregivers in the first few months of life.

White, Castle and Held (1964) claim that the visual motor system reaches functional maturity by the third month of life, when other developmental systems are relatively less mature. Thus, mother-infant gaze interaction constitutes the first dyadic system in which both members have almost equal control over and facility with the same behavior.

Control of the eyes gives some measure of control over perceptual input. Regulating perception also applies to social stimuli; the control of gaze allows the infant to regulate from instant to instant his social and visual contact with the environment (Robson, 1967). Accordingly, gaze behavior has a social function. The study of gaze behavior permits observation of some of the earliest forms of social interaction. Social interaction or play at this developmental period is concerned mainly with the mutual regulation of gaze interaction. Within this dyadic play interaction,

maternal facial and vocal behaviors are elicited not simply by the presence of the infant but specifically by his gaze at the mother (Stern, 1974).

Stern (1971) states that the mother-infant relationship plays a large role in influencing the developing personality. He posits that researchers must identify specific maternal-infant behaviors, otherwise interactional analysis remains at the level of generalization and description. Behaviors associated with gaze interaction were chosen for studying mother-infant interaction. A portable television unit recorded all activity between a mother and her infant twins during three consecutive morning hours in the home environment. At the beginning of the study, the infants were three months old. Home visits occurred twice a week for three weeks, then every other month through the infants' ninth month, then every three months through their fifteenth month. The twins were in separate infant seats facing the mother, who sat on the floor directly opposite them.

Selected portions of the television tapes were converted to 16 mm motion pictures and viewed on a small gridded screen so that the speed and size of any motion could be quantified. The following motions were scored: infant head motions (eye gaze direction), rotational and nonrotational movement of the mother's head relative to the infant's face and motions of

the mother's upper extremities. The mother and infant behaviors were scored separately without reference to the record of the other member. The results indicated that the average duration of the face-to-face interaction was consistently longer for one infant; this difference was maintained in interactions with mother at 3, 6, 9 and 14 months. The difference between the two infants was present in all interactions observed. Given this consistent and distinctive behavioral difference between the infants at the early age of three months, it becomes important for researchers to determine to what extent this characteristic reflects differences in genetic factors or results from accommodation to observed differential maternal behavior. Stern (1971) concludes that the mother-child interaction is not solely directed by the mother. It is a mutual interactive event in which specific infant and maternal behaviors together produce communicative sequences.

Specific infant behaviors are of developmental interest because they establish the framework for later more complex forms of interaction. Stern (1971) describes the infants in later social interactions asserting that the interactive patterns identified during infancy were observed at fifteen months. "The performance of more complex behaviors at twelve to fifteen months is consistent with the

interpersonal patterns and behaviors developed at three months with visual motor behaviors" (p. 514). In conclusion, identifying and examining early social interactive behaviors may provide insight into the role of the mother-infant relationship in the development of communicative and linguistic behaviors in normal and impaired populations.

Jaffe, Stern and Peery (1973) indicate that a highly articulated conversational pattern characterizes the gaze interaction behavior of this developmental period. This pre-linguistic interaction is a social dialogue which is conversational and systematic in nature. The researchers observed six normal infants in the fourth month of life during free play with the mother. Observations were conducted in the home environment. One observer was positioned several yards behind the infant and scored adult gaze fixations of the infant's face. Another observer was positioned behind the adult and similarly noted infant gaze fixations of the adult's face. The dyadic gaze interaction was coded into one of four states: (1) neither looking, (2) only the infant looking, (3) only the adult looking, and (4) both looking at one another. The researchers propose a model of interpersonal constraint, which assumes that both mother and infant make statistically independent decisions to look at or look away. They conclude that the conversational coupling of early gaze behavior is a

precursor of later gaze patterns; thus, some universal formal property of dyadic communication is observable in the infant's gaze pattern long before the development of verbal linguistic forms.

Wolf (1963) has commented on the dramatic effect of eye-to-eye contact on increasing maternal responsiveness. The mother's gazes are extraordinarily long compared to average gaze exchanges (Argyle and Kendon, 1967). Mutual gaze between mother and infant often lasts over 30 seconds. The infant's gaze at the mother has the effect of reducing the probability of her gazing away. The mother, then, in the presence of an infant, alters her normal adult interactional behaviors and performs what can be called infant-elicited maternal facial, vocal and gaze behaviors. These behaviors make up a major part of the infant's world of social stimuli during play. Each infant gaze can be considered to be a learning trial. The infant is learning to participate within a social environment where visual interaction plays an important role in communication. The infant at this stage of development contributes to the communication interaction largely through the regulation of gaze behavior. During the social play activity with the mother (and other adults), the infant acquires experience with communicative social interaction.

Stern (1974) states that play between mothers and infants was chosen as an investigative medium because it consists mainly of social interaction. Dyadic communication and play at this developmental period are concerned mainly with the mutual control of gaze behavior. He comments that social behaviors must be studied in the presence of a partner, and in a natural setting which permits the behaviors of both members to be mutually elicited and maintained. A dyadic model provides an interactional system. Spontaneous play is one of the most important naturally occurring dyadic interactions in the infant's development. Stern focused on social behaviors mediated by distance receptors, namely visual gaze to the partner. He observed eighteen infants from their third to fourth month of life. He described the communicative patterns that emerge from the interaction of mother-infant and the role of the dyadic pattern in development. All data were collected in the home. To record gaze behaviors, one observer was placed several yards behind the mother, and another behind the infant. Observers recorded gaze interaction (frequency) and duration (time). The effect of infant's gaze on inhibiting maternal gaze aversion is strong, and reaches significance for all mothers with their infants. The variations in normal adult social gazing behavior constitute an important effect of the infant on the mother. The

mother deviates from the adult social communication pattern by assuming the role of an almost continuously gazing listener, and acts as if the infant were talking.

The infant also performs an array of facial, vocal and gaze behaviors. Stern (1974) states that gaze behavior is clearly a social phenomenon. Gaze alternation is possibly the first communication process the infant brings to the social situation. During interactional play the infant is less likely to avert his gaze and look away if the mother is gazing at him. The infant's response to maternal stimuli results in his regulating his gaze alternations to serve a social play function.

Bateson (1975) presents further evidence for the position that linguistic interchanges have their analogues in the prelinguistic mother-infant communicative interactions. As with adult conversations there is near constant communication in one modality (visual) and intermittent, alternating communication in another (vocal). The importance of gaze behavior in early social development has been described by several researchers which highlights the role of infant research in the study of the etiology of communication disorders.

In the communication interplay between mother and infant, the two are coparticipants in an ongoing interactive

event. The present study was conducted with data drawn from a longitudinal corpus of five children from birth. The investigation involved an analysis of tapes and films in order to identify the earliest development of social interaction between mother and child. The data indicate that social interactions similar to conversation were recognizable for all of the pairs before three months; due to the unstructured data collection system, not all were equally analyzable. The following criteria were used to select communicative interchanges: frequent vocalization by both mother and child; sustained gaze behavior; and absence of caretaking activities. Sequences selected by these criteria showed several regularities. Typically, mother and infant were less than a yard apart, with the mother's face frequently at the infant's level. Mother and infant interact by turns. The nature of the alternation indicates that the participants rarely interrupt one another. Bateson (1975) hypothesizes that a complex process is occurring during communication in which both mother and infant are receiving gratification and trying to maintain interaction.

The results of the Bateson (1975) research support the importance of studying infant communicative behaviors in interactional contexts. Interactions of this type are joint performances, governed by rules of coparticipation between

mother and infant. This suggests that attention to the interactional context should shed some insight into developmental and linguistic processes in early language behavior. The above analysis depends on a concept of conversation that focuses on the importance of exchange in maintaining social contact rather than on content. From this perspective, Bateson (1975) suggests that the interactions between the preverbal infant and his mother can be viewed as a "proto-conversation," equivalent at their level to the adult conversation.

The study of the development of social communication forms in interactional contexts may provide insights into communication disorders; "an interpersonal failure may underlie a failure in individual development, for instance, in autism" (p. 111). Bateson (1975) concludes that verbal behavior in the older child is the result of the development of prelinguistic performances in interactional contexts. To study the etiological components related to communication disorders, the prelinguistic counterparts of linguistic communicative forms should be investigated.

Gaze also serves a signal function in human interaction. The onset of visual gaze, as a signal, indicates a readiness and an intention to engage in a social communication interaction (Chance, 1962; Goffman, 1963). Similarly,

gaze aversion, as noted in autistic children, is a signal of the termination of, or reduction in the level of interaction and has been compared to social cut-off (Chance, 1962; Hutt and Ounsted, 1966). Gaze interaction also provides experience with a form of dialogue exchange. Later in development gaze patterns become coordinated with speech, so as to facilitate the flow of dyadic verbal communication. The clinical import of gaze play activity is that the infant learns to initiate and maintain interactive social contact (Kendon, 1967).

Stern, Jaffe, Beebe and Bennett (1975) have been involved in an ongoing research project on the ontogeny of communication. They have been studying naturally occurring interactions between mothers and infants in nonverbal communication during the prelinguistic period of development. The present study provides evidence that mothers and infants have two modes of vocal interaction with each other that differ structurally and functionally; a coaction mode and an alternating mode. The researchers suggest that "coactional vocalizing is not simply an early developmental pattern that later transforms into the alternating pattern of conversational dialogue, but that it is also an enduring mode of communication that shares much structurally and functionally with

the kinesic systems of mutual gaze, posture sharing and rhythm sharing" (p. 90).

Eight infants, consisting of four sets of twins, were involved in the study from their third to fourth month of life. The naturally occurring, undirected mother-infant interactions were videotaped in the home environment. Video tapes were analyzed to determine patterns of gaze interaction and vocalization. The present data indicate that the dyadic coactional vocalizing pattern follows closely the dyadic gazing pattern between mother and infant. In addition, coactional vocalizing occurs usually during mutual gazing. In another study, Stern (1974) also found that the gaze behaviors of mother and infant form a proto-conversation that constitutes an early dialogic system; both partners tend to create a preponderance of mutual gazes.

Stern, Jaffe, Beebe and Bennett (1975) posit that gaze and vocalization interaction performances are communicative acts which contribute to the formation of mother-infant bonding, early attachment behavior, and affective-emotional development. The researchers have provided evidence that two structurally different patterns of dyadic interaction (vocal and kinesic behaviors) exist between mother and infant by the time the infant is three to four months old. Further research must determine if these communicative patterns are

universal to all infants and if they appear as a developmental milestone between three to four months. It would then become important to identify infants who do not evidence the development of these communicative functions for the purposes of early identification and therapeutic intervention.

The importance of the studies described above can be seen when diagnostic considerations are of primary concern. The research procedures provide a methodology for measuring gaze patterns in infants and gaze disordered populations. Such a quantitative analysis might prove to be a useful tool in diagnosing and/or identifying children who are not responding to mother's gaze initiation. Early identification of children with deviant gaze patterns should result in careful observation to determine other signs of deficit. In addition, the determination of a gaze disordered population of infants, followed longitudinally, might shed light on some theoretical assumptions concerning the relationship between gaze disorder and emotional/affective/educational developmental problems. The discovery of such a relationship would have important clinical implications for gaze remediation in infants. It would support the premise that gaze remediation techniques be instituted as soon as gaze impairment is identified. The present writer suggests that the development of empirically based gaze intervention techniques has an

important place in the therapeutic experience of autistic children and infants.

For the clinician working with gaze disordered populations a therapeutic perspective seems to be the more pragmatic orientation, given "here and now" management problems. Interestingly enough, the present writer was not able to identify any experimental studies which were oriented toward modification of deviant gaze patterns. Stern, Jaffe, Beebe and Bennett (1975), however, suggest a learning theory model. When infant vocalization is viewed and treated as a response in the learning paradigm and the adult vocalization is viewed as the reinforcer, an alternating dialogic pattern will emerge. The present writer suggests that the validity of such an assumption can only be determined by empirical research. This raises a related clinical issue. If infant vocalization is viewed within the framework of a learning paradigm (i.e., either clinically for the impaired child or theoretically for the normal child) then is gaze behavior determined by the same variables?

Clinical research which is oriented toward developing modification procedures for gaze impairment serves an important function in the study of communication in disordered populations. Remediation procedures would develop gaze behavior and provide the basis for social and communication

learning between adult and child. Since gaze behavior is of critical importance developmentally and therapeutically, gaze aversion seriously limits interaction.

Gaze Disordered Populations

There is a sizable literature on children who display deficits in gaze interaction. Ross (1976) describes one population, learning disabled children, as those whose "learning is associated with difficulties in sustaining selective attention." Douglas (1974) reviewed the work she and her colleagues had done on the problems of hyperactive, learning disabled children to determine whether there is some basic dimension on which these children differ from normal children. The basic difficulty does not relate to intelligence, perceptual or conceptual, or short-term memory. Even activity level did not seem to be the critical aspect, although these children move around a lot. Douglas (1974) suggests that the inability to focus, sustain, and organize attentional strategies underlies maladaptive behavior in learning disabled children. When considering a training regimen, if the child's problem is with attention and impulse control, both would have to be taught. Ross (1976) suggests that impulsivity is a vague construct which has resulted in a number of studies dealing with remediation (Palkes, Stewart and Kahana, 1968;

Douglas, 1972). According to Ross (1976) simply teaching learning disabled children to slow down (not to be impulsive) does little to improve behavioral performances. When intervention is aimed at teaching them to attend to the distinctive aspects of stimuli (to attend selectively), the performance deficits can be overcome.

Egeland (1974) notes that learning disabled children trained to use more adaptive attentional strategies reverted to impulsive responses when they encountered more difficult problems. Ross (1976) suggests that impulsive responding may not be the cause but the effect of failure. These failure experiences could be a function of the learning disabled child's not having developed sufficient ability to use selective attention in gradually more difficult and complex tasks.

Mackworth, Grandstaff and Pribram (1973) present evidence that retarded, dysphasic and normal children display differences in gaze behavior and its relation to items in the environment. Ten dysphasic children attending the Scottish Rite Institute of Childhood Aphasia were involved in this investigation. All children were between the ages of 5 and 9 years; subjects were matched with a normal group on the basis of age and sex. The method used was to present simple pictorial material to discover whether the children differed in measurable nonverbal difficulties. A Wide Angle Reflection

Eye Camera was used to record where the children were looking on the display. With this apparatus the child places his forehead and chin against supports. The display consisted of a 4 x 4 matrix of white geometric symbols on a black background. It was presented for 10 successive 3-second trials. Then a novel symbol was introduced: one circle unexpectedly appeared as red, all the other symbols remained white. The test circle remained red for 20 trials and then changed back to white for the final 10 trials, which were therefore the same as the first 10 trials. A videotape record of the subject's pupil was made while he was looking at the display. The record showed a reflection of the display in the child's pupil. The main measure was the time that each child spent looking at the test circle, both when it was white and when it was red. Results indicated that the dysphasics as a group showed less habituation to novelty than the normal children tested.

Muir (1968) found that retarded children spend less (rather than more) time than normal children on informative areas in pictorial displays. Such children may have problems determining which details are important. Mackworth, Grandstaff and Pribram (1973) note that when the dysphasic children were ranked on the basis of verbal I.Q. score, they could be divided into two groups. The data indicated that the two

dysphasic groups behaved quite differently. The severe dysphasic children showed immediate and prolonged orientation to a novel stimulus, with no habituation. The mild dysphasic children were slower than normal to notice the novel stimulus; such behavior is characteristic of mildly retarded children. The researchers posit that gaze analyses provide predictive indications of children since "so much of language comprehension depends on the ability to make accurate predictions at high speed" (p. 443).

Friel-Patti (1976) found that language disordered children demonstrate significantly less gaze behavior during interaction than normal controls because they experience difficulty in the acquisition of overall communicative skills. Three of the language disordered children in her study spent fewer than five seconds out of twelve minutes looking at their mothers during mother-child interaction. Mean eye gaze for the normal children was 35.05 seconds, while the mean for the language disordered children was 15.44 seconds. The child-child interaction situation indicated results quite different from those of the mother-child condition. The number of gaze initiated episodes in the child-child condition was significantly greater for the language impaired children than for the normal children. The difference between the language disordered children's performance in the

mother-child condition and in the child-child condition warrants further discussion. In the mother-child condition, the mothers of the language disordered children were more directive in their interactions with their children than the mothers of the normal children. Though the language disordered children responded to their mothers' initiations, the number of child initiated interactions was much less for the language disordered children. The differences in performance across the conditions suggest the following relationships and implications:

1. Language disordered children exhibited fewer initiations in the mother-child condition than in the child-child condition. They exhibited a fewer number of gaze initiations because of the greater number of initiations on their mothers' part. This gave the children less of an opportunity to initiate interactions because they were placed in the role of listener.

2. The decrease in directives in the child-child condition resulted in an increase in the number of gaze initiations for the language disordered children.

From this investigation of the gaze and nonverbal behaviors of language disordered children, some clear trends are evident. First, language disordered children differ in their nonverbal, as well as linguistic behaviors, when

compared with their normal peers. Second, this difference appears to vary as a function of the interaction condition; interaction with the mother is clearly different from interaction with another child. The present writer suggests that further investigation of nonverbal behaviors in language disordered children should consider variables relevant to the development of gaze interactions.

There is another group of infants and young children showing abnormalities in gaze behavior, namely, those suffering from the syndrome of early infantile autism (Kanner, 1944). Hutt and Ounsted (1966) observed eight autistic children between the ages of three and six years in a hospital playroom with particular attention to their interactional behaviors. The researchers found that approach gestures (to an adult) in the autistic children were not different from those of normal children except for one feature--gaze aversion. The observations indicated that apart from gaze aversion, other components of social interaction exhibited by autistic children were those shown by normal nonautistic children. The description of these children's behavior as aloof, abnormal, impersonal or detached, results primarily from their lack of gaze interaction.

From detailed examination of cinefilms, Hutt and Ounsted (1966) discovered that 3- to 6-year-old

autistic children look at people with unusually brief gazes and very rarely permit mutual gazing. Hermelin and O'Connor (1970) provide evidence to support the premise that autistic children's gaze behaviors can be described as fluid and randomized. These eye movements are uncharacteristic of normal children, whose attention is selected and directed.

A number of questions invite research. Investigations of the development of facial-visual signalling, especially between mother and infant, during the first year, are particularly important for our understanding of the development of communication and interactional skills. Vine (1970) suggests that the occurrence of gazing and smiling in the infant is an indication of social responsiveness in later childhood. Longitudinal data on the subsequent social development of infants whose early gaze patterns were disordered would yield valuable clinical information with important implications for early diagnosis. Finally, the importance of gaze interaction in the development of communication and social skills in the normal child suggests a need to remediate gaze deficits in the populations of children described above independent of when diagnosis occurred.

Learning Contexts

Play Interaction

The tendency to exhibit behavior that laymen and professionals have labeled as "play" is universal in children. Further, it is generally acknowledged that such behavior is important to the development of adaptability, learning, cognition and social behavior (Weisler and McCall, 1976). Bruner (1969) has suggested that the function of play is to exercise and develop manipulative and interactional strategies which the child will later integrate into more sophisticated task-oriented sequences. A more general theory suggests that in play the child learns to affect and control activities he or she is unable to execute or dominate in other contexts. In young children, play develops control over animate and inanimate objects or contexts (Eckerman and Whatley, 1977). Recent analyses of early social interactions occurring during play suggest that much play behavior served to influence the actions of another child (Garvey, 1974).

Mueller and Rich (1976) posit that before an understanding of the early development of peer social interaction can progress, it is necessary to assess when children are acting socially. Their study provides some descriptive data and tests a methodology for studying socially directed behaviors. The subjects were five first-born males. All

children but one ranged in age from 13 to 15 months. The playgroup met for about 2 1/2 hours each Monday and Friday morning for three months. The room contained a variety of toys and play equipment. The playgroup was videotaped for one hour each Friday morning. Tapes were analyzed to locate all play clusters, their duration and participation. Clusters were operationally defined as periods of 10 seconds or more where three or more children focused their attention on a single object or activity. Each cluster was scanned for socially directed behaviors (defined here as vocalizing, laughing and/or manipulating a toy while looking at another child). When appearing without gaze interaction, the social character of these behaviors cannot be determined. However, when these behaviors occur simultaneously with gaze interaction, they take on a social character.

From their first session, 1-year-olds were found to cluster together. The analyzed tapes yielded a total of 42 clusters or one cluster for every fifteen minutes of tape. Clusters were found to be of about one minute in duration and were attended by nearly all the children in the playgroup. Early clusters invariably formed around a single child who was actively playing with an object. The quantity and quality of social behavior changed during the three-month experimental/observational period. As early as 1 year of age children

learn that peers, like toys, can be controlled through action. The researchers suggest that the changes in play indicate that children were now coming together for the purpose of initiating exchanges with each other and not simply with toys. This provides evidence that considerable interpersonal orientation and skill is present at 12 months of age.

Eckerman and Whatley (1977) provide evidence to support the premise that infants from at least 10 months of age are socially responsive to one another. By contrasting peer interaction in the presence and absence of toys, this study evaluates differences in social interaction between 1- and 2-year-old children across play contexts. Forty-four pairs of like-aged infants were involved in this study; half the pairs were 10-12 months of age and half were 22-24 months of age. At each age, half the pairs were assigned to a toys condition and half to a no-toys condition. The children were left free to play or interact without any adult direction or interference. Each session was 16 minutes in length. The primary goal was to describe in behavioral terms how each child acted upon and reacted to his peer. Two observers behind a one-way vision window sampled each child's behavior by focusing upon a single child at a time and then shifting focus at the end of 1 minute of observation. The observers continuously recorded the occurrence of predefined behaviors.

Peer-related behaviors were those developed in a prior study of infant peers (Eckerman, Whatley and Kutz, 1975). The criterion for judging behaviors to be peer directed or social in nature was the accompanying gaze interaction with or of the peer. The results indicate that infants as young as 10 months of age are attentive and responsive to unfamiliar like-aged peers. Whether toys were present or not, peers of both ages observed and interacted with one another frequently. The presence of toys provided new opportunities for interaction. When toys were not present infants more often contacted or stayed near the peer. Eckerman and Whatley (1977) conclude that "infants approaching 1 year of age were as responsive to the social versus nonsocial aspects of the novel play setting as infants approaching 2 years of age" (p. 1653).

Mueller and Brenner (1977) note that though the importance of early social relations has been stressed, there has been little certainty as to what concepts should be part of an experimental analysis. The purpose of the present study was to test several concepts oriented toward the developmental analysis of toddler interactions. Two playgroups were formed. In playgroup 1, children were 12 months of age. In playgroup 2, children were 16 1/2 months of age. Each group met weekday mornings for 7 months. Television equipment provided videotapes of the interactional dyads. The

group routine included free play, snack time, free play, activity period, rest time and pick-up. All videotapes were made during free play. Data for this study were collected on four occasions over the 7-month period. On every occasion dyads generated by the six playgroup members were videotaped and analyzed. Central to the present analysis was the distinction between socially directed behavior and social interaction. Socially directed behavior used gaze behavior to determine when action was directed to a peer. Peer social behavior was conceptualized as a developmental ability to combine and coordinate a series of formerly separate behaviors (i.e., wave and vocalize or smile and vocalize). Social interactions were defined as a series of socially directed behaviors. Social interactions were alternation sequences. Results indicate that contacts occur at a frequency related to age, increasing until about 18 months and then remaining constant. The pattern in both groups was one of linear growth of social interaction. Mueller and Brenner (1977) posit that the increased use of coordinated social behaviors was consequent on participation in peer interaction. Interaction is basic to cognitive development.

Clune and Foley (1979) suggest that the relationship between play and intelligence, though accepted generally, has not been systematically supported. The present research

focused on play with the goal of assessing the usefulness of a particular measure of play to determine the functioning of severely disturbed or atypical children. The premise that the play of impaired children might serve as a measure of cognitive functioning was based on the report that adjustment was reflected in play (Weiner and Ottinger, 1969). The researchers note that play was used as an assessment measure because it is not dependent upon verbal performance and interaction with an examiner. Since there would be no basis for considering the relationship between cognitive functioning and play for impaired children if a relationship did not exist for normal children, a two-part investigation was initiated. The findings of the two studies suggest that the play of impaired children has potential for assessing functioning. Play scores provided a quantitative and objective approach for evaluating impaired children who were labeled as nontestable. The play measures demonstrated that impaired children differing in degree of pathology could be differentiated. Thus, play measures can be utilized to assess differences between children, determine level of functioning in the individual child and possibly measure therapeutic changes in severely impaired children.

Play begins with action manipulations directed by the child. As his manipulative and physical abilities expand he

develops an increasing capacity to deal with objects more actively. The autistic child, however, is limited in his interaction with the environment. Because of his restricted experience, he shares with other disordered children many behavioral and learning problems, whether the specific diagnosis is mental retardation, cerebral palsy, brain damage or autism. As a function of sensory motor impairment, emotional or social maladjustment, the autistic child may withdraw from interactional experiences or learn to manipulate by means of temper tantrums and disruptive behaviors. The autistic child exhibits disturbances of perception and motor behaviors, as well as language that may be absent or pathological. Bizarre, self-stimulatory and/or repetitive behavior might include handflapping, rocking or twirling. The child's withdrawal from the environment makes it difficult to determine whether he does not know how to play or lacks the opportunity to do so--or both.

Michelman (1976) posits that when an autistic child sits for hours rocking back and forth, his sensory, perceptual and intellectual pathways are pathologically engaged and his development is impeded. Unlike the normal child, he does not discover his own body movements in relation to objects and people within the environment. Basic skills such as banging, shaking, rolling or throwing do not generalize to other

objects and activities. Repetition does not lead to learning and object manipulation does not result in learning about cause and effect. The process of play that spontaneously leads to learning and environmental control in the normal child does not occur in the autistic child.

The characteristic toy play behavior of psychotic children has been described by a number of authors. Black, Freeman and Montgomery (1975) report that these children become fixated with one kind of object performance, such as spinning objects, and retain these primitive manipulative patterns as a mode of play. Eisenberg and Kanner (1956) describe autistic children's preoccupation with simple repetitive activities. Despert and Sherwin (1958) refer to a lack of development of functional play. Bakwin (1954) cites a disinterest in toys or play with one toy which continues for hours. Polan and Spencer (1959) characterize the toy play behavior of autistic children as compulsive and perseverative. Tilton and Ottinger (1964) describe the play of autistic children as including higher proportions of both oral and repetitive use of toys than normal or retarded children. The toy play repertoires of autistic children contained fewer different manipulations than the repertoires of other groups.

Bruner (1969) provides insights about the play-route to learning. Bruner suggests that the child's manipulations

are of utmost importance. Self-initiated play stimulates learning. The autistic child who sits for hours with nothing to do withdraws unless he is directed through play experiences. The ability to interact with the environment and process reality is first related to action upon or manipulation of objects within the environment.

Behavioral disorders and developmental retardation are consequences of sensory and environmental deprivation (Thomas, 1968). The importance for the autistic child of intensive environmental interaction is critical since sensory and kinesthetic experiences are the basic building blocks of learning. Such experiences discriminate one object from another and self from the world. Objects are the means by which the child can learn to control and manipulate his environment. To do so, however, he must be actively involved with the environment.

Through play the autistic child can learn and experience. As the autistic child becomes involved in play, his gaze is spontaneously engaged in the very act of doing. Such gaze behavior is fundamental to all learning. Thus, play is a natural integrator of these two important behavioral performances (Michelman, 1976). This suggests that play may be a crucial part of the autistic child's treatment since it provides a gaze interaction learning experience. For many

reasons, however, the autistic child is often overlooked as a candidate for play experiences. Since he, himself, may be unable to function in play unassisted, he fails to acquire interactional skills.

Tilton and Ottinger (1964) and Weiner and Ottinger (1969) investigated aspects of toy play across three populations of children--normal, retarded and autistic. The researchers suggest that the observation of toy play seems an appropriate and practical method of studying certain characteristics of nonverbal children since it would not be dependent on verbal communication or compliance with an adult. The present writer suggests that the experimental purpose of the above studies, the objective analysis of nonverbal behavior, presents a valuable evaluative technique for assessing changes in behavior and obtaining measures of behavior differences among children. The research described generates several questions. How are the play patterns of severely impaired populations different from the play patterns of normal children? Can identified differences in play patterns with peers and objects be used as an early diagnostic tool during the first year of life? In addition, the infant and his social play interaction with mother/father might yield important insight into environmental variables that affect learning in the home. To obtain answers to these questions

researchers must investigate the social play patterns exhibited by impaired children.

In conclusion, the nonverbal autistic child presents complex therapeutic problems due to his withdrawal from the social environment. Traditional learning procedures (using operant conditioning techniques) demand laborious therapeutic manipulations (Lovaas, 1968; Peterson, 1968; Baer, Peterson and Sherman, 1968). Harris (1975) describes many of the therapeutic problems encountered in attempting to condition autistic children to respond to people and structured tasks. Thus, less structured forms of dyadic interaction, which circumvent the child's resistance to intervention, should be explored as a means of teaching and learning. Play interaction may be a means of providing active and continuous learning. Vygotsky (1976) points out that play teaches the child to guide his behavior not only by manipulation of objects but by his affect upon the environment. He asserts that play is the leading source of development in preschool years. Considering the significance of the play experience in the development of the normal child, play with objects might be the most naturalistic context for the development of interaction in the autistic child. The purpose of the present research was to evaluate three interaction procedures by measuring changes in object manipulation behavior and gaze behavior in autistic children.

Object Interactions

To know the environment, it is necessary to act upon and control it. In the process of manipulating the environment, the child discovers properties of objects not from actions alone but from the specific objects themselves. For example, the child can derive the property of enclosure only from objects that allow that action (e.g., a mouth or a cup but not a table). The relations between objects are derived from coordinating actions on the objects. Physical knowledge is derived from interactions with objects in the environment (Piaget, 1971).

Aside from the development of physical knowledge, objects also play an important role in the emergence of both social behaviors and interactional interchanges (Mueller and Vandell, 1976). Mueller and De Stefano (1973) have outlined in theoretical terms why objects may be so important in development. In their analysis, objects provide a basis for social interaction. Objects can invite infants to notice a peer and his manipulation with objects; and thus stimulate contacts. Interaction around the same or similar objects invites the mutual discovery of interpersonal contingencies. Given the potential importance of objects it is noteworthy that a majority of early social contacts in the normal child include objects. Durfee and

Lee (1973) found that in 6- to 9-month old children at least 60 percent of the contact sequences incorporated inanimate objects. Mueller and Brenner (1977) found that in young children 88 percent of the contact sequences incorporated objects of some kind. Eckerman, Whatley and Kutz (1975) noted that toddlers (12- to 24-months) tended to play with the same toys at the same time. The objects seemed to "act as vehicles" for various forms of interaction. The importance of object manipulation and play interaction has been described in the development of learning and social skills in the normal child. For the autistic child who has a limited interaction repertoire with objects and people in the environment, object play should be investigated as a learning context.

Imitative Interaction

The importance of imitation has been stressed in normal development (Piaget, 1962) and in therapeutic intervention for impaired populations (Peterson, 1968; Kozloff, 1973; Sloane, Johnston and Harris, 1968; Sherman, 1965; Lovaas, 1968). Piaget described the development of imitation within a cognitive framework.

The first imitative behaviors appear in the context of general sensorimotor development (4- to 8-months). The infant learns to listen and shortly after coordinates

looking and listening, listening and vocalization, and so on. These coordinations are crucial for the onset of imitation. The infant can only imitate the actions of the model when the model produces actions that the infant has just made. In addition, the infant can only imitate a movement which is part of its own repertoire. These restrictions are due to the general lack of coordination in the perceptual-motor system. Imitation at this stage is an attempt to prolong something that is perceptually familiar but only recognized by reproducing it at the same time it is perceived. With the appearance of sporadic imitation (at the end of this substage), the child shows the first clear indication of what Piaget (1962) calls a prelinguistic act. In summary, the Piagetian Theory of cognitive development attributes to imitation an integral and significant role in all aspects of social, perceptual and language learning.

Rees (1975) posits that the relationship between imitation and learning is of theoretical and clinical interest. Several theories of language acquisition take the position that imitation has little to do with language learning (Dale, 1972; Slobin, 1968). Many of these studies, however, have been concerned with syntax and syntactic development. Theoretical frameworks other than psycholinguistic approaches to child language development attribute a more significant role to imitation in language

learning. Cognitive, behavioral and social learning theorists suggest that imitation once developed provides a process for further learning (Peterson, 1968; Lovaas, Berberich, Perloff and Schaeffer, 1966; Bandura, 1969; Courtright and Courtright, 1976; Piaget, 1962). The theoretical role of imitation is even more complicated when language is viewed separately from communication.

Separating language from communication makes it clear that communication is only one of the uses or functions of language. Communication is not limited to the instrument of language, as can be seen from investigations of nonverbal communication and animal behavior. When theoretical and clinical emphasis shifts from the structure of language to the communicative function of language, the role of imitation changes. Whatever the role of imitative behavior in the child's acquisition of the structure of language, imitation of the child by the adult may be a critical factor in the child's learning to establish and maintain interaction (Rees, 1975). Studies such as Cazden's (1965) and Slobin's (1968) have shown that parents seem naturally to engage in imitations of the child. The adult's imitation of the child's performances occurs for the purpose of communicative interchange. Slobin (1968) suggests that the purpose of a mother's imitation is to check on the child's

message. An alternative explanation is that the "mother imitates her young child, and finds it unnatural not to do so, because she is communicating with the child in the same way he communicates with her" (Rees, 1975, p. 348)-- that is, by imitation. The imitative episode indicates that the verbal message has been received. Thus, early vocal and verbal imitations have a communicative function apart from the linguistic code. The parent's tendency to imitate her child's utterances during early interaction, is viewed as a natural first step in establishing the tendency to communicate.

Nonverbal communication constitutes an extensive experiential component during the course of a child's first and second year of life. From a clinical perspective, the role of the language clinician is to structure experiences for the impaired child, which allow him to develop interactive behaviors. The present writer suggests that the natural tendency for the adult to imitate the child to establish and develop communication interactions should be explored with the autistic child experimentally. Imitating the autistic child in an object-play situation places the child in control of the environment. Interaction with objects and people within the environment, as has been described, provides the learning context for communication.

Given the potential for the clinical application of play interaction, it is important to investigate the differential effects of various types of play interaction in developing gaze behaviors and manipulative performances in the autistic child.

Description of Subjects

Terminological Differences in the Literature

The central question concerned the criteria used in identifying a homogeneous group of autistic children. Literature by the most frequently cited authors was reviewed to highlight nosological and etiological differences. Criteria for classification of children as autistic are not completely similar across authors. The only similarity for classification of such children appears to be specific failures in the normal development of language (Rutter, 1965; Hermelin, 1968).

Psychiatrists who diagnose infantile autism or childhood schizophrenia are troubled by problems of agreement on terms and diagnostic reliability. The same difficulties confront neurologists and language pathologists who diagnose developmental aphasia or central language disorders. Diagnostic problems and terminological differences create formidable complications in placement and remediation. Specific theories relating to causation have been proposed; none have been proved. The range of etiological views of autism extends

from a psychoanalytic perspective of the parent-child relationship to organic, genetic and biochemical causes.

Kanner (1943) was the first to describe autistic children as having a distinct categorical separateness. Since that time, autism has been the subject of much clinical investigation and research; yet the nature of its causes, manifestations, and treatment remains in dispute. Kanner (1943) attempted to define the cause as an innate inability to form biologically affective contact with people, just as other children come into the world with innate physical and intellectual deficits. He attributed this to an emotional deprivation resulting from rigidity of the parents. The parents of the children he studied were characterized by obsessive-meticulousness and intellectualization. This was supported by Eisenberg (1956) who characterized the mothers of autistic children as cold and distant.

Bettelheim, in The Empty Fortress (1967), takes a similar perspective. He posits that the mother does not produce autism, but it is the child's reactions to her attitudes. The autistic child fears destruction; this leads to rejection of the mother. If the mother then withdraws from the child, autism develops. When the child withdraws, the mother becomes indifferent or angry. The child retreats within himself even further and reality becomes so fearful that inactivity is the only available response.

Wolf and Rutter (1967) suggest that infantile autism is a disorder that affects ego functioning and as a result, thought, speech and communication are all impaired. The disorder encompasses the total functioning of the child and consequently presents a picture of language deficits within the framework of an emotional disorder. Thus, the symptoms of psychotic children have been attributed to problems with early interpersonal relationships, motivation and emotionality (Baltaxe and Simmons, 1975). Psychotic children have often been described as emotionally, rather than neurologically impaired. These children have been considered separate from central language disordered children: different cause, different condition. However, with more systematic and controlled studies, an increasing number of researchers have concluded that psychotic children also suffer from a neurological deficit (Bryson, 1970; Gittleman and Birth, 1967; Hingtgen and Churchill, 1969).

Other controlled studies have failed to demonstrate significant differences in parental psychopathology and early mother-child interaction between groups of psychotic and non-psychotic brain-damaged children (Alpern and Yang, 1960; DeMyer, Pontius, Norton, Barton, Allen and Steele, 1972). For a long time the psychoanalytic view that the mother-child relationship was the cause of autism was widely accepted; however, several other researchers have proposed an organic etiological basis. Ornitz and Ritvo (1968) emphasize the

importance of a defective perceptual apparatus which is manifested by a heightened awareness of sensory stimuli. The defective perceptual apparatus results in the child's distorted perception of reality; this in turn affects his ability to establish appropriate object relations and reality contact.

Dalgleish (1975) posits that research on information processing in autistic children has revealed difficulties in integration of sensory functioning and in sequencing processes. These functions are basic to the acquisition of communication and linguistic systems. Several experimental studies have highlighted the difficulties of the autistic child in sensory integration. Conditioning experiments provide information on integration functioning in situations where simultaneous input from different sources is precisely controlled. Lovaas, Schreibman, Koegel and Rehm (1971) attempted to condition three groups of children (autistic, retarded and normal) to respond to a complex stimulus involving the simultaneous presentation of auditory, visual and tactile elements. Once this discrimination was trained, the components of the complex stimulus had acquired control over the child's behavior. The autistic subjects responded primarily to only one of the cues. The normal children responded to all three cues and the retarded children functioned between the two extremes. The data did not indicate that any one sense modality is

impaired in autistic children. Rather when presented with a complex stimulus, they revealed a marked preference for one of the components. The researchers refer to this pattern of responding as "stimulus overselectivity" or "overselective attention." Lovaas (1978) hypothesized that autistic children encounter difficulties in learning situations requiring shifts in stimulus control.

Koegel (1971) trained two groups of children (autistic and normal) to respond in a color discrimination task. The colors were then used as prompts subsequently for more difficult training stimuli. The colors were presented simultaneously with stimuli in a prompt-fading procedure which was used to train four different discriminations. The results indicate that autistic children were capable of making discriminations but they had difficulty in shifting from one stimulus cue to another.

Churchill (1978) presents a different theoretical model from which to analyze the autistic child. He posits that psychotic children with a psychiatric diagnosis of autism share with brain-damaged children perceptual-motor and perceptual deficits. The characteristic identifying psychotic children is a central language deficit which is more severe than that found in children with central language disorders. He proposes that this hypothesis was the

most parsimonious way of explaining the three most prominent and clinically significant features of childhood psychosis: impairment of communicative interaction, social interactions and appropriate object manipulations. In infantile autism, the child appears to live in an inner, self-contained world which is for all intents and purposes devoid of emotion and feeling. The child lives within an inanimate environment of objects. Communication between the autistic child and other people is severely limited. Speech is not used as extensively as nonverbal cues in understanding others in the environment. He presents some general similarities in responding for the autistic children involved in the nine-word language experimental investigation. Some of the autistic children evidenced channel-specific deficits (i.e., they indicated a conditioning preference for one stimulus modality). Some children displayed a difficulty in responding to two familiar elements simultaneously. Children also displayed difficulties in generalization, classification, cross referencing and syntactic/linguistic manipulations. The most important information may be that each child was unique (i.e., autistics are a heterogeneous group of disordered children). Churchill (1978) concludes that each child generated a different profile of linguistic abilities and disabilities.

The autistic child's pattern of language learning highlights the bizarre communicative and interactional strategies used (Baltaxe and Simmons, 1975). Often there is no demonstration of speech production ability, which often raises the question of deafness or aphasia. The strikingly aberrant aspect of the language behavior is the pattern of language learning and language usage. Language is often learned without any appreciation of the behavioral context within which it is being used. Impersonal sources of learning, such as television, frequently provide the major sources of learning (Chase, 1972).

Eisenberg (1957) notes severe disturbances in behavior may be noted from infancy. A particularly well-defined group of behavioral abnormalities consists of avoidance of physical and eye contact, continued efforts to maintain stereotypic routines and physical arrangements, preference for physical objects instead of people and minimal use of meaningful speech. The proposal here is that a central language disorder may well be the necessary and sufficient cause of that behavior which marks children as autistic.

The lack of communicative speech and severe problems in the area of interpersonal relationships tend to rule out or limit the use of standard evaluative measures as diagnostic and research tools with this clinical population.

Alternative techniques must be devised for evaluating these children, assessing changes in behavior and obtaining measures of behavioral differences which may exist between them and other populations (Clune, Paoletta and Foley, 1979). In addition, the literature described above illustrates that diagnosis and description of autistic children is complicated. Achenbach (1978) suggests that psychopathology lacks a coherent conceptual framework for describing and discriminating among disorders. In the absence of a generally accepted taxonomy, diagnostic classification schemes often vary from theoretician to theoretician or from researcher to researcher. Since the goal of the present study was not to develop or analyze a taxonomy of characteristics related to infantile autism, psychiatric and neurological criteria were utilized to identify subjects for this investigation. In addition, behavioral characteristics presented by Lovaas (1977) were used to describe the children involved in this study:

- a. language deficiency
- b. severe affect isolation
- c. self-stimulatory behavior
- d. absence of social and self-help skills
- e. self-destructive behaviors

All children were observed for two days at Iris Hill Nursery School. In addition, the teaching staff was asked to confirm the profile developed on the children involved (see Appendix A).

Description of Methodology

In designing the present study, the writer had to decide how the adult was to interact with the child (Independent Variable: I.V.) and how gaze (Dependent Variable: D.V. 1) and manipulative responses (Dependent Variable: D.V. 2) were to be measured. Procedural considerations were based in part upon the therapeutic recommendations of Liebergott and Swope (1976). The researchers describe that the normal child engages in object specific behaviors before the child develops functional use of words. The nonverbal language impaired child must also engage in these behaviors prior to his use of words. The role of the language clinician is to structure experiences for the impaired child, which allow him to engage in these types of behaviors. Liebergott and Swope (1976) propose that

the language clinician does this by providing the child with a variety of objects on which she and the child can engage in parallel activities while engaging in these activities, the clinician alternately imitates the child's action patterns, models new action patterns, and expands on old patterns by combining the child's previously learned action patterns into sequences (p. 24).

In a pilot study performed by Tiegerman and Silverman (1977), one interaction procedure described by Liebergott and Swope (1976)--imitation--was investigated as a play procedure with two autistic children. In this procedure, a completely reactive environment was developed when the adult imitated all

of the child's motoric movements. The clinician's imitative performance presented a "mirror-image" to the child of his own performance in relation to an object. The clinician's imitation of the child's performances resulted in changes in the interaction between the child and clinician. Initially, the child interacted with various objects without looking at the clinician or the clinician's imitation. A developmental progression was then noted; as the clinician continued to imitate the child, the child looked at the clinician's performances. The imitative interaction resulted in an increase in the duration and number of looking (gaze) performances at the clinician and the clinician's performances. The results supported the contentions of Liebergott and Swope (1976) that imitation of the child's performances was a viable therapeutic technique which warranted further investigation.

In the present study, the issue of adult-child interaction was further investigated and expanded by comparing two other procedures to the imitation procedure. These other procedures were also based upon the application of Piaget's theory to clinical remediation proposed by Liebergott and Swope (1976). The importance of the present investigation lies in the fact that experimental analysis of descriptive procedures yields valuable clinical information. In addition, the theoretical significance of play in the learning and

development of the normal child cannot be assumed for the impaired child without empirical evidence. Thus, this study sought to determine the effectiveness of three play procedures with an autistic population of children.

Description of Data Analysis

The analysis of the children's play performances and gaze behaviors was based upon the research of Tilton and Ottinger (1964). In designing their study, they assumed that a higher degree of objectivity and more definitive data could be accumulated by defining toy play as specific or concrete manipulations and combinations. Each manipulative performance was categorized according to the type of action or manipulation. This type of objective analysis was utilized in the present research in order to reduce subjective judgments, both in the construction of behavioral play categories and in the recording of behavior during experimentation. Experimental observation resulted in the compilation of discrete toy manipulations which were subsequently analyzed by means of a factorial analysis of variance.

The frequency of the child's gaze behavior was noted and categorized into three groups (i.e., gaze at clinician's face, gaze at clinician's action less than 3 seconds, gaze at clinician's action greater than 3 seconds). In this way,

frequency and duration changes in the child's gaze behavior were measured across the experimental conditions. A factorial analysis of variance was used to determine significant changes in the dependent measures:

1. frequency of object manipulation;
2. duration of object manipulation;
3. frequency of eye contact;
4. duration of eye contact;
5. frequency of gaze to clinician's performance less than 3 seconds;
6. duration of gaze to clinician's performance less than 3 seconds;
7. frequency of gaze to clinician's performance greater than 3 seconds;
8. duration of gaze to clinician's performance greater than 3 seconds.

CHAPTER III

METHODS AND PROCEDURES

Introduction

The present research was undertaken to study the gaze behaviors and the object manipulation performances of autistic children as a function of three play interaction situations. The design features of the research are briefly previewed in the next paragraph and are then described in detail in the balance of the chapter.

The changes in gaze behavior and toy manipulation were measured in terms of frequency and duration of occurrence across the three procedures. The design of the research required that the subject(s) sit opposite the experimenter at a table covered with pairs of duplicate (identical) objects. The subject's gazes at the experimenter and his toy manipulations were noted by two trained observers who functioned as recorders. The experimenter's performance varied as a function of the play procedure. Two of the three experimental procedures (each 15 minutes in length) were presented during a 30-minute experimental session. The order of presentation of the experimental procedures was

counterbalanced across sessions, as well as randomized as to order within sessions. All subjects were involved in each experimental procedure. The study was conducted across seventeen sessions. The subject's manipulative responses were then compared across play procedures and within play procedures. The design features of the research are described in more detail below.

The Research Setting

The experiment was conducted at Iris Hill Nursery School, a preschool facility, which is part of Creedmoor Hospital. The twelve children in the program had a primary diagnosis of emotional disturbance. The range in age was from 4 to 6 years. The Iris Hill staff consists of a director, a program coordinator, an occupational therapist, a part-time psychiatrist, a dance specialist, a social worker and four therapy aides. A speech and language pathologist was not on staff and, therefore, the children were not receiving language therapy at the time this experimental investigation occurred. The experiment was conducted in three rooms which measured 10 feet by 10 feet. Two children were assigned to one of the three rooms. Each child was assigned to a 30-minute period of time. The child was seen at that time and in the same room each day. After an hour and 15

minutes, the experimenter and two observers moved to the next room. The 15-minute interval was employed to allow sufficient time for observers to complete recording behavior which occurred during the previous segment and provide time to move to the next room after two children had been seen.

The experimenter and subject were seated facing each other at a table which measured 18 inches (width) by 48 inches (length) by 24 inches (height).

Criteria for Selection of Subjects

The psychiatrist on staff at Iris Hill identified which of the twelve children in the school program were autistic. Of the twelve children screened by the psychiatrist, three were found not to have a primary diagnosis of infantile autism and were thus excluded from the study. A subsequent check of hospital records revealed that three of the remaining nine children had significant neurological involvements. As a result, these three were also excluded, leaving a total of six children to participate in this investigation.

Behavioral characteristics presented by Lovaas (1977) were utilized to describe the present population:

- a. language deficiency defined as mutism or echolalia;
- b. severe affect isolation defined as looking at or through people and/or an indifference to contact;

- c. self-stimulatory behavior defined as rocking, spinning, twirling, and/or handflapping;
- d. absence of social and self-help skills defined as an inability to wash, dress or care for himself and as not being toilet trained;
- e. self-destructive behavior defined as tantrums, scratching, biting and/or head-banging.

Using the Lovaas (1977) system as a model, the six subjects were observed independently on two consecutive days by the experimenter and the two trained recorders. The independent observations were then cross-validated with the impressions of the teaching staff to develop a subject profile (see Appendix A).

Finally, anecdotal data were collected to determine pre-experimentally how each subject responded to variables investigated in this study (i.e., gaze behavior and object manipulation).

Anecdotal Criteria

On two consecutive days children were brought into a room in which the research was conducted and were seated opposite the experimenter. The observers, who recorded observations, were seated on each side of the experimenter. Several informal activities were presented on the first day and then repeated on the second day. An analysis of the

subjects' responses indicated that they did not respond to their names, did not look at the experimenter and either repetitively manipulated presented objects (i.e., patting, shaking, twirling and spinning) or did not manipulate the objects. The informal pretraining activities are described below.

1. The experimenter presented the verbal discriminative stimulus (S^D), "S., look at me." The experimenter waited 10 seconds and re-presented the stimulus. This verbal S^D was presented ten times. The observers noted the frequency and duration of gazes at the clinician.
2. The experimenter held up an object by her face and presented the verbal discriminative stimulus, "S., look at me." The experimenter waited 10 seconds, replaced the object on the table and re-presented the stimulus along with the object. The verbal S^D and the object were presented ten times. The experimenter repeated the baseline with two other objects. The observers noted the frequency and duration of gazes at the clinician.
3. The experimenter placed an object on the table in front of the child and waited 60 seconds. If the object was not touched within this time period, it was replaced by another object. If the object was manipulated, the observers noted the action of the subject with respect to the object and reset the 60-second time period. The

observers also noted the frequency and duration of gazes at the clinician. The experimenter repeated the baseline with the other objects used in the experiment.

4. The experimenter placed a pair of duplicate objects (e.g., two telephones) on the table directly between the experimenter and subject. The experimenter manipulated her object for 60 seconds. If the duplicate object was not touched by the subject within this time period, it was replaced by another pair of objects and a new trial was initiated. If the object was manipulated by the subject, the observers noted the action on the object by the subject and reset the 60-second period. The observers also noted the frequency and duration of gazes at the experimenter. The experimenter repeated the baseline with the other objects used in the experiment.

Experimental Stimuli

In terms of the stimuli used in this research, the objects were selected from the toys found in the Nursery School toy box. The experimenter then purchased duplicates of the items identified for experimental usage (see Appendix B). The experimenter was guided in her choice of toys by the objects used in the studies performed by Tiegerman and Silverman (1977), and Tilton and Ottinger (1964).

Training and Function of Observers

In order to reduce the discrepancies in data recording and data analysis, two graduate students enrolled in the Queens College Speech and Hearing Program were trained to assess the frequency and duration of gaze behaviors and the frequency and duration of object manipulation. The observers were second semester graduate students who had worked closely with the experimenter on several clinical cases (some of whom were autistic children enrolled at the Queens College Speech and Hearing Center).

The observers were initially trained to record the frequency and duration of gaze behaviors of an autistic child enrolled at the Queens College Speech and Hearing Center. The child was seated opposite the experimenter at a table which contained ten pairs of duplicate objects. The observers were seated on either side of the experimenter, also facing the child. The observers sat with a stop watch in one hand, a data sheet on their laps and a pencil in their other hand. The stop watch was used to determine the duration of the subject's gazes at the experimenter. The observers then recorded the subject's gazes on data sheets (see Appendix C) by length and type of performance (i.e., eye gaze, gaze to performance less than 3 seconds, gaze to performance greater than 3 seconds). The stop watch was started and reset for

each gaze performance. Inter-rater reliability was assessed by comparing rater performances over blocks of twenty gazes. Three blocks were assessed each session. Training continued until inter-rater reliability was .85 or better for each performance category for three consecutive days. Eight days of training were required to achieve three consecutive days of .85 inter-rater reliability (three blocks a day).

The raters were then trained to record the frequency and duration of object manipulation performances of an autistic child enrolled at the Queens College Speech and Hearing Center. The child was seated opposite the experimenter at a table, which contained ten pairs of duplicate objects. The observers were seated on either side of the experimenter also facing the subject. The observers sat with a stop watch in one hand, a data sheet on their laps and a pencil in their other hand. The number of performances with each object was counted and timed by means of a stop watch. The stop watch was used to determine the duration of the subject's manipulation of an object. The stop watch was started when the subject manipulated the object and reset when the subject stopped manipulating the object. This information was recorded on a data sheet (see Appendix C). During the first five days of training, a video-tape recording was made using a Panasonic NV-3020 tape-a-vision machine. Inter-rater

reliability was assessed by comparing rater performance over blocks of twenty performances. Three blocks were assessed each session. The differences between inter-rater analyses were resolved by viewing the tape after the session. The research of Tilton and Ottinger (1964) was helpful in developing performance categories with each object. Performances which were not categorizable during the session were placed in a miscellaneous category until the end of the session when the raters and the experimenter could decide upon a performance label (i.e., shake, throw, push, etc.). Training continued until inter-rater reliability was .85 or better for type of performance, frequency and duration categories. Eight days of training were required to achieve three consecutive days of .85 inter-rater reliability (three blocks a day).

The final stage of reliability training was five days of rater assessment. Four performance blocks were analyzed each day. On Day 1, gaze performance (A) and object manipulation (B) were analyzed in the following order by both raters: ABAB. On Day 2, the analysis order was changed: BABA. On the next three days the analysis order was changed in similar ways. Inter-rater reliability on all five days (twenty blocks) is presented in Appendix D. Inter-rater reliability measures had to be .85 on each block before

experimentation was started (the Pearson product moment correlation was employed).

Experimental Procedures

Procedure I

In procedure I, the child was seated opposite the experimenter at a table with various objects. Duplicate objects were placed before the experimenter. As the subject manipulated his object, the experimenter imitated the subject's movements with her object. The experimenter continued to manipulate an object only as long as the subject did. If the subject stopped manipulating an object the experimenter stopped. A group of objects was present on the table at all times to continue the subject's exploratory performances and thus, the experimenter's imitation of the subject. The basis for interaction was controlled by the subject in this procedure. The similarity in performance between the subject and experimenter was the manipulation of the same object, the same action on the object and the same interaction time with the object. (The experimenter continued to manipulate an object only as long as the subject did.)

Procedure II

In procedure II, the subject was seated opposite the experimenter at a table with various objects. Duplicate objects were placed before the experimenter. As the subject

manipulated an object, the experimenter performed a different movement with the duplicate object. When the subject changed his manipulation on an object, the experimenter changed her manipulation with the duplicate object. The experimenter never produced a performance which was an imitation of the subject's manipulation. When the subject changed to another object, the experimenter changed to the same (duplicate) object. The experimenter continued to manipulate an object only as long as the subject did. If the subject stopped manipulating an object the experimenter stopped. The basis for interaction was partially controlled by the subject. The similarity between the subject and experimenter was the manipulation of the same object and the same interaction time with the object.

Procedure III

In procedure III, the subject was seated opposite the experimenter at a table with various objects. Duplicate objects were placed before the experimenter. As the subject manipulated an object, the experimenter performed a different action on a different object. The experimenter never produced a performance which was an imitation of the subject's manipulation. When the subject changed to another object, the experimenter did not change. When the subject changed action (on an object), the experimenter did not change. The

experimenter changed action and/or object at random without any regard to what the subject was doing. Thus, there was no relationship between the subject's performance and the experimenter's performance. In this procedure, there was no similar basis for interaction. The subject had no control of the experimenter's performance.

Procedural Analysis

The differences among the procedures can also be described in terms of the subject's manipulative control of the experimenter and the experimenter's performance. In procedure I, in which there was total similarity in interaction between experimenter and subject, the subject had manipulative control of the experimenter's choice of object, object manipulation, and when she started and stopped manipulating the object. In procedure II, in which there was less similarity in interaction between the experimenter and subject, the subject had limited manipulative control. The subject had control over the experimenter's choice of object, and when she started and stopped manipulating the object. In procedure III, in which there was no similarity in interaction between experimenter and subject, the subject had no manipulative control over the experimenter's choice of object, action on an object, or when she started and stopped manipulating the object.

Experimental Design

The affects of three types of play interaction on the development of gaze behavior and object manipulation were investigated.

The study was conducted across seventeen sessions. Two of the three experimental procedures (each 15 minutes in length) were presented during a 30-minute experimental session. The order of presentation of the experimental procedures was counterbalanced across sessions, as well as randomized as to order within sessions. All six subjects were involved in each experimental procedure.

Data Collection

The experimenter served as the clinician in each experimental session. Recording of the dependent variables was divided between the two observers/recorders. The six subjects were involved in the research each day. For the first three subjects involved, observer A recorded the frequency and duration of object manipulation, while observer B recorded the frequency and duration of gaze behaviors. For the next three subjects, the recorders switched the variables they recorded.

During the course of the research, inter-rater reliability was assessed on four occasions (see Appendix D). A child in the Iris Hill Nursery School Program, who was not

part of the experimental research, was involved with two play procedures (presented that day) for purposes of inter-rater reliability assessment. During presentation of the first play procedure, both observers recorded the frequency and duration of object manipulation, then during the second play procedure, both observers recorded the frequency and duration of gaze behaviors.

During experimental interaction and inter-rater assessment, the data collected by the two recorders were summarized at the end of each session. Frequency and duration totals were found for each category by summing values. Thus, data were collected for each child (two procedures a day) across seventeen days of interaction. All six subjects completed the seventeen days of interaction. Performance totals were accumulated for the days of interaction for each of the following variables (see Appendices E-L):

1. Gaze Behavior
 - a. Eye gaze (eye contact): frequency
 - b. Eye gaze (eye contact): duration
 - c. Gaze less than 3 seconds: frequency
 - d. Gaze less than 3 seconds: duration
 - e. Gaze greater than 3 seconds: frequency
 - f. Gaze greater than 3 seconds: duration

2. Object Manipulation
 - a. Object manipulation: frequency
 - b. Object manipulation: duration

Data Treatment

A two-factor analysis of variance for repeated measures as outlined by Winer (1971) was computed separately for frequency and duration of gaze behavior and object manipulation. Significant main effects were not examined further since the major interest here was how subjects changed across sessions under the three different conditions, and not how treatments, averaged over sessions, differed or how sessions, averaged over treatments, differed.

CHAPTER IV

RESULTS AND DISCUSSION

Results

The present research was designed to answer four questions. The analysis of the results will be described in this chapter in light of these four questions. Each of the four sections of the chapter will be divided into four subsections as follows: the question, data treatment used, findings and interpretations.

Object Manipulation Across Conditions

Question

The first question to be answered was: did any of the play procedures affect the frequency and/or duration of object manipulation in the autistic subjects involved in this study?

Data Treatment Used

A two factor analysis of variance for repeated measures as outlined by Winer (1971) was computed separately for frequency of object manipulation and duration of object manipulation. Significant main effects were not examined further

since the major interest here was how subjects changed across sessions under the three different conditions, and not how treatments, averaged over sessions, differed or how sessions, averaged over treatments, differed. Significant interactions were examined graphically as outlined by Winer (1971).

Findings

Table 1 presents the summary of the analysis of variance for frequency of object manipulation. One can see from examining this table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 2 shows the means for the frequency of object manipulation for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 2 that the total frequency of object manipulation was largest for Procedure I, followed by Procedure II, and smallest for Procedure III. Examination of the mean for sessions indicates that the mean total of object manipulation increased as the number of sessions increased. The mean frequency of object manipulation for each procedure for each session was graphed and is presented in Figure 1 wherein one can see that the mean number of object manipulations changed rapidly for Procedure I, less rapidly for Procedure II, and not at all for Procedure III.

TABLE 1
 SUMMARY OF THE ANALYSIS OF VARIANCE ON FREQUENCY
 OF MANIPULATION SCORES FOR THE THREE
 PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	182113.50	2	91056.75	29.60	.0001
Error 1	30756.62	10	3075.66		
Sessions	151748.50	10	15174.84	31.75	.0001
Error 2	23895.62	50	477.91		
Procedures by sessions	97186.50	20	4859.32	19.09	.0001
Error 3	25454.37	100	254.54		

TABLE 2

MEAN AND STANDARD DEVIATION FOR FREQUENCY OF MANIPULATION
FOR EACH PROCEDURE FOR EACH SESSION

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
1	36.8	24.3	30.8	24.7	16.5	24.4	28.0
2	42.0	26.8	36.5	27.4	29.1	18.0	35.8
3	54.5	34.7	41.6	27.3	33.3	22.5	43.1
4	64.7	33.0	50.0	27.1	32.3	21.6	49.0
5	75.8	34.7	56.7	34.7	33.5	17.9	55.3
6	106.0	43.9	62.8	36.2	40.0	24.5	69.6
7	110.2	44.0	66.6	32.7	38.1	18.8	71.6
8	130.3	53.5	78.5	35.6	39.0	23.0	82.6
9	166.2	74.1	84.8	37.4	35.2	20.4	95.3
10	186.3	86.3	92.0	34.9	34.8	19.8	104.3
11	209.2	82.1	103.7	37.6	37.0	20.4	116.6
Procedural Mean	107.45		64.01		33.54		

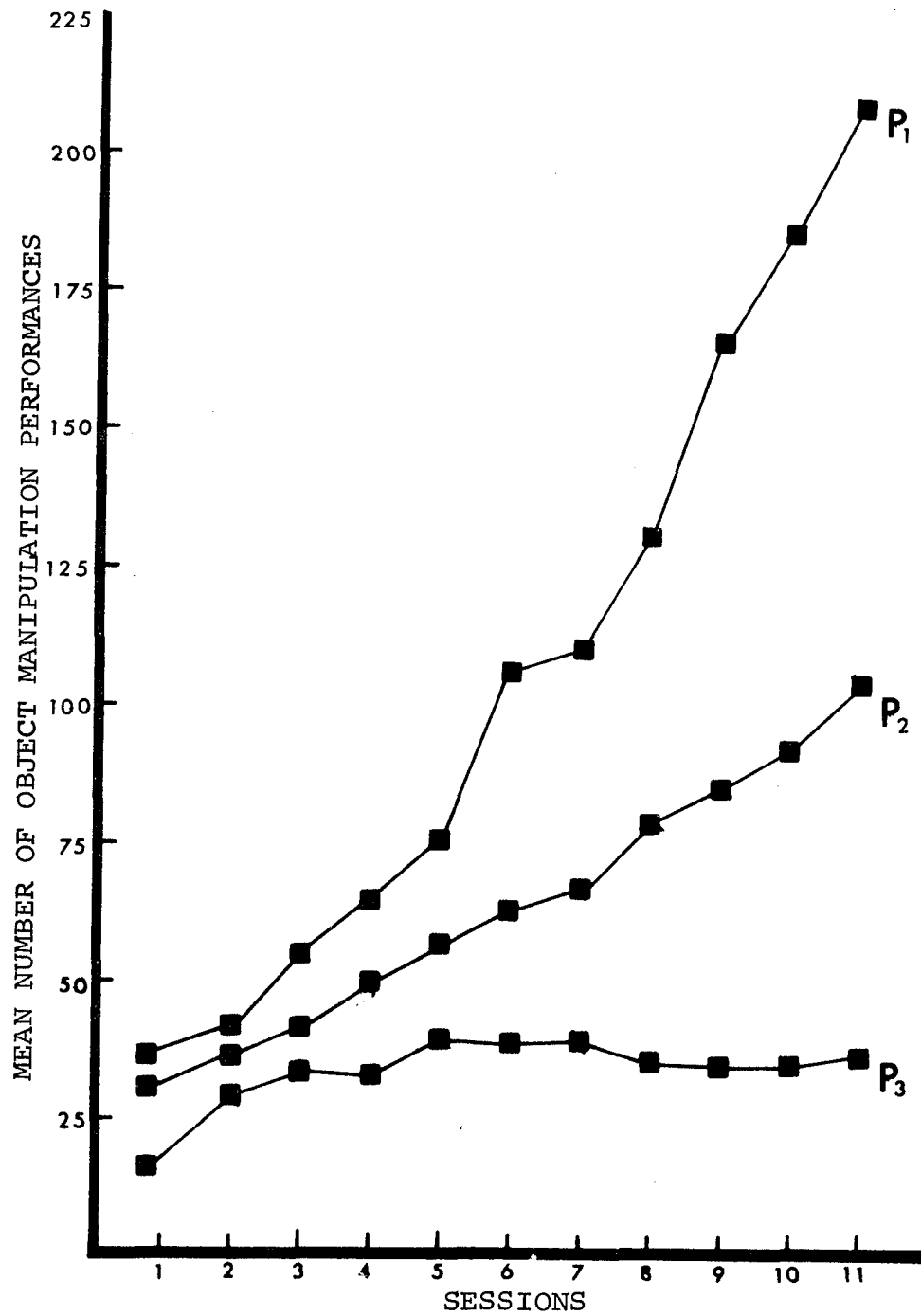


Figure 1: Frequency of object manipulations for procedures across sessions

Table 3 presents the summary of the analysis of variance for duration (in seconds) of object manipulation. One can see from examining this table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 4 shows the means for the duration of object manipulation for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 4 that the total duration of object manipulation was longest for Procedure I, followed by Procedure II, and shortest for Procedure III. Examination of the mean for sessions indicates that the mean total for duration of manipulation increased as the number of sessions increased. The mean duration of manipulation for each procedure for each session was graphed and is presented in Figure 2 wherein one can see that the duration of manipulation changed rapidly for Procedure I, less rapidly for Procedure II, and not at all for Procedure III.

Interpretation

The data indicate that the Imitative Interaction Procedure (P1) in which the experimenter imitated the child's performances was effective in increasing the frequency and duration of object manipulation in the autistic subjects. Procedure II, in which only similar objects were used by experimenter and child, was less effective in increasing the

TABLE 3

SUMMARY OF THE ANALYSIS OF VARIANCE ON DURATION
OF MANIPULATION SCORES FOR THE THREE
PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	2187006.00	2	1093503.00	27.26	.0001
Error 1	401005.00	10	40100.50		
Sessions	2180350.00	10	218035.00	28.86	.0001
Error 2	377629.00	50	7552.58		
Procedure by sessions	554162.00	20	27708.09	4.61	.0001
Error 3	601011.00	100	6010.11		

TABLE 4

MEAN AND STANDARD DEVIATION FOR DURATION OF MANIPULATION FOR
EACH PROCEDURE FOR EACH SESSION (SECONDS)

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	
1	127.0	87.6	129.2	88.4	41.5	53.7	99.2
2	176.8	85.9	169.0	112.0	88.0	56.1	144.6
3	247.5	132.9	181.0	97.2	114.8	72.4	181.1
4	300.0	168.5	194.8	100.2	123.6	57.9	206.1
5	365.7	200.6	247.3	112.2	116.0	55.2	243.0
6	388.0	194.0	277.8	104.7	140.7	61.5	268.8
7	438.7	199.1	298.2	194.2	189.5	98.3	308.7
8	488.3	187.3	354.0	169.9	169.1	71.8	337.1
9	607.5	215.0	358.7	125.5	159.7	54.0	375.2
10	675.3	236.0	411.8	153.5	213.5	90.9	433.5
11	586.5	364.1	431.7	159.1	214.2	100.4	410.7
Procedural Mean	400.12		277.59		142.78		

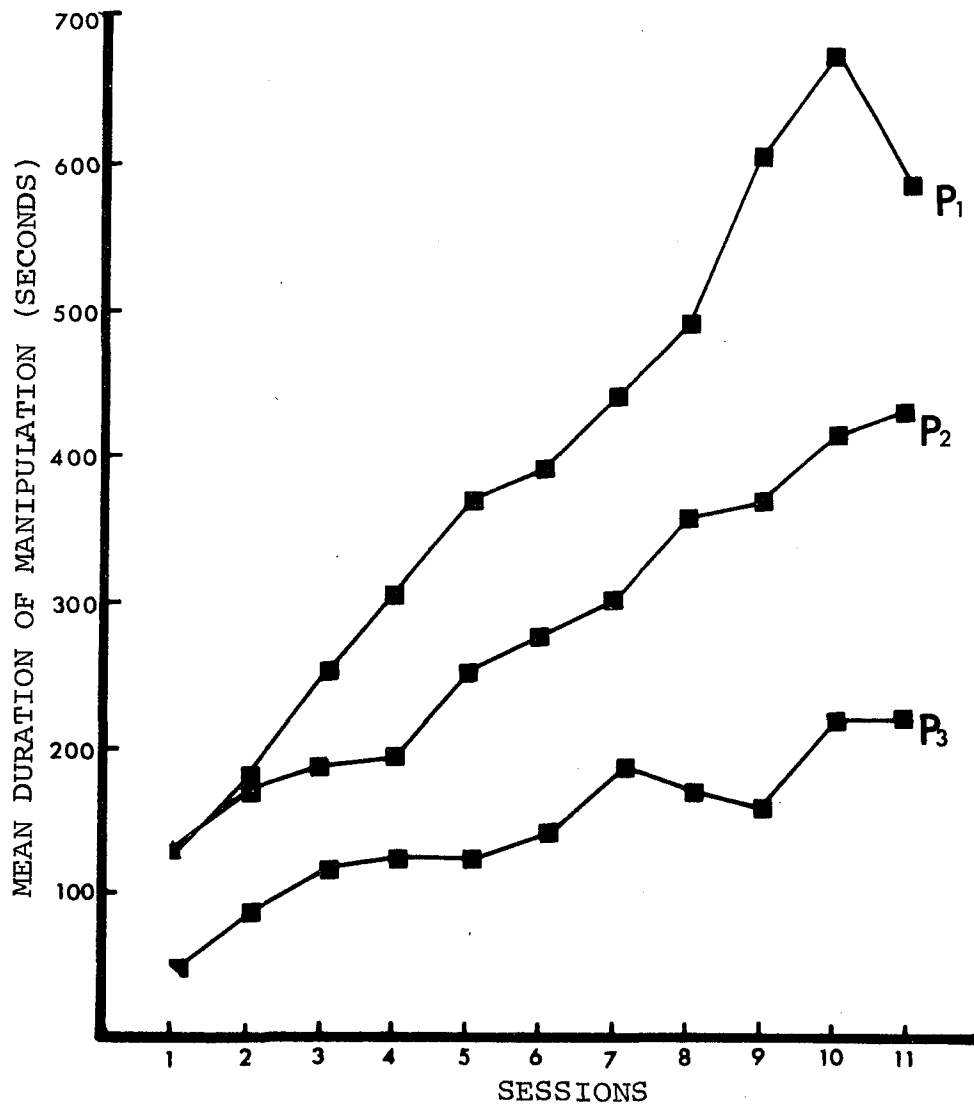


Figure 2: Means for duration of manipulation for each procedure across sessions

frequency and duration of manipulative performances. The ineffectiveness of Procedure III, in which there was no relationship between the experimenter's and child's performances, suggests that such a relationship is important to manipulative development. The increase in manipulative performances was translated into an increase in duration of manipulation. The relationship between changes in frequency and duration was observed throughout the course of the experiment across procedures.

Eye Contact Across Conditions

Question

The second question to be answered was: did any of the play procedures affect the frequency and/or duration of gaze behavior (eye contact) in the autistic subjects involved in this study?

Data Treatment Used

A two factor analysis of variance for repeated measures as outlined by Winer (1971) was computed separately for frequency of eye contact and duration of eye contact. Significant main effects were not examined further since the major interest here was how subjects changed across sessions under the three different conditions, and not how treatments, averaged over sessions, differed or how sessions, averaged over

treatments, differed. Significant interactions were examined graphically as outlined by Winer (1971).

Findings

Table 5 presents the summary of the analysis of variance for frequency of eye contact. One can see from examining this table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 6 shows the means for the frequency of eye contact for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 6 that the total frequency of eye contact was largest for Procedure I, followed by Procedure II, and smallest for Procedure III. Examination of the mean for sessions indicates that the mean total of eye contact increased as the number of sessions increased. The mean frequency of eye contact for each procedure for each session was graphed and is presented in Figure 3. One can see from examining this figure that the mean number of eye contact performances changed rapidly for Procedure I, less rapidly for Procedure II, and not at all for Procedure III.

Table 7 presents the summary of the analysis of variance for duration (in seconds) of eye contact. One can see from examining this table that the main effects for procedures

TABLE 5

SUMMARY OF THE ANALYSIS OF VARIANCE ON
 FREQUENCY OF EYE CONTACT FOR THE
 THREE PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	5339.76	2	2669.88	56.19	.0001
Error 1	475.07	10	47.50		
Sessions	1232.60	10	123.26	17.56	.0001
Error 2	350.97	50	7.01		
Procedure by sessions	1093.78	20	54.68	7.91	.0001
Error 3	691.36	100	6.91		

TABLE 6

MEAN AND STANDARD DEVIATION FOR FREQUENCY OF EYE CONTACT
FOR EACH PROCEDURE FOR EACH SESSION

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
1	4.0	2.8	1.7	1.9	0.2	0.4	1.9
2	4.2	3.1	2.3	2.7	0.3	0.5	2.2
3	9.7	3.4	2.5	3.3	1.3	2.0	4.5
4	11.2	4.2	3.7	3.8	1.5	2.7	5.4
5	11.3	3.8	4.2	3.3	0.7	1.2	5.3
6	14.5	4.1	4.7	5.5	2.0	3.6	7.0
7	15.5	5.8	5.8	3.9	2.3	2.1	7.8
8	17.2	5.6	5.7	4.3	1.3	2.8	8.0
9	19.7	3.8	6.3	4.9	1.5	1.0	9.1
10	21.8	9.2	4.8	3.6	1.0	1.5	9.2
11	19.0	3.9	5.7	3.6	1.3	2.1	8.6
Procedural Mean	13.45		4.30		1.22		

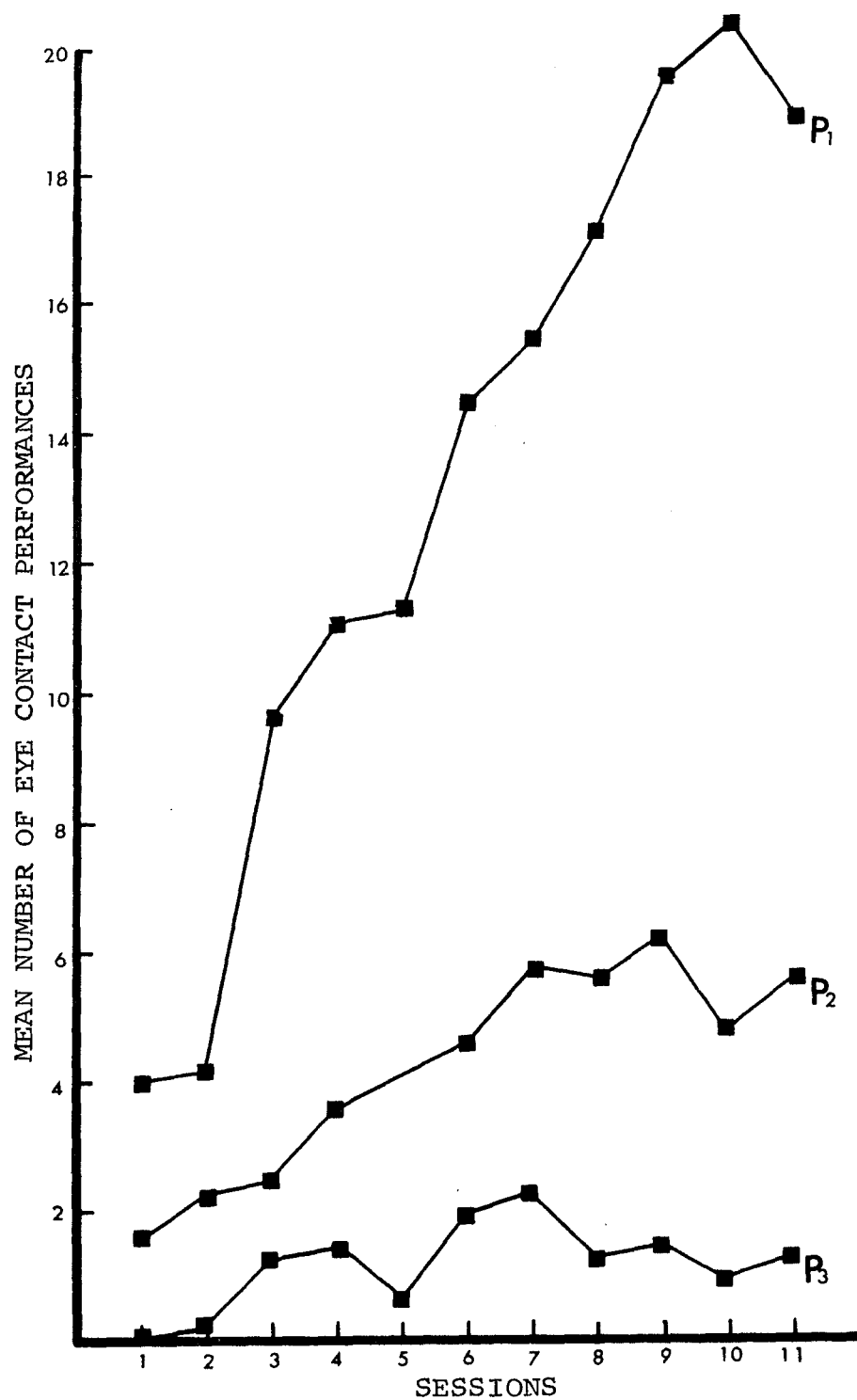


Figure 3: Means for frequency of eye contact performances for each procedure across sessions

TABLE 7

SUMMARY OF THE ANALYSIS OF VARIANCE ON DURATION
OF EYE CONTACT FOR THE THREE PROCEDURES
ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	60.79	2	30.39	26.44	.0001
Error 1	11.49	10	1.14		
Sessions	17.55	50	1.75	8.08	.0001
Error 2	10.86	50	.21		
Procedure by sessions	8.09	20	.40	3.32	.0001
Error 3	12.16	100	.12		

and sessions, as well as their interaction, were found to be significant. Table 8 shows the means for the duration of eye contact for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 8 that the total duration of eye contact was longest for Procedure I, followed by Procedure II, and shortest for Procedure III. Examination of the mean for sessions indicates that the mean total for duration of eye contact increased as the number of sessions increased. The mean duration of eye contact for each procedure for each session was graphed and is presented in Figure 4. One can see from examining this figure that the duration of eye contact changed rapidly for Procedure I, less rapidly for Procedure II, and not at all for Procedure III.

Interpretation

The data indicate that the Imitative Interaction Procedure (P1) was more effective than Procedure II in increasing the frequency and duration of eye contact in the autistic subjects. The ineffectiveness of Procedure III, in which there was no relationship between the experimenter's and child's performances, suggests that such a relationship is important to gaze (eye contact) development. The imitative relationship was a form of interaction, which changed

TABLE 8

MEAN AND STANDARD DEVIATION FOR DURATION OF EYE CONTACT FOR
EACH PROCEDURE FOR EACH SESSION (SECONDS)

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	
1	1.0	0.5	.8	0.6	0.2	0.5	.6
2	1.3	0.1	.8	0.6	0.4	0.6	.7
3	1.4	0.3	1.0	0.5	0.6	0.7	1.0
4	1.6	0.4	1.1	0.5	0.6	0.7	1.0
5	1.8	0.5	1.3	0.1	0.4	0.6	1.0
6	1.8	0.5	1.3	0.2	0.4	0.6	1.1
7	1.9	0.5	1.5	0.2	0.8	0.6	1.3
8	2.3	0.6	1.6	0.4	0.4	0.6	1.3
9	2.3	0.6	1.6	0.5	1.0	0.5	1.6
10	2.5	0.7	1.7	0.5	0.4	0.6	1.5
11	2.6	0.7	1.7	0.6	0.4	0.6	1.5
Procedural Mean	1.8		1.3		.5		

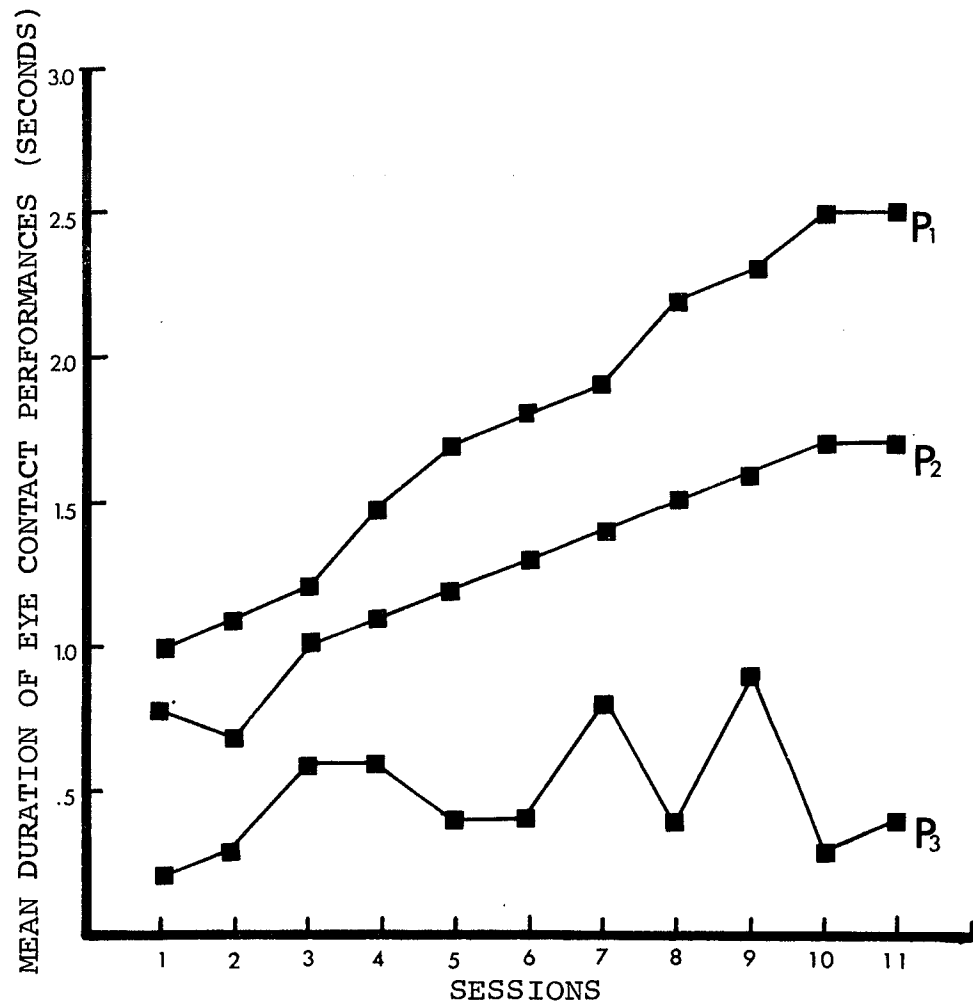


Figure 4: Means for duration of eye contact for each procedure across sessions

the subject's pattern of eye contact from a fleeting gaze to a sustained gaze.

Gaze Behavior Less Than 3 Seconds Across Conditions

Question

The third question to be answered was: did any of the play procedures affect the frequency and/or duration of gaze behavior oriented to the experimenter's performance (less than 3 seconds) in the autistic subjects in this study?

Data Treatment Used

A two factor analysis of variance for repeated measures as outlined by Winer (1971) was computed separately for frequency of gaze behavior (less than 3 seconds) and duration of gaze behavior. Significant main effects were not examined further since the major interest here was how subjects changed across sessions under the three different procedures, and not how treatments, averaged over sessions, differed or how sessions, averaged over treatments, differed. Significant interactions were examined graphically as outlined by Winer (1971).

Findings

Table 9 presents the summary of the analysis of variance for frequency of gaze behavior (less than 3 seconds). One

TABLE 9

SUMMARY OF THE ANALYSIS OF VARIANCE ON FREQUENCY
OF GAZE LESS THAN 3 SECONDS FOR THE THREE
PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	6870.53	2	3435.26	23.44	.0001
Error 1	1465.36	10	146.53		
Sessions	2372.88	10	237.88	17.47	.0001
Error 2	679.06	50	13.58		
Procedures by sessions	1492.33	20	74.61	6.40	.0001
Error 3	1164.30	100	11.64		

can see from examining this table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 10 shows the means for the frequency of gaze behavior (less than 3 seconds) for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 10 that the total frequency of gaze behavior was largest for Procedure I, followed by Procedure II, and smallest for Procedure III. Examination of the mean for sessions indicates that the mean total of gaze behavior increased as the number of sessions increased until session 6 and then steadily decreased. The mean frequency of gaze behavior for each procedure for each session was graphed and is presented in Figure 5. One can see from examining this figure that the mean number of gaze performances changed rapidly for Procedure I, less rapidly for Procedure II, not at all for Procedure III. This pattern was reversed after session 6. Procedure I decreased more rapidly than Procedure II, while Procedure III remained unaffected.

Table 11 presents the summary of the analysis of variance for duration (in seconds) of gaze behavior (less than 3 seconds) oriented to the experimenter's performance. One can see from examining this table that the main effects for procedures and sessions, as well as their interaction,

TABLE 10

MEAN AND STANDARD DEVIATION FOR FREQUENCY OF GAZE LESS THAN
3 SECONDS FOR EACH PROCEDURE FOR EACH SESSION

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
1	6.7	4.9	4.3	2.3	1.5	1.4	4.16
2	9.5	4.9	7.0	2.8	2.8	1.8	6.44
3	15.0	7.5	8.8	2.6	2.2	1.9	8.66
4	19.3	10.4	11.0	3.2	2.2	1.0	10.83
5	24.5	12.0	13.2	2.6	1.5	0.5	13.05
6	25.7	14.2	15.0	4.4	2.3	1.2	14.33
7	24.2	9.9	13.7	6.0	1.2	1.2	13.00
8	20.2	8.2	10.5	4.1	1.2	1.2	10.61
9	13.8	6.0	7.5	2.6	0.8	1.2	7.38
10	9.2	5.6	5.7	2.0	1.5	1.0	5.44
11	8.7	5.3	4.2	1.7	0.8	0.8	4.55
Procedural Mean	16.06		9.16		1.63		

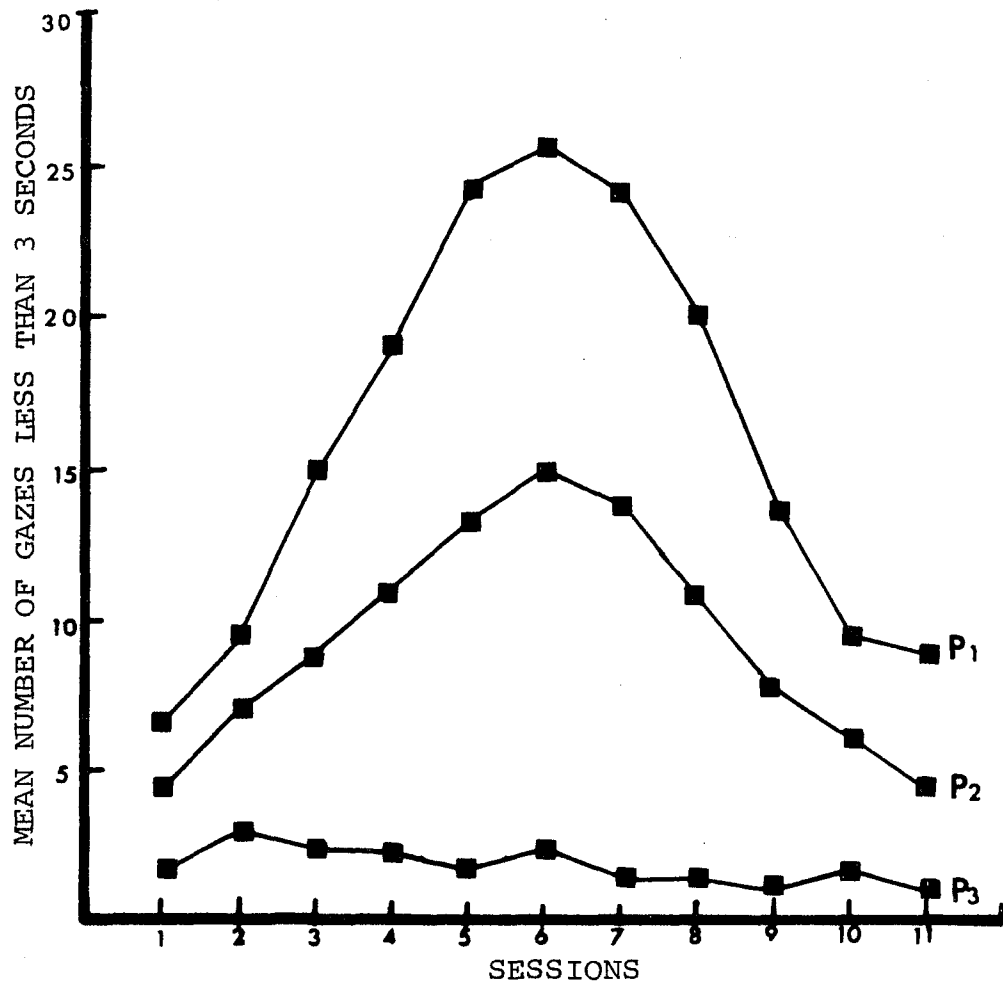


Figure 5: Means for frequency of gazes less than 3 seconds for each procedure across sessions

TABLE 11

SUMMARY OF THE ANALYSIS OF VARIANCE ON DURATION
OF GAZE LESS THAN 3 SECONDS FOR THE THREE
PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	39.38	2	19.69	55.99	.0001
Error 1	3.51	10	.35		
Sessions	28.25	10	2.82	16.60	.0001
Error 2	8.50	50	.17		
Procedure by sessions	24.54	20	1.22	15.63	.0001
Error 3	7.85	100	.07		

were found to be significant. Table 12 shows the means for the duration of gaze behavior (less than 3 seconds) for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 12 that the total duration of gaze behavior (less than 3 seconds) was longest for Procedure I, followed by Procedure II, shortest for Procedure III. Examination of the mean for sessions indicates that the mean total for duration of gaze behavior increased as the number of sessions increased. The mean duration of gaze behavior for each procedure for each session was graphed and is presented in Figure 6. One can see from examining this figure that the duration of gaze behavior changed more rapidly for Procedure I than for Procedure II. Procedure III effected little change.

Interpretation

The data indicate that the Imitative Interaction Procedure (P1) was more effective than Procedure II in increasing the frequency and duration of gaze behavior (less than 3 seconds) in the autistic subjects. The ineffectiveness of Procedure III in which there was no relationship between the experimenter's and child's performances suggests that such a relationship is important to gaze (less than 3 seconds) interaction development. Though the duration of gaze (less than 3 seconds) increases across sessions for

TABLE 12

MEAN AND STANDARD DEVIATION FOR DURATION OF GAZE LESS THAN 3 SECONDS
FOR EACH PROCEDURE FOR EACH SESSION (SECONDS)

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	
1	0.9	0.3	0.8	0.3	0.8	0.6	0.8
2	1.1	0.4	0.9	0.3	1.3	0.1	1.0
3	1.4	0.4	1.0	0.4	1.0	0.5	1.1
4	1.7	0.5	1.3	0.3	1.3	0.1	1.4
5	2.0	0.4	1.6	0.2	1.3	0.1	1.6
6	2.3	0.4	1.6	0.2	1.2	0.0	1.7
7	2.5	0.1	1.8	0.2	0.9	0.7	1.7
8	2.8	0.2	2.2	0.3	1.0	0.5	1.9
9	2.9	0.1	2.2	0.3	0.6	0.7	1.8
10	2.8	0.1	2.2	0.4	1.0	0.5	2.0
11	2.9	0.1	2.1	0.3	0.7	0.6	1.8
Procedural Mean	2.1		1.6		1.0		

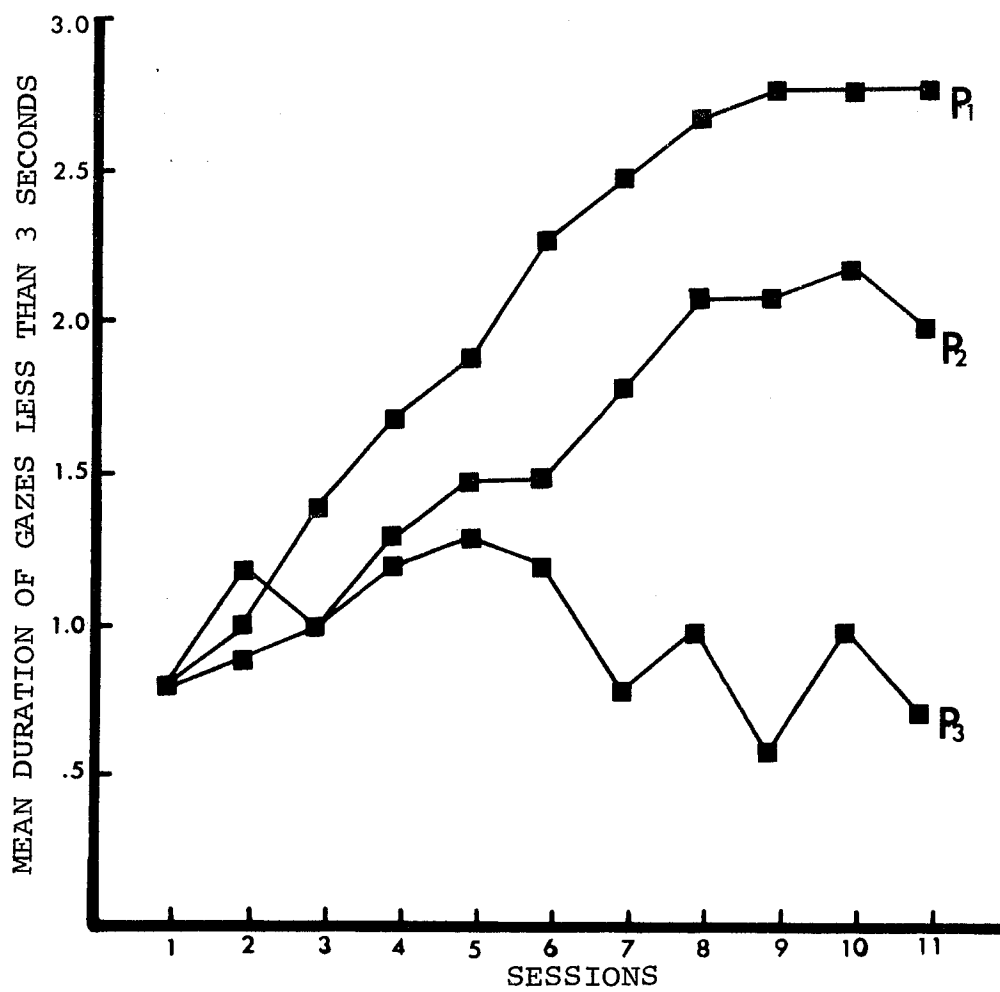


Figure 6: Means for duration of gazes less than 3 seconds for each procedure across sessions

P1 and P2, the frequency of gaze performances decreases after session 6. The decrease in the frequency of gaze behavior can be explained in terms of the developmental shift from shorter (gaze less than 3 seconds) to longer (gaze greater than 3 seconds) gaze performances. As the frequency of longer gazes increased the frequency of shorter gazes decreased. The duration of gaze performances (less than 3 seconds for P1 and P2), however, remained fairly constant during the last four sessions for P1 and P2. Here frequency and duration did not change in the same direction throughout the course of the experiment; the frequency of shorter gazes (less than 3 seconds) was affected by the development of longer gazes (greater than 3 seconds). Figures 5 and 7 indicate that the number of shorter gazes decreased as the number of longer gazes increased. The data suggest a gradual change in the frequency and duration of gaze interaction.

Gaze Behavior Greater Than 3 Seconds Across Conditions

Question

The fourth question to be answered was: did any of the play procedures affect the frequency and/or duration of gaze behavior (greater than 3 seconds) oriented to the experimenter's performance in the autistic subjects in this study.

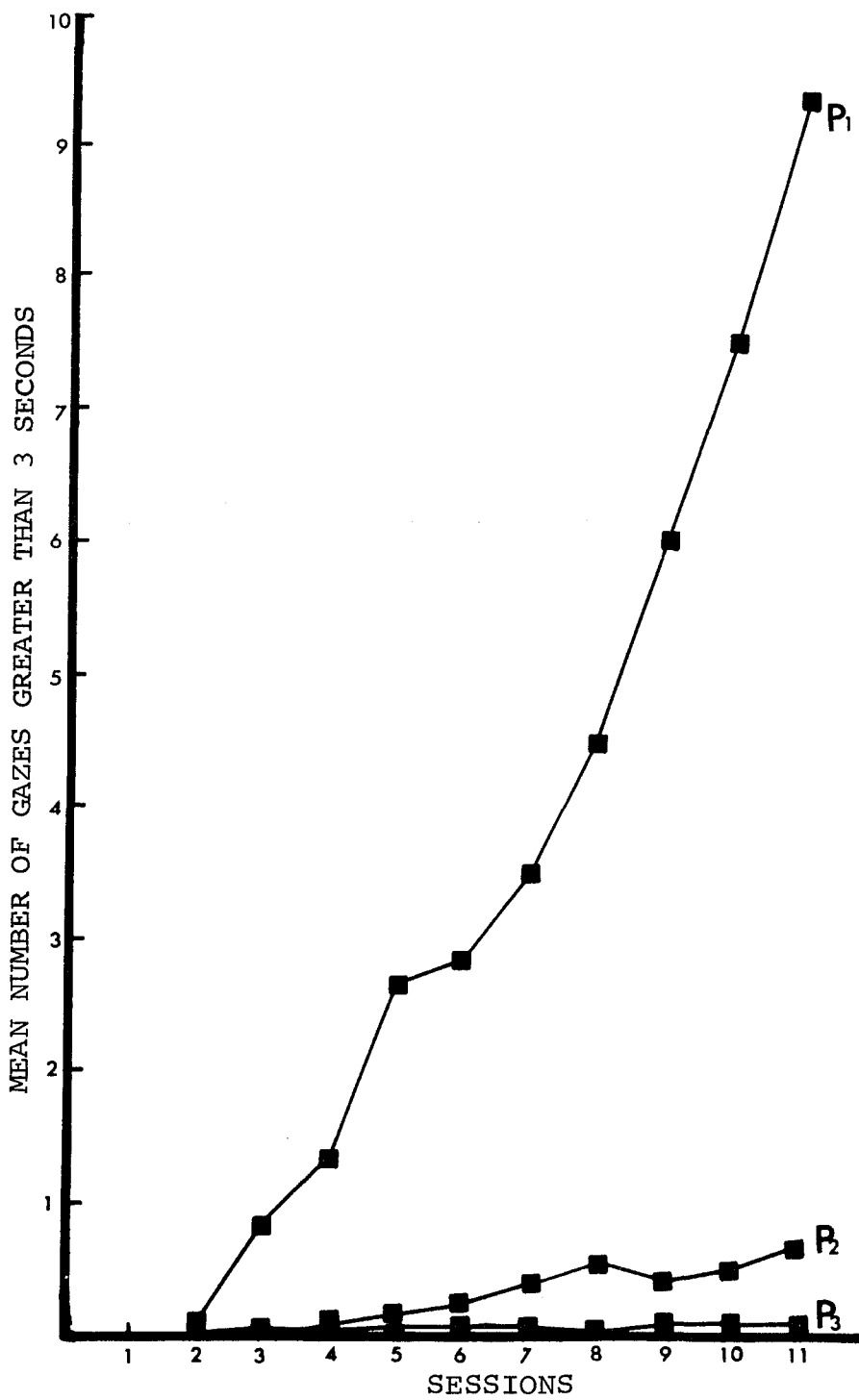


Figure 7: Means for frequency of gazes greater than 3 seconds for each procedure across sessions

Data Treatment Used

A two factor analysis of variance for repeated measures as outlined by Winer (1971) was computed separately for frequency of gaze behavior (greater than 3 seconds) and duration of gaze behavior. Significant main effects were not examined further since the major interest here was how subjects changed across sessions under the three different procedures and not how treatments, averaged over sessions, differed or how sessions, averaged over treatments, differed. Significant interactions were examined graphically as outlined by Winer (1971).

Findings

Table 13 presents the summary of the analysis of variance for frequency of gaze behavior (greater than 3 seconds). One can see from examining this table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 14 shows the means for the frequency of gaze behavior (greater than 3 seconds) for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 14 that the total frequency of gaze behavior was largest for Procedure I, followed by Procedure II, and smallest for Procedure III. Examination of the mean for sessions indicates that the mean total of gaze behavior for each procedure for

TABLE 13

SUMMARY OF THE ANALYSIS OF VARIANCE ON FREQUENCY
OF GAZE GREATER THAN 3 SECONDS FOR THE
THREE PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	383.82	2	191.91	9.71	.0051
Error 1	197.50	10	19.75		
Sessions	359.20	10	35.92	8.32	.0001
Error 2	215.82	50	4.31		
Procedure by sessions	292.27	20	14.61	7.73	.0001
Error 3	189.05	100	1.89		

TABLE 14

MEAN AND STANDARD DEVIATION FOR FREQUENCY OF GAZE GREATER THAN
3 SECONDS FOR EACH PROCEDURE FOR EACH SESSION

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
1	0.0	0.0	0.0	0.0	0.0	0.0	0.00
2	0.0	0.0	0.0	0.0	0.0	0.0	0.00
3	0.8	0.8	0.2	0.4	0.3	0.5	0.44
4	1.3	1.4	0.5	0.5	0.0	0.0	0.61
5	2.7	1.6	0.8	0.8	0.2	0.4	1.22
6	2.8	2.1	1.3	0.5	0.2	0.4	1.44
7	3.5	2.7	2.0	1.1	0.2	0.4	1.88
8	4.5	4.0	2.5	1.8	0.0	0.0	2.33
9	6.0	5.2	2.3	1.2	0.2	0.4	2.83
10	7.5	6.0	2.7	2.1	0.2	0.4	3.44
11	9.3	7.1	3.2	2.9	0.2	0.4	4.22
Procedural Mean	3.50		1.40		0.12		

each session was graphed and is presented in Figure 7. One can see from examining this figure that the mean number of gaze performances changed rapidly for Procedure I, less rapidly for Procedure II, and not at all for Procedure III.

Table 15 presents the summary of the analysis of variance for duration (in seconds) of gaze behavior (greater than 3 seconds) oriented to the experimenter's performance. One can see from examining the table that the main effects for procedures and sessions, as well as their interaction, were found to be significant. Table 16 shows the means for the duration of gaze behavior (greater than 3 seconds) for procedures for each session, as well as the total mean for sessions and procedures. One can see from Table 16 that the total duration of gaze behavior (greater than 3 seconds) was longest for Procedure I, followed by Procedure II, and shortest for Procedure III. Examination of the mean for sessions indicates that the mean total for duration of gaze behavior increased as the number of sessions increased. The mean duration of gaze behavior for each procedure for each session was graphed and is presented in Figure 8. One can see from examining this figure that the duration of gaze behavior changed more rapidly for Procedure I than for Procedure II. Procedure III effected little change.

TABLE 15

SUMMARY OF THE ANALYSIS OF VARIANCE ON DURATION
OF GAZE GREATER THAN 3 SECONDS FOR THE
THREE PROCEDURES ACROSS SESSIONS

Source	Sum of Squares	df	Mean Square	F	P
Procedures	235.50	2	117.75	87.52	.0001
Error 1	13.45	10	1.34		
Sessions	207.88	10	20.78	23.97	.0001
Error 2	43.35	50	.86		
Procedure by sessions	96.30	20	4.81	6.71	.0001
Error 3	71.73	100	.71		

TABLE 16

MEAN AND STANDARD DEVIATION FOR DURATION OF GAZE GREATER THAN 3 SECONDS
FOR EACH PROCEDURE FOR EACH SESSION (SECONDS)

Sessions	Procedures						Session Mean
	P1		P2		P3		
	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	Mean (seconds)	Standard Deviation	
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	2.1	1.6	0.5	1.3	1.0	1.5	1.2
4	2.2	1.7	1.5	1.7	0.0	0.0	1.2
5	3.4	0.4	2.1	1.6	0.5	1.3	2.0
6	3.7	0.5	3.1	0.2	0.5	1.3	2.4
7	3.7	0.4	2.8	1.4	0.5	1.3	2.3
8	4.1	0.7	3.4	0.3	0.0	0.0	2.5
9	4.2	0.6	3.5	0.3	0.5	1.3	2.7
10	4.6	0.8	3.6	0.4	0.5	1.2	2.8
11	4.9	0.9	3.1	1.5	0.5	1.3	2.8
Procedural Mean	2.9		2.1		0.3		

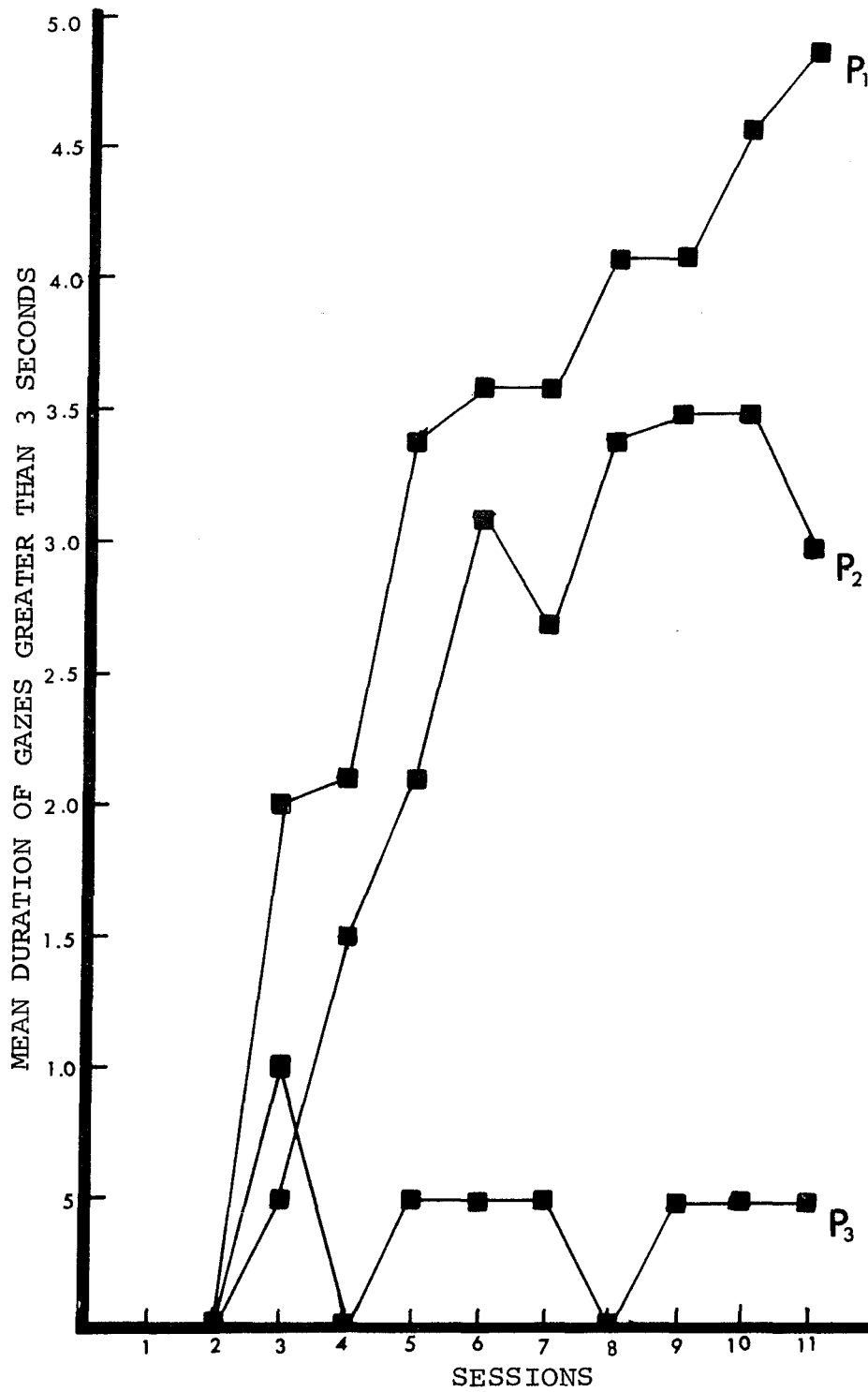


Figure 8: Duration of gaze behavior greater than 3 seconds for procedures across sessions

Interpretation

The data indicate that Imitative Interaction Procedure (Pl) was more effective than Procedure II in increasing the frequency and duration of gaze behavior (greater than 3 seconds) in the autistic subjects in this study. The ineffectiveness of Procedure III, in which there was no relationship between the experimenter's and child's performances, suggests that such a relationship is important to gaze (greater than 3 seconds) interaction development. The relationship between changes in frequency and duration was observed throughout the course of the experiment. A comparison of Figure 7 and Figure 8 indicates that there was a greater difference between Procedure I and Procedure II in frequency of gaze behavior than in duration of gaze behavior. Procedure I effected more of a change in frequency of gaze than Procedure II, whereas there was less of a difference between the two procedures in terms of duration of gaze. This suggests that duration might plateau more quickly than frequency. Duration must stop increasing at some point in time as continuous gazing would not permit integration of the performance observed.

Discussion

Research is useful to the extent that it generates new research questions and/or to the extent that research findings may be generalized to a larger clinical population. Several new and researchable questions have been suggested by the present research and a more detailed discussion of these appears on pages 125-128.

Data from this research may be viewed in terms of several contemporary issues which relate to autistic children and to the remediation of their clinical-interactional problems. Several of these issues are discussed below and provide a frame of reference for considering the data of this research. The present chapter is divided into the following areas--object interaction and imitative interaction. Each area is presented to highlight the following:

- a. The relationship between the research data and the interactional area discussed;
- b. The relationship between the research data and therapeutic intervention for the autistic child.

The Relationship between Gaze Interaction and Object Manipulation

A problem often experienced in therapy is that much of what a child learns is not modeled on the clinician's face. To learn many tasks and activities, the child's gaze

must be oriented toward the clinician's hand and body movements. Gaze interaction may, therefore, be described as a process of learning in which the child acquires relationships between people, actions and events within the environment. A procedure is required which would teach the child to gaze at the clinician's behavior over time, so that there would be a transference of stimulus control from the facial area to the body and/or task to be learned. Experimental research on this topic which is clinically oriented should focus, therefore, on the design of gaze remediation techniques.

Gaze Interaction. The nonverbal autistic child exhibits a persistent and characteristic feature known as gaze aversion. Therapy must focus on the modification of gaze interactional skills since gaze interaction between the autistic child and the clinician (or adult) is a requisite experience in therapeutic learning.

Experimental results of the present research revealed that the autistic children, who served as subjects, initially interacted with various objects without gazing at the experimenter's performances. As a result of procedures I and II, the children became more aware of the experimenter's performance as indicated by an increase in the frequency and duration of gaze behavior. The experimenter's imitation

of the child's movements and performances with objects (procedure I) resulted in a greater increase in the dependent variables: frequency and duration of gaze behavior and object manipulation--than procedure II. The present research serves to support the belief that it is possible to modify the disordered gaze behavior observed in autistic children.

Stern (1974) contends that each gaze interaction can be considered a learning trial. If so, what is it that the child learns by means of gaze interaction? Morehead and Morehead (1974) assert that the normal child learns about his world by gazing at the results of his actions on the environment. For the autistic child, the therapeutic environment provides essential learning experiences that have not been identified in the natural environment. Gaze interaction is a prerequisite to therapeutic interaction between clinician and child. The present writer suggests that modification of gaze interaction will increase learning in the therapeutic environment and in the natural environment by permitting the autistic child to gaze at the results of his actions on people and objects. In addition, gaze interaction would enable the clinician to teach tasks and activities to the child. In the opinion of the present writer, data from this research can be interpreted to support the role of

gaze interaction in the learning process (in this case, the development of object manipulated performances). This interpretation is supported by Hutt and Ounsted (1966), who posit that interaction (in this case play interaction) is not possible without gaze interaction.

Object Interaction. In modifying the process of gaze interaction, an expansion of the manipulation repertoire (measured by the increase in the frequency and duration of object manipulation performances) was also noted as a function of procedures I and II (a greater increase resulted as a function of procedure I). Imitation of the autistic child's performances may be a significant step in establishing the gaze interactional skills required to develop a manipulation repertoire of objects.

A problem frequently cited about autistic children is the paucity of object interactions as well as the maladaptive nature of their object manipulations, i.e., repetitive movements and oral use of toys (Black, Freeman and Montgomery, 1975; Tilton and Ottinger, 1964).

Several studies have described the manipulative behaviors of the autistic child whose most salient characteristic is gaze aversion. Eisenberg and Kanner (1956) describe the autistic child's preoccupation with simple

repetitive activities. Bakwin (1954) describes a disinterest in toys and/or repetitive toy play which endures for hours. Polan and Spencer (1959) characterize the toy play of the autistic child as perseverative. Black, Freeman and Montgomery (1975) also note that if the autistic child does play at all, it is alone and manipulation of objects is inappropriate. The inability to play appropriately with objects further limits the already impaired interactional and social system in autistic children. Unless a child develops appropriate play skills through interaction with objects in the environment, social development will be severely impaired and inappropriate patterns of behavior will be reinforced.

Increasing the manipulation repertoire is essential in expanding the autistic child's interaction with the environment. Results of the present research suggest that by making use of the autistic child's limited manipulation repertoire, it is possible to expand his interactions (measured by the increase in the frequency and duration of object manipulation performances) within the environment. In the opinion of the present writer, the development of object manipulations seems to be related to gaze interaction skills. Though the two processes (i.e., gaze interaction and manipulative interaction) seem to be related, from a

developmental point of view, gaze interaction must be the initial, and perhaps, primary concern of therapeutic intervention (Hewett, 1965; Hartung, 1970; Sulzbacher and Costello, 1970).

In summary, data of the present research seem to support the assertion that imitation of the autistic child's performances serves to emphasize the effect he has on the object and on the environment. It would seem that by this process the autistic child is given an enhanced opportunity to observe his own actions and the results of those actions on people and objects. This in turn seems to affect the autistic child's level of object manipulation.

The Relationship between Child Interaction and Imitative Interaction

Child Interaction. The results of the three interaction procedures in the present study provide some insight into the controlling variables in adult-child interaction. In procedure III, in which the child had no control of the adult or the adult's performances, the number of gaze behaviors and object-manipulated performances, initiated by the child, was insignificant. In terms of the child's behavior, the adult was completely nondirective. In procedure I, in which the child had total control of the adult and the adult's performances the number of gaze behaviors

and object-manipulated performances, initiated by the child, changed significantly. In terms of the child's behavior, here too, the adult was completely nondirective. Further analysis suggests that the degree of control exercised by the child over the environment, the adult and the adult's performances, is the critical procedural variable. With respect to this particular population of impaired children, the imitative interaction procedure provides an experience basic to development, i.e., learning to control the environment through manipulation of the environment. In procedure I, the autistic child's performance is reinforced by the immediate and controlling effect it has on the environment.

Imitative Interaction. Data from the present study support the premise that imitation of the child by the adult may be a critical factor in the autistic child's learning to establish and maintain interaction (Liebergott and Swope, 1976). Imitation of the autistic child's manipulation performances places the child in complete control of the environment, the adult, and the adult's performances. In addition, it ensures that the development of object manipulations is not confounded by the presentation of manipulative performances not within the child's behavioral

repertoire. Here, the child's performances are used to develop adult-child interaction.

The present writer suggests that the procedural results of the present study lend support for the role of imitation in the development of interaction. Research data support the contentions of Rees (1975) and Liebergott and Swope (1976) that interaction is basic to language; imitation of the autistic child provides the means by which interaction between adult and child can be developed and maintained.

In summary, a basic clinical question with the autistic child is, how does the clinician teach the child to interact with the environment? The present study suggests that gaze and manipulative interaction can be modified by reinforcing the effect of the autistic child's behavior on the environment. The imitative interaction procedure provides a means of reinforcing the child's initiations through control of the adult and the adult's performances.

Limitations of the Present Research

This section is organized around a discussion of certain limitations in the present study: subject selection, sample size, research setting, rater-reliability, and longitudinal considerations. The purpose here is to discuss

these difficulties in light of the recommendations for future research appearing in the next section.

Subject Selection

Garfield (1978) notes that the terminological differences present in psychopathology greatly enhance the problems related to defining a particular disordered population. Consequently, it is exceedingly important that the subjects be selected with as much useful descriptive information as possible. Though the present writer agrees with the need for a detailed subject description, the term "useful" information (as used by Garfield, 1978) highlights the difficulties in attempting to come to terms with this problem. The selection of subjects in experimental research is clearly of prime importance. Thus, the criteria used in selecting subjects require explicit presentation. Garfield (1978) posits that in studies conducted on populations in which the psychiatric diagnosis is a factor, it is essential that commonly accepted characteristics be utilized. Unfortunately, there are no commonly accepted standard reference measures that can be used to define the autistic population-- or any clinical population for that matter. Therefore, replication of the present study with other children from this clinical population (using the present selection

criteria as well as other characteristics) should be considered since it is apparent that subject differences affect the reliability of the results, and the generality of conclusions.

Sample Size and Setting

The problems described above are particularly visible when samples of modest size are employed in experimental research. Small-scale studies have a greater tendency to produce findings limited in reliability (Garfield, 1978). The problem of small sample size becomes even more evident when variations in the clinical setting, from which children are drawn, are considered. The clinical settings can have a major effect on behavior. The different experiential histories and expectations of subjects coming from public schools, hospitals, clinics and residential institutions, can produce differences in behavior, despite similarities in developmental-diagnostic characteristics. It is, therefore, essential that the experimental-clinical setting be treated as an important variable that can influence results. Since generalizations from one setting to another setting are limited, even though the subjects involved are all members of the same clinical group, replication of the present study within another clinical environment should be considered.

Rater-Reliability

In addition to situational effects, the type of observer and his/her relationship with the child inevitably affect the behavioral changes reported. Since there is no single criterion situation against which to validate observations, it is important to:

- a. train raters to observe changes in the dependent variables;
- b. obtain multiple reliability measures from observers during experimental intervention.

Further problems with reliability become apparent when variability involved with training raters is considered. Part of the difficulty with recording behavioral changes (and thus, rater-reliability) could have been circumvented by the use of audio-visual equipment throughout experimentation. Audio-visual equipment was used only during rater training. Thus, observers could not record and analyze data from tapes. For the reasons described, replication of the present study should involve the use of audio-visual equipment.

Longitudinal Considerations

The present study was conducted across seventeen experimental sessions. Though significant changes occurred in all of the dependent variables, further experimental

interaction might have provided clinical insights which accrued as a function of a longitudinal effect. Though longitudinal research is slow and expensive, it provides more clinically relevant data than cross-sectional analyses (especially when small samples are involved). Achenbach (1978) posits that "one-shot studies" are limited in their contribution to the clinical body of knowledge by the uniqueness of their procedures, measures and subject samples. Replication should be considered with extended procedural intervention in mind.

Summary

Since no study provides definitive answers by itself, an experimental investigation is of little value if it cannot be replicated for purposes of cross-validation and generalization. Achenbach (1978) suggests that new studies will provide confusion rather than clinical knowledge, unless research practitioners and academicians attend more systematically to issues related to procedures, measures and subject samples. Linking research in one field to research in another professional-clinical area with the goal of generalization and replication cannot be achieved unless research can be more efficiently coordinated.

Finally, it should be noted that the ultimate aim of clinical research is to remediate maladaptive development

and interaction. Therefore, experimental validation is of utmost importance if broad clinical applications are to occur. The present study should be replicated and designed with the above-mentioned limitations in mind.

Recommendations for Future Research

The importance of a research study can be evaluated in terms of its insights and contribution to future investigations. Since practicing clinicians are the major consumers of clinical research, clinical researchers must orient their work to the needs of practitioners by providing usable results in a constructive manner. It is only through implementation in clinical practice that researchers can obtain feedback on the efficacy of their results (Achenbach, 1978).

Generalization

The importance of generalization: the problem of teaching subjects to generalize their responses to a variety of settings and to a variety of people, emphasizes the need for replication of the present study. The work of Lovaas, Schreibman, Koegel and Rehm (1971) regarding the responses of autistic, retarded and normal children highlights the necessity of replication for autistic children. Lovaas et al. found that autistic children responded to only one

stimulus of the multiple stimulus complex. Thus, the autistic subjects were not able to respond to all of the stimuli presented in the learning context. Harris (1975) goes even further by suggesting that autistic children, having learned under highly controlled conditions, often fail to generalize to contexts or situations which contain some, but not all, of the stimuli present during the initial training experience. Since autistic children have particular difficulty identifying similar stimuli in various contexts, which would set the occasion for appropriate responding, repeated training in a wide range of situations is necessary to facilitate generalization. The present study should be replicated in a variety of settings and with a variety of disordered populations for the following reasons:

1. Replication of the present study with autistic children in different situations would have a twofold effect. First, it would indicate whether therapeutic-clinical effects must be limited to a particular context and/or clinician involved. Second, it would provide training in a variety of settings and with a variety of therapists; this would facilitate generalization.
2. Replication of the present study with other gaze disordered populations would indicate whether

the therapeutic-clinical effects must be limited to a specific group.

Parents as Co-therapists

The notion that training must focus upon the transition to the natural environment raises support for parental involvement in the therapy experience. The present research should be replicated within the autistic child's home environment with the parent(s) to ensure that there is sufficient environmental support to maintain gaze and manipulative interaction behaviors beyond the therapy room (Lovaas, Koegel, Simmons and Long, 1973). Such a study should measure the therapeutic effects that result when parents are involved with the experimenter in the training experience as compared to the experimenter alone providing the training.

Self-Play

The present study investigated the modification of gaze and manipulative behavior in a dyadic interaction. Further research should investigate the autistic child's gaze behavior and object manipulated responses during isolated interaction with objects, longitudinally. The results of this type of research would indicate whether the autistic child's gaze and manipulative behaviors are different under the two conditions. It would, also be important

to note what, if any, changes in behavior occurred over time in self-play.

Diagnostic Indicator

The identification of gaze behavior as a diagnostic indicator requires long-term assessment of high-risk infants to discover a gaze disordered pattern. Longitudinal analysis would indicate whether or not the disordered gaze behavior characteristic of autistic children, as well as other populations, has its onset in infancy. If a high proportion of gaze disordered infants later developed into children with the etiological characteristics of autism, remediation procedures could be developed given the early identification of impairment. At the present time, researchers and clinicians can only assume that the disordered gaze pattern observed in autistic children occurred in early infancy and that disordered infants can be identified on the basis of gaze behavior. This research would have important implications for the areas of diagnosis and clinical intervention.

APPENDIX A

SUBJECT PROFILE

<u>Subject</u>	<u>Age</u>	<u>Language Deficiency</u>	<u>Affect Avoidance</u>	<u>Stimulatory Behaviors</u>	<u>Absence of Skills</u>	<u>Destructive Behaviors</u>
1	4.0 years	nonverbal	avoids physical contact and eye contact glazed stare	spinning tapping rocking	not toilet trained does not wash or dress herself	-
2	4.5 years	nonverbal	avoids physical contact and eye contact glazed stare	rocking twirling	not toilet trained does not wash or dress himself	tantrums bites himself
3	4.7 years	echolalic	avoids physical contact and eye contact glazed stare	rocking spinning handflapping	not toilet trained does not wash or dress himself	tantrums head banging biting
4	4.3 years	nonverbal	avoids physical contact and eye contact glazed stare	rocking spinning	not toilet trained does not dress or wash herself	tantrums
5	5.7 years	nonverbal	avoids physical contact and eye contact glazed stare	rocking twirling handflapping	not toilet trained does not dress or wash himself	tantrums
6	6.0 years	echolalic	avoids physical contact and eye contact glazed stare	twirling spinning	not toilet trained does not dress or wash himself	tantrums scratching

APPENDIX B

OBJECTS USED DURING EXPERIMENTATION

Motorcycle

Dump Truck

Baby Doll

Slinky

Rattle

Telephone

Bell

Car

APPENDIX C
PLAY INTERACTION

Name: _____ Date: _____

Procedure: _____
Session: _____

Object Presented	Object Manipulations		Eye Contact			Gaze Directed to Clinician's Performance G<3			Gaze Directed to Clinician's Performance G>3			
	Type of Performance	f	T.T.	f	T.T.	\bar{t}	f	T.T.	\bar{t}	f	T.T.	\bar{t}
Truck	push/pull	8	15	3	10.0	3.3	2	5.0	2.5	1	4	4
	turn wheels	12	5	4			3	5.0	1.6	0	0	0
	back up/down	3	4	0	0.0	0.0	1	2.0	2.0	0	0	0
Slinky	shake	11	14	1	1.0	1.0	2	1.6	0.8	0	0	0
	open/close	6	25	0	0.0		1	0.4	0.4	0	0	0
Rattle	shake	7	10	1	2.0	2.0	1	0.3	0.3	0	0	0
	bang	4	2	1	1.5	1.5	1	0.9	0.9	0	0	0
Motorcycle	push/pull	2	5	3	5.0	1.6	0	0.0	0.0	0	0	0
Total		53	83	13	19.5	1.5	11	15.2	1.3	1	4	4

Note: f = frequency; \bar{t} = mean time in seconds; T.T. = total time in seconds

APPENDIX D

RATER RELIABILITY

Dependent Variables	Training Days					Experimental Days			
	1	2	3	4	5	1	2	3	4
Object manipulation: frequency	.87	.89	.91	.85	.94	.92	.91	.89	.93
Object manipulation: duration	.86	.85	.87	.85	.86	.86	.85	.87	.85
Eye contact: frequency	.88	.89	.85	.89	.93	.92	.89	.91	.95
Eye contact: duration	.85	.85	.86	.87	.85	.86	.87	.85	.86
Gaze less than 3 seconds: frequency	.94	.97	.93	.91	.95	.96	.98	.95	.96
Gaze less than 3 seconds: duration	.87	.87	.85	.85	.86	.85	.87	.85	.86
Gaze greater than 3 seconds: frequency	.99	.98	.99	1.00	1.00	1.00	1.00	1.00	1.00
Gaze greater than 3 seconds: duration	.89	.92	.96	.91	.92	.94	.93	.97	.91

APPENDIX E
 MEAN DATA FOR
 EYE GAZE (EYE CONTACT): FREQUENCY

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	8	6	10	9	12	15	13	17	21	38	23
2	3	1	14	15	9	18	25	26	23	24	18
3	6	2	9	11	10	13	12	14	18	11	12
4	4	9	12	15	16	18	13	15	23	19	20
5	3	5	9	13	15	16	20	21	20	23	22
6	0	2	4	4	6	7	11	10	13	16	19
<u>Procedure II</u>											
1	1	2	1	3	1	1	4	2	1	1	2
2	4	4	0	2	8	4	9	6	12	4	8
3	0	1	1	0	1	1	2	1	1	1	1
4	4	7	9	11	8	15	12	13	10	9	9
5	1	0	3	4	5	6	5	7	10	9	9
6	0	0	1	2	2	1	3	5	4	5	5
<u>Procedure III</u>											
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	5	7	3	9	5	7	2	3	4
3	0	1	0	0	0	0	0	0	1	0	0
4	0	1	2	1	1	3	4	1	2	3	4
5	1	0	1	0	0	0	3	0	1	0	0
6	0	0	0	1	0	0	2	0	3	0	0

APPENDIX F
 MEAN DATA FOR
 EYE GAZE (EYE CONTACT) : DURATION (SECONDS)

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	1.0	1.4	1.9	2.2	2.4	2.5	2.6	2.9	3.1	3.0	3.0
2	1.5	1.4	1.6	1.8	2.2	2.3	2.4	2.7	3.1	3.6	3.4
3	1.2	1.2	1.1	1.2	1.3	1.3	1.4	1.6	1.7	1.7	1.7
4	1.2	1.3	1.2	1.3	1.2	1.4	1.5	1.8	1.9	1.8	2.0
5	1.3	1.2	1.3	1.3	1.5	1.6	1.5	1.9	2.0	2.2	2.3
6	0.0	1.2	1.4	1.6	1.9	1.8	2.1	2.8	2.2	2.7	2.9
<u>Procedure II</u>											
1	1.2	1.1	1.3	1.4	1.2	1.5	1.7	1.6	1.8	2.1	2.4
2	1.3	1.2	0.0	1.3	1.4	1.6	1.8	2.3	2.5	2.6	2.6
3	0.0	1.1	1.1	0.0	1.1	1.1	1.2	1.2	1.2	1.2	1.2
4	1.2	1.3	1.3	1.4	1.3	1.2	1.3	1.3	1.4	1.4	1.3
5	1.2	0.0	1.3	1.2	1.3	1.3	1.3	1.4	1.3	1.4	1.3
6	0.0	0.0	1.2	1.3	1.3	1.3	1.4	1.5	1.5	1.5	1.6
<u>Procedure III</u>											
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	1.2	1.3	1.3	1.1	1.2	1.3	1.2	1.2	1.2
3	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
4	0.0	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2
5	1.2	0.0	1.2	0.0	0.0	0.0	1.2	0.0	1.2	0.0	0.0
6	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	1.2	0.0	0.0

APPENDIX G
 MEAN DATA FOR
 EYE GAZE LESS THAN 3 SECONDS: FREQUENCY

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	8	12	23	28	33	21	14	12	8	4	7
2	16	18	25	36	44	53	41	30	21	18	19
3	4	5	10	12	16	15	20	14	11	8	6
4	4	9	12	15	18	21	16	13	8	5	4
5	5	8	14	16	24	28	29	23	14	6	7
6	3	5	6	9	12	16	25	29	21	14	9
<u>Procedure II</u>											
1	4	7	8	9	12	13	7	5	4	4	2
2	8	11	13	12	15	19	22	16	11	8	7
3	5	9	11	15	15	20	18	14	9	7	4
4	2	5	8	11	16	16	15	10	8	7	4
5	4	7	9	13	12	14	13	11	8	5	5
6	2	3	5	6	9	8	7	7	5	3	3
<u>Procedure III</u>											
1	3	5	1	1	2	1	0	3	1	2	1
2	0	3	5	3	2	3	2	1	3	3	2
3	0	2	0	1	1	3	0	1	0	2	0
4	1	1	2	3	1	2	1	0	0	0	0
5	3	5	4	3	1	4	3	2	0	1	1
6	2	1	1	2	2	1	1	0	1	1	1

APPENDIX H

MEAN DATA FOR
EYE GAZE LESS THAN 3 SECONDS:
DURATION (SECONDS)

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	0.8	0.9	1.1	1.3	1.7	1.9	2.6	2.9	2.9	2.8	2.9
2	0.5	0.7	1.7	1.8	1.9	2.5	2.4	2.7	3.0	2.8	2.9
3	0.8	1.2	1.7	2.4	2.6	2.9	2.6	2.9	2.8	2.7	2.9
4	0.8	0.8	1.4	1.9	2.3	2.7	2.6	2.5	2.7	2.9	2.9
5	0.9	1.1	0.9	1.0	1.5	1.8	2.4	2.7	2.9	2.9	2.7
6	1.4	1.7	1.8	1.8	1.8	2.1	2.5	2.9	2.8	2.9	2.8
<u>Procedure II</u>											
1	1.1	0.8	1.2	1.4	1.3	1.5	1.8	2.3	2.4	2.1	2.2
2	0.5	0.8	0.8	0.9	1.5	1.4	2.0	2.4	2.3	2.3	2.3
3	0.9	1.1	1.3	1.4	1.6	1.8	1.5	2.3	2.1	2.0	2.1
4	0.4	0.8	0.5	1.4	1.7	1.8	1.8	1.5	1.7	1.8	1.6
5	0.8	0.7	0.8	1.2	1.3	1.3	1.9	2.3	2.5	2.3	2.0
6	1.1	1.4	1.6	1.7	1.9	1.7	1.9	2.1	2.1	2.3	2.2
<u>Procedure III</u>											
1	1.2	1.2	1.3	1.2	1.3	1.2	0.0	1.2	1.3	1.2	0.9
2	0.0	1.2	1.2	1.2	1.3	1.2	1.4	1.3	1.2	1.3	1.0
3	0.0	1.2	0.0	1.2	1.3	1.2	0.0	1.2	0.0	1.2	0.0
4	1.2	1.3	1.2	1.3	1.2	1.2	1.2	0.0	0.0	0.0	0.0
5	1.3	1.3	1.2	1.2	1.3	1.2	1.2	1.2	0.0	1.2	1.3
6	1.3	1.3	1.3	1.5	1.4	1.3	1.3	1.2	1.3	1.3	1.2

APPENDIX I
 MEAN DATA FOR
 EYE GAZE GREATER THAN 3 SECONDS: FREQUENCY

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	0	0	1	3	4	5	8	11	14	15	19
2	0	0	0	3	5	6	5	7	9	14	16
3	0	0	0	0	1	2	1	1	2	3	5
4	0	0	1	1	2	1	1	1	2	2	2
5	0	0	1	0	1	1	2	2	1	2	3
6	0	0	2	1	3	2	4	5	8	9	11
<u>Procedure II</u>											
1	0	0	0	1	0	2	3	5	3	6	7
2	0	0	0	0	1	2	2	3	3	4	5
3	0	0	0	0	1	1	2	1	1	1	1
4	0	0	0	0	0	1	0	1	2	1	0
5	0	0	0	1	1	1	2	1	1	1	1
6	0	0	1	1	2	1	3	4	4	3	5
<u>Procedure III</u>											
1	0	0	0	0	0	0	1	0	0	0	1
2	0	0	1	0	1	0	0	0	1	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	0	1	0	0	0	1	0

APPENDIX J

MEAN DATA FOR
EYE GAZE GREATER THAN 3 SECONDS:
DURATION (SECONDS)

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	0.0	0.0	3.2	3.4	4.0	3.8	4.1	5.2	4.9	5.5	5.9
2	0.0	0.0	0.0	3.3	3.7	4.1	3.8	4.3	4.5	5.0	5.2
3	0.0	0.0	0.0	0.0	3.0	3.1	3.0	3.3	3.2	3.4	3.5
4	0.0	0.0	3.0	3.1	3.1	3.2	3.4	3.6	3.7	4.0	4.1
5	0.0	0.0	3.3	0.0	3.2	3.5	3.6	3.9	4.2	5.0	5.5
6	0.0	0.0	3.0	3.3	3.6	4.2	4.1	4.5	4.5	4.9	5.4
<u>Procedure II</u>											
1	0.0	0.0	0.0	3.1	0.0	3.4	3.2	3.3	3.6	3.6	3.9
2	0.0	0.0	0.0	0.0	3.2	3.1	3.4	3.8	3.7	3.8	3.9
3	0.0	0.0	0.0	0.0	3.1	3.0	3.1	3.2	3.1	3.1	3.2
4	0.0	0.0	0.0	0.0	0.0	3.1	0.0	3.2	3.2	3.3	0.0
5	0.0	0.0	0.0	3.0	3.1	3.0	3.1	3.2	3.5	3.4	3.4
6	0.0	0.0	3.1	3.0	3.2	3.4	3.7	3.8	4.0	4.1	4.1
<u>Procedure III</u>											
1	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	3.1
2	0.0	0.0	3.0	0.0	3.1	0.0	0.0	0.0	3.1	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	3.0	0.0	0.0	3.1	0.0	0.0	0.0	3.0	0.0

APPENDIX K
 MEAN DATA FOR
 OBJECT MANIPULATION: FREQUENCY

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	80	86	92	94	107	134	159	160	236	277	276
2	23	39	50	69	65	88	103	119	144	166	214
3	13	17	21	19	36	41	59	62	61	73	88
4	23	16	23	49	66	79	78	97	109	113	137
5	34	35	39	48	53	157	94	127	199	202	239
6	48	59	102	109	128	137	168	217	248	287	301
<u>Procedure II</u>											
1	72	74	69	80	81	97	85	99	125	103	102
2	43	56	65	69	94	86	99	102	93	115	123
3	1	3	5	16	19	20	32	33	47	51	50
4	15	11	18	29	28	27	34	39	41	49	69
5	23	28	31	33	29	46	47	78	75	99	131
6	31	47	62	73	89	101	103	120	128	135	147
<u>Procedure III</u>											
1	63	59	71	68	57	74	65	70	51	53	59
2	0	22	43	28	32	53	30	29	31	24	36
3	0	10	13	11	14	12	25	13	16	17	15
4	3	14	9	10	13	16	17	21	15	18	13
5	10	38	35	37	36	30	35	38	31	32	39
6	23	32	29	40	49	55	57	63	67	65	60

APPENDIX L
 MEAN DATA FOR
 OBJECT MANIPULATION: DURATION (SECONDS)

Subject	Sessions										
	1	2	3	4	5	6	7	8	9	10	11
<u>Procedure I</u>											
1	280	293	284	305	378	405	488	549	612	789	811
2	35	237	238	275	363	518	581	601	722	761	880
3	79	77	110	156	197	201	218	217	333	358	438
4	73	79	78	82	88	104	158	287	362	397	422
5	133	187	386	484	592	512	596	644	839	900	881
6	162	188	389	498	576	588	591	632	777	847	898
<u>Procedure II</u>											
1	131	126	138	141	262	269	289	303	324	445	506
2	85	200	201	230	285	303	357	358	363	362	384
3	3	13	72	84	92	201	211	230	258	298	288
4	97	93	90	101	132	121	143	137	202	203	221
5	227	297	294	304	362	390	520	593	475	576	592
6	232	285	291	309	351	383	469	503	530	587	599
<u>Procedure III</u>											
1	142	151	160	181	193	187	299	201	176	289	295
2	0	62	78	101	99	138	183	231	201	300	277
3	0	47	57	82	68	79	93	78	101	113	89
4	13	24	37	41	48	57	72	79	82	90	84
5	45	160	230	182	128	211	304	231	195	265	293
6	49	86	127	155	160	172	186	195	203	224	247

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