# PRE-INTENTIONAL AND INTENTIONAL COMMUNICATION IN PRE-LINGUISTIC PROFOUNDLY MENTALLY RETARDED MULTIHANDICAPPED ADULTS

By

ANNE CHARLENE HARBOUR

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ADULTS

Thesis Approved:

Arthur L Pent
Thesis Adviser

Gary J. Beeby

Cheryl M. Scott

Norman N Durham
Dean of the Graduate College

## PREFACE

Twelve young adults with profound mental retardation and multiple sensory and motor handicaps were videotaped as they interacted with a researcher who presented them with eight objects, familiar and novel, moving and still. From transcriptions of the videotapes, the subjects' actions and reactions judged to be communicative were described, analyzed, and categorized. The analyses were then compared to descriptions of pre-intentional and intentional communication in normally-developing children.

Results indicated that the subjects exhibited many communicative behaviors present in normal children of the same developmental language and mental ages. Subjects with language and mental ages of less than eight months exhibited pre-intentional communicative behaviors typical of infants aged eight months or younger. They reacted to and acted upon stimuli without apparent realization that their actions had communicative value. Subjects with language and mental ages over eight months exhibited communicative intents shown by typical children eight months of age or older. These subjects showed awareness that their actions could be directed to a message receiver who would understand their communicative intent. Results could have implications for assessment and treatment of individuals with similar developmental disorders.

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# CHAPTER I

## INTRODUCTION

Sixty years of research into the development of speech and language have revealed some fairly predictable patterns in the normal progression of vocalizations as they become speech, as well as the higher processes of speech as it becomes language. Researchers have noted the patterns of development, but still lack complete understanding of the processes underlying those patterns (Stark, 1979).

While most studies of speech and language development have been conducted with young, normally-developing children as subjects, other studies have been done with young children whose speech and language have not developed as expected. Some research has centered on the speech and language of children with mental retardation who, however delayed, may still have potential for further development. A few studies have also considered the communication disorders of adults with mental retardation.

However, no systematic studies on communication development have been conducted using adults who are severely developmentally disordered due to profound mental retardation accompanied by one or more physical or sensory handicaps. The disparity of the numerous variables encountered, and the inevitable interplay of those variables, make it difficult to match similar subjects, study myriad results, and draw reliable conclusions. A single aspect of overall

development, such as the acquisition of communication skills, can be difficult to track amid the multitude of interrelated conditions which can affect it.

# CHAPTER II

## REVIEW OF LITERATURE

Recent research has supported the view that early developing non-verbal gestural behaviors (whole-body responses or facial expressions), which can be observed even in newborns' initiations and responses to interaction, are significantly related to later development of verbal communication (McLean, Snyder-McLean, Sack and Decker, 1981). Gestures not only have been shown to contain communicative intent (Bates, Benigni, Bretherton, Camaioni, and Volterra, 1977; Coggins and Carpenter, 1981; Mastergeorge, 1980; Snyder, 1978; Sugarman, 1973), but also communicative intents conveyed gesturally have been termed as communicatively valuable as the same intents conveyed verbally (Carpenter, Mastergeorge, and Coggins, 1983). Siebert, Hogan and Munday (1986) studied children with mental retardation and found a positive correlation between sensorimotor and linguistic communication. Oller and Siebert (1988) studied vocalizations in preverbal children with retardation and suggested that canonical (well-formed syllabic) babbling may be a necessary prerequisite for development of spoken language. Others (Cruttenden, 1970; Menyuk, 1968; Oller, Weiman, Doyle & Ross, 1975; Vihman, 1986; Vihman, Macken, Miller, Simmons & Miller, 1985) have shown developmental relationships between infant babbling and early meaningful speech.

A pilot study (Harbour, Pentz, and Panagos, 1988) was conducted using 16 subjects with profound mental retardation and multiple physical and sensory handicaps. It revealed that the pattern of speech-like sound development was relatively normal, but extremely delayed. Those subjects who could produce speech sounds observed at 12 months in the normal infant's repertoire appeared to have the best potential for further development of speech.

However, many individuals with such serious oral communicative deficits rely heavily on non-verbal dimensions of communication such as speech-like vocalizations and gestural behaviors. Those individuals who supplement phonetic productions with gestures such as facial expression, body orientation, and purposeful hand movements, may also be better potential candidates for more extensive oral language or augmentative/alternative language training.

There is little evidence to indicate that communication processes in seriously problematic communicators have been studied in any controlled and systematic way. Until a systematic protocol and response recording criteria are established, little valuable information can be derived from the observation of such subject populations. Once the information is systematically gathered, it can provide valuable data about the multidimensional skills of severely limited individuals, and may perhaps be used to help determine which individuals similar to those in the present study may be the best candidates for a variety of verbal or other communicative options.

The goal of the present investigation is to ascertain and relate verbal and nonverbal communicative behaviors and speech-like vocalizations of subjects with profound mental retardation and multiple sensory and motor handicaps with those of non-retarded, non-multihandicapped individuals. It is assumed that determination of which subjects would be better candidates for augmentative/ alternative communication (AAC) options can be made by determining which subjects produce intentional communicative behaviors, despite the severity of their motor and sensory limitations.

# CHAPTER III

# METHODS

## Subjects

Subjects were paired according to two criteria: similarity of chronological ages, and difference of language ages. A subject pair would be of the same chronological age, with one subject exhibiting a developmental language level or language age (LA) of less than eight months (coded <8) and the other subject exhibiting a language age over eight months (coded >8). Eight months were used as the cut-off point because the literature on language development notes the beginning of intentionality at approximately eight or nine months in a normally-developing child (McLean, Snyder-McLean, and Rowland, 1981). Intentionality refered to the communicator's awareness of a message receiver, and purposeful direction of a vocalization or gesture toward the message receiver, in order to convey some meaning.

The 12 subjects of this study, A through L, were divided into two groups of six chronologically age-matched individuals, six males, and six females. In addition to profound mental retardation, each subject was additionally affected by conditions which produced one or more physical or sensory handicaps. The etiologies of the subjects' physical and mental disabilities ranged from prenatal conditions to early childhood illness or trauma. All were residents

of a medically-oriented unit in a state institution for persons with mental retardation.

Table 1 lists the sex, chronological age, age at admission to the institution, and number of years of residence in the institution of each subject. Subjects in each age-matched pair had birth dates which were approximately eight months or less apart. Current ages of the subjects ranged from 18 to 34 years. All subjects had been residents of the institution for at least four years, one subject as long as 31 years. Prior to their admission to the institution, five of the subjects had lived at home, and seven had resided in other types of residential schools or shelters. Some had attended day schools, while others had been provided no academic or adaptive training.

The six male and six female subjects divided into two pairs of female subjects, two pairs of male subjects, and two mixed pairs of male and female subjects (Table 1). Pairs A-B and E-F were female, pairs C-D and G-H were male, and pairs I-J and K-L were mixed.

The level of mental retardation of each subject had been determined by a psychologist upon admission to the institution, and is subject to yearly review. Table 2 lists mental and adaptive ages derived from psychological tests including the Vineland Adaptive Behavior Scale (VABS) (Sparrow, Balla, and Cicchetti, 1984), and the California Adaptive Behavior Scale (CABS) (Gardner, 1984). Results from those assessments reflected IQ scores of less than 20 for each subject. The CABS scores were used in this study as measures of each subject's mental age because the CABS is currently regarded as

Table 1

Subject Age and Admission Data

| Subject | Sex | CA | Age Diff. | Age Admit. | Time Spent |
|---|---|---|---|---|---|
| A | F | 34-00-26 | 08-01 | 02-02-08 | 31-10-25 |
| B | F | 33-04-25 | | 07-03-08 | 26-01-24 |
| C | M | 29-05-00 | 06-23 | 05-03-29 | 24-01-08 |
| D | M | 28-10-07 | | 12-08-29 | 16-01-05 |
| E | F | 25-08-09 | 01-10 | 05-11-27 | 19-08-19 |
| F | F | 25-08-29 | | 06-10-05 | 18-02-01 |
| G | M | 25-09-11 | 06-10 | 06-02-09 | 19-07-09 |
| H | M | 25-03-01 | | 07-03-07 | 18-00-01 |
| I | M | 21-00-23 | 03-03 | 17-03-04 | 04-04-04 |
| J | F | 20-09-20 | | 06-00-22 | 14-09-05 |
| K | M | 18-08-05 | 06-11 | 06-04-04 | 12-04-08 |
| L | F | 18-01-24 | | 06-08-25 | 11-05-06 |

Note. Sex, chronological ages, age differences of subject pairs, ages at admission to institution, and length of time spent in institution. Ages and time spent are reported in years, months, and days. Age differences are reported in months and days.

Table 2

Mental and Adaptive Ages of Subjects in Months

| Subject | IQ | VABS | CABS | ICAP | HELP | GSAI |
|---|---|---|---|---|---|---|
| A | <20 | 14 | 9 | 5 | 8 | >8 |
| B | <20 | 5 | 3 | 3 | 4 | <8 |
| C | <20 | 18 | 12 | 9 | - | >8 |
| D | <20 | - | 5 | 3 | - | <8 |
| E | <20 | 14 | 19 | 11 | 18 | >8 |
| F | <20 | - | 1 | 3 | - | <8 |
| G | <20 | - | 9 | 5 | 11 | >8 |
| H | <20 | 16 | 15 | 5 | - | <8 |
| I | <20 | 14 | 16 | 10 | - | >8 |
| J | <20 | 7 | 5 | 9 | 15 | <8 |
| K | <20 | 6 | 10 | 4 | - | >8 |
| L | <20 | - | 1 | 4 | - | <8 |

Note. Tests include Vineland Adaptive Behavior Scale (VABS), California Adaptive Behavior Scale (CABS), Hawaii Early Learning Profile (HELP), Inventory for Client and Agency Planning (ICAP), and Generic Skills Assessment Inventory (GSAI).

the most accurate test instrument for the intellectual assessment of individuals with moderate to profound mental retardation. A copy of the CABS is included in Appendix A.

The Inventory for Client and Agency Planning (ICAP) (Bruininks, Hill, Weatherman, and Woodcock, 1986), was completed by social workers within six months of the beginning of this study. The ICAP is used to ascertain an overall level of functioning for each client of the institution, and will be subject to annual review. Language levels were determined, and are reviewed annually for continual accuracy, by speech pathologists using the Generic Skills Assessment Inventory (GSAI) by McLean, Snyder-McLean, and Rowland, (1981). A copy of the GSAI is also included in Appendix A.

Additional adaptive age equivalent scores shown in Table 2 were determined by occupational and physical therapists, and are also subject to annual review. The Hawaii Early Learning Profile (HELP) (Furuno, Inatsuka, O'Reilly, Hosaka, Zeisloft, and Allman, 1984) was used by occupational and physical therapists to determine adaptive age equivalents for fine and gross motor abilities.

Conditions producing multiple handicaps in the subjects ranged from cerebral palsy to genetic syndromes. Ten subjects were routinely given medication for seizure disorders. Only one of the 12 subjects was ambulatory. Two subjects exhibited moderate to severe hearing impairments, one conductive and one sensorineural. Two subjects were visually impaired but responsive to visual stimuli; two were blind. One subject was both blind and hearing impaired, but responded to sounds of at least 75 dB HL presented to

one ear. The subjects with sensory impairments were included in the study because the stimulus protocol offered multimodal sensory input, therefore each subject could respond to at least one property of each stimulus object.

A wide range of oral motor abilities was represented in the subjects. Three subjects were self-feeding and were provided regular diets; four were provided diets of chopped, ground, or pureed food and were assisted with eating; five were provided non-oral feedings through gastrostomy tubes. The subjects were familiar with the researcher, who had frequent direct contact with each of them. Additional personal information regarding each subject was provided through interview with members of each subject's interdisciplinary team.

## Instrumentation

The GSAI (McLean, et al., 1981) measures skills prerequisite to speech and language development through the assessment of five areas: object relationships, representation, dyadic interaction, expressive communication, and comprehension and imitation. According to McLean, et al., (1981), generic skills are defined as both basic and constant: they are generic to all environments (to all activity contexts), and generic to all ages and developmental levels (once acquired, are never lost or unlearned, and will be integrated into higher order skills as development progresses).

The GSAI yielded approximate developmental language age ranges in months, up to the 18-month level. Developmental age scores are

reported as being within the following ranges: birth to three months, three to eight months, eight to 12 months, and 12 to 18 months. A GSAI score was available for each subject; individuals up to age 18 are assessed annually, and those 18 and over are assessed every five years with informal updates filed in the intervening years.

The two groups of subjects in this study consisted of a lower-functioning group of six subjects with developmental language ages between birth and eight months (<8), and a higher-functioning group of six subjects with developmental language ages over eight months (>8), as determined by the GSAI. Eight months was chosen as the cut-off age for grouping subjects because language development is noted to become intentional (purposefully directed toward a message receiver) at approximately the eight or nine-month age level (McLean, et al., 1981). Prior to eight or nine months, a child may produce purposeful behaviors to act on the environment, but not realize that those behaviors are communicative.

## Procedure

Each subject was simultaneously audio and video tape recorded on an individual basis, during two separate sessions. The two recording sessions for each subject were scheduled at least one week apart, to avoid subject familiarity with the procedure. Each recording session lasted approximately fifteen minutes. Both morning and afternoon recording times were scheduled for subjects in an attempt to avoid any patterns of sleepiness or other periods when

the subjects may have been less than fully alert, such as following administration of medication. Recording was done in a quiet environment in a room adjacent to the subjects' living areas, located in the same building. Each of the subjects had been in the recording room prior to the sessions. No interruption occurred during any session.

Subjects were brought in random order to the sessions. Those who were usually seated in wheelchairs were brought to the recording sessions in their personal wheelchairs. Those who could not or were usually not positioned in wheelchairs were brought to the sessions in carts. Some subjects were brought in their personal hydraulic carts, while some were positioned in carts with foam wedges or pillows placed around their bodies as recommended by occupational or physical therapists. All subjects' upper bodies were elevated to at least a 45-degree angle.

Recording equipment included a General Electric VHS Movie Video System (CG 9808SE) video camera positioned on a tripod approximately 12 feet away from the subjects. The video camera was in full view of the subjects, but no attention was called to the camera's presence. The camera and tripod were elevated approximately two feet higher than full tripod extension by positioning them on a mat table. This was done so that the faces of subjects brought to the recording area in carts with siderails could be seen above the rails on the video tape.

Other recording equipment used included a Magnavox reel-to-reel recorder for future acoustic analysis of subject vocalizations. A

remote microphone from the recorder was placed approximately 12 inches to one side of each subject at head level.

A stimulus protocol, developed from communication therapy techniques and situations known through experience to be conducive to production of communicative behaviors in the subjects, was followed during each recording session. The protocol consisted of a verbal greeting and introduction to the activity. Eight objects, four in each session, were presented with verbal descriptions, comments, and questions regarding each object delivered in a natural, conversational tone. A verbal conclusion was provided to end each session.

Stimulus objects were placed directly in front of each subject, on wheelchair tray if available, or on a bedside table elevated above the cart siderails. Each subject faced each stimulus object from a 45-degree to 90-degree angle. Familiar and novel objects with distinct properties that could, as a group, offer stimulation to the subjects' available sensory systems were used as protocol stimuli. Familiar objects were presented to afford subjects the chance to exhibit any established responses, and unfamiliar objects were presented to catch the subjects' interest and to bring out any communicative abilities not previously noted. In each session the subjects were presented with four objects: two stationary objects, one known to be familiar and one unfamiliar, and two moving or sound-producing objects, one familiar and one unfamiliar. Stimulus items for session one included a hairbrush, a candle, a fan, and a music box. Stimulus items for session two were a spoon, a

decorative tin, a blender, and a robot-arm device, Armatron by Radio Shack. The spoon was presented alone and then integrated into the activity with the blender.

The subjects who were visually impaired could respond to auditory and tactile dimensions of the stimulus objects. The subject with conductive hearing loss was not visually or motorically impaired, and could explore and manipulate the objects. The subject who was blind and had sensorineural hearing loss did respond to sound presented to one ear, and also had full use of hands and arms for exploration and manipulation of objects. Subjects who were motorically impaired and unable to independently reach for, touch, or manipulate the objects could respond to the visual and auditory dimensions. In order for these subjects to receive tactile sensation, the objects were placed in or held against the palms of their hands by the investigator.

In order to achieve a natural-sounding, but uniform verbal delivery of the stimulus protocol to each subject, a trial session was conducted with an individual who was similar to, but not among those chosen as subjects for this study. During the trial session, the researcher presented the eight objects chosen for the study, and talked spontaneously to the individual about each object. Each object was shown to the individual, verbally described, and then demonstrated according to its physical properties or functional use.

The trial session was recorded on audio tape using a Sony Cassette-Corder TCM-14, and later transcribed. The transcription was then read back on audio tape, and pauses of 15 to 65 seconds

were inserted on tape where responses in the protocol script could be expected from the subjects. At least 15 seconds were allowed for each expected response; pauses of 30 and 65 seconds were allowed for listening to the music box.

By listening to the prepared audio tape via earphone as each session was conducted, the researcher could repeat each line of the script at the appropriate time in the routine, and thus offer each subject a live presentation without reading from a script. The researcher was also assured of providing consistent verbal delivery and equivalent opportunity for response to each subject. A copy of the transcript for each session is included in Appendix B.

The transcripts were also used following the completion of all 24 sessions, as guides for viewing the video tapes and describing the subject responses. A finished transcript of each session was then prepared for response analysis.

Subject responses to the stimulus protocol were described, and categorized as to presence or absence of communicative intentionality. The relationships between vocal and non-vocal behaviors were investigated, as well as relationships between pre-intentional and intentional communicative behaviors produced by the two groups of subjects. Comparisons were made among subject responses according to sex, chronological age, mental age, language age and oral motor skill level.

The video tapes and transcipts were independently reviewed for reliability by a second qualified observer (a speech-language pathologist with a master's degree, a Certificate of Clinical

Competence from the American Speech-Language-Hearing Association, and a state license) who was also familiar with the subjects. Close observer agreement was noted; however, in cases of non-agreement, the observers met and discussed reasons for stated responses or developed alternative statements, and resolved discrepancies in their observations.

# CHAPTER IV

## RESULTS

From the transcriptions of the video tapes, 1658 vocalizations and non-vocal gestures were described, along with the perceived meaning or reason for each, and listed according to frequency of occurrence. Table 3 lists the responses according to five categories: vocalizations (311), whole-body gestures (192), facial gestures (702), self-stimulatory or atypical habitual behaviors (221), and hand gestures (232). In Table 3, as in most tables constructed to show data from this study, subjects were listed according to two criteria: language age (LA) and mental age (MA). Subjects were grouped first according to language age (<8 months then >8 months), then according to increasing mental ages within the language age groups.

For purposes of description, operational definitions were developed for the vocalizations noted in this study, as well as for the non-vocal gestural behaviors. A unit of continuous, phonated sound produced by a subject on one breath exhalation, shaped in various ways by tongue height or other vocal tract airstream constrictions, with suprasegmental features such as pitch, intensity, and duration described where notable, constituted a vocal segment or vocalization.

Table 3

Total Communicative Behaviors of Subjects

| S | MA | LA | n | Voc. | Body | Fac. | SS/A | Hand |
|---|---|---|---|---|---|---|---|---|
| F | 1 | <8 | 70 | 5 | 36 | 29 | 0 | 0 |
| L | 1 | <8 | 91 | 9 | 18 | 49 | 15 | 0 |
| B | 3 | <8 | 39 | 1 | 8 | 30 | 0 | 0 |
| D | 5 | <8 | 100 | 9 | 17 | 73 | 0 | 1 |
| J | 5 | <8 | 198 | 63 | 26 | 67 | 20 | 22 |
| A | 9 | >8 | 66 | 37 | 4 | 25 | 0 | 0 |
| G | 9 | >8 | 164 | 18 | 7 | 0 | 35 | 104 |
| K | 10 | >8 | 160 | 53 | 19 | 79 | 7 | 2 |
| C | 12 | >8 | 212 | 5 | 12 | 94 | 82 | 19 |
| H | 15 | <8 | 191 | 73 | 18 | 84 | 14 | 2 |
| I | 16 | >8 | 173 | 11 | 20 | 107 | 33 | 2 |
| E | 19 | >8 | 194 | 27 | 7 | 65 | 15 | 80 |
| Totals | | | 1658 | 311 | 192 | 702 | 221 | 232 |
| Total gestural behaviors | | | | | | 1347 | | |

Note. Subjects (S) are listed in first column in order of increasing mental age (MA), shown in months. Total number (n) of behaviors for each subject and totals of each type of behavior (vocalizations, and body, facial, self-stimulatory/ atypical, and hand gestures) are shown.

## Vocalizations

Vocalizations produced by the subjects were primarily described in terms of vowel-like segments according to perceived place of production, which were sometimes preceded or followed by various consonant-like air stream constrictives, also reported according to perceived place of production. If two consonant-like segments were perceived as produced in the same location but needed further differentiation to avoid confusion, the segments were additionally described as to perceived manner of production. Table 4 lists the vocalizations of the subjects under the following eight categories: (a) nonspeech-like sounds, (b) single vowel-like segments (coded V in the transcriptions), (c) vowel-like segment combinations (VV and VVV), (d) consonant-like segments and combinations (C and CC), (e) vowel-like and consonant-like segment combinations (VC and VCV), (f) CV and CVV, (g) CVCV, and (h) words. These categories were listed in order of increasing phonetic complexity and difficulty of production. Total number of vocalizations of each subject are also shown in Table 4, as well as the total of each type of vocalization. Raw data for Table 4 is available in Appendix C.

Forty nonspeech-like sounds to which meaning or reason could be attributed, including audible breathing noise and sounds described as gutteral, low-pitched growl, or high-pitched squeak, were produced by eight subjects in response to the stimulus protocol. Four of these subjects, F, L, D, and H, had language ages below 8 months (<8) and four, A, K, I, and E, had language ages above 8 months (>8).

Table 4

Vocalizations of Subjects

| | | <8 Months LA | | | | | | >8 Months LA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voc. | n | F | L | B | D | J | H | A | G | K | C | I | E |
| NS | 40 | 2 | 8 | | 4 | | 4 | 15 | | 1 | | 3 | 3 |
| V | 177 | 3 | | 1 | 3 | 61 | 34 | 21 | 6 | 44 | | 4 | |
| VV | 10 | | | | | | 10 | | | | | | |
| VVV | 4 | | | | | | 4 | | | | | | |
| C | 14 | | 1 | | | | | | 10 | 1 | | | 2 |
| CC | 8 | | | | | | | | 2 | | | | 6 |
| VC | 1 | | | | | | 1 | | | | | | |
| VCV | 4 | | | | | | 2 | | | 2 | | | |
| CV | 26 | | | | 2 | 2 | 15 | 1 | | 5 | | | 1 |
| CVV | 3 | | | | | | 3 | | | | | | |
| CVCV | 4 | | | | | | | | | | | 4 | |
| Words | 20 | | | | | | | | | | 5 | | 15 |
| Totals | | | | | | | | | | | | | |
| | 311 | 5 | 9 | 1 | 9 | 63 | 73 | 37 | 18 | 53 | 5 | 11 | 27 |

Note. NS = Non-speech sounds. Subjects are listed across top in order of increasing mental age, except for Subject H who is grouped with <8 month LA subjects. Vocalizations are listed in order of increasing complexity.

The vowel-like segments resembled high, mid, and low front vowels, central vowels, and high, mid, and low back vowels (Appendix C). Eight of the 12 subjects, F, D, J, and H (<8), and A, G, K, and E (>8) produced sounds resembling back vowels. Seven subjects produced sounds resembling central vowels: B, D, J, and H (<8), and A, I, and E (>8). Only three subjects, J and H (<8), and K (>8) produced sounds resembling front vowels. Subject H (<8) produced 14 different combinations of two and three vowel-like segments, and produced segments in all vowel positions.

Ten of the 12 subjects produced at least one consonant-like segment alone or combined with a vowel-like segment. Subjects F and B (<8) produced no consonant-like segments. Subjects D, L, J, and H (<8) produced sounds resembling the following consonant types: nasalized bilabial, liquid, nasalized lingua-alveolar, voiced labio-dental fricative, and voiceless glottal fricative (Appendix C). Except for the liquid and glottal fricative types, the consonant-like segments produced by the lower-functioning subjects resembled front consonants.

The higher-functioning subjects, A, G, K, C, I, and E (>8), produced consonant-like segments resembling the following consonant types: voiceless glottal fricative, nasalized bilabial, nasalized lingua-alveolar, and voiced lingua-alveolar stop. With the exception of the voiceless glottal fricative, all the segments produced by the higher-functioning group also resembled front consonants.

Subject E (>8) was the only subject to use a back consonant-like segment other than a glottal fricative in the word "Thank you." Subject E produced "Thank you" seven times and "Hey" eight times. Subject C (>8) produced the word "Mama" five times, and no other vocalizations. Subject A (>8) was the only subject to produce more vocal behaviors (37) than any other type of gesture.

## Gestures

A total of 1347 gestural behaviors were analyzed from the video tape transcriptions. Operational definitions for the non-vocal gestural behaviors, including body, facial, self-stimulatory or atypical habitual, and hand gestures, indicate movements that can be singularly described and that suggest a meaning or reason for having occurred. For example, turning toward a stimulus suggests eye, head, or body movement in the direction of the stimulus in response to some attention-getting output by the stimulus. Reaching implies some body movement (usually by a hand) toward the stimulus which results in fairly close proximity to it, whereas touching implies actual contact with the stimulus. Since normal physical development occurs from proximal to distal points and development of movement progresses from gross to fine motor (as in the development of refined pointing), the non-vocal gestures noted in this study are arranged in most tables in order from gross to fine motor movements to reflect that typical developmental order.

Body gestures (Table 5) are defined as generalized, total-body, gross motor movements, including systemic reactions such as startle

Table 5

Body Gestures Produced by Subjects

| | | Body responses | | | | |
|---|---|---|---|---|---|---|
| LA | n | Total | Startle | Quiet | Comply | Resist |
| <8 | 70 | 53 | 2 | 5 | 8 | 2 |
| >8 | 26 | 17 | | 1 | 8 | |
| T | 96 | 70 | 2 | 6 | 16 | 2 |

| | | Body orientation | | |
|---|---|---|---|---|
| | | Toward object/speaker | Turn away | Lean toward speaker |
| <8 | 26 | 16 | 10 | |
| >8 | 30 | 6 | 21 | 3 |
| T | 56 | 22 | 31 | 3 |

Note. Total body response: generalized body movement. Startle: reflexive reaction. Quieting: generalized relaxation and cessation of movement. Compliance: overall attitude of acceptance. Resistance: attitude of refusal. Responses are totaled for <8 and >8 month LA subjects.

reflexes, generalized quieting or relaxation, and overall attitudes of resistance to or compliance with tasks or requests. Body orientation refers to rotation of the body toward the stimulus (speaker or object) so that an attitude of attention is suggested by the position.

Table 5 shows total numbers of body gestures for the two groups of subjects, <8 LA and >8 LA. The <8 LA group produced more total body gestures in response to stimuli (70), while the >8 LA group produced more behaviors showing body orientation (30). Subject F (<8) produced more body gestures (36) than other behaviors, and produced at least ten more body gestures than any other subject. (Raw data for Table 5 is available in Appendix C.)

More subjects produced facial gestures (Table 6) than any other type of gestural communication. Facial gestures are defined as any facial motion or readable expression that can be singularly described and that suggests a particular meaning, or for which a reason can be discerned. Facial gestures noted in this study included movement of eyes or mouth, such as opening or closing, and eye shifting, blinking, or widening. Directed eyegaze was noted to be toward or away from the speaker, a target object, the general environment, or intermittently between stimuli. Facial expressions were generally positive or negative. Positive expressions included smiling, and indications of interest, curiosity, or amusement, such as brow-lifting, nose-wrinkling, and quizzical looks. Negative expressions included frowning, pouting, grimacing, or casting the eyes down, and suggested such attitudes as disappointment,

Table 6

Facial Gestures Produced by Subjects

| | | Movement | | Eyegaze | | Expression | | |
|---|---|---|---|---|---|---|---|---|
| S | n | Eyes | Mouth | Target | Away | Pos. | Neg. | Other |
| F | 29 | 22 | 4 | 2 | | 1 | | |
| L | 49 | 10 | | 35 | 2 | 2 | | |
| B | 30 | 7 | 4 | 14 | 2 | 3 | | |
| D | 73 | 8 | 9 | 50 | | 6 | | |
| J | 67 | 3 | | 32 | 18 | 12 | | 2 |
| A | 25 | 4 | 2 | 19 | | | | |
| G | 0 | | | | | | | |
| K | 79 | | | 46 | 3 | 28 | 2 | |
| C | 94 | | | 49 | 11 | 30 | 4 | |
| H | 84 | 15 | 3 | 49 | 2 | 14 | 1 | |
| I | 107 | 9 | | 45 | 16 | 31 | 6 | |
| E | 65 | 1 | | 50 | 2 | 10 | | 2 |
| T | 702 | 79 | 22 | 391 | 56 | 137 | 13 | 4 |

Note. Eyegaze toward target: looking at speaker or objects presented. Eyegaze away: eyeshift/head turn away from target after looking at it. Positive facial expression: smile. Negative: frown/pout. Other: quizzical, etc.

irritation, or unwillingness to cooperate.

Eight subjects, L, B, D, J, and H (<8), and K, C, and I (>8), exhibited a predominance of facial gestures over other gestures produced. Subject G (>8), who was both blind and hearing impaired, produced no communicative facial gestures, while all other subjects produced at least 25 each. Eyegaze toward a target (the speaker or stimulus object) was by far the most often-used facial gesture by the subjects in this study. Directed eyegaze occurred 391 times during the stimulus protocol, followed in frequency by positive facial expression (137 times) and eye movement (79 times). (Raw data for Table 6 is available in Appendix C.)

Table 7 shows the non-vocal gestures that were termed self-stimulatory or atypical habitual behaviors. These are defined as head, eye, mouth, and hand movements that were consistently produced by the subjects, but seemed to be purposeless or were at least unconventional. (Raw data for Table 7 is included in Appendix C).

Eight of the 12 subjects produced self-stimulatory or atypical habitual behaviors, with Subject C (>8) producing the most (82). These gestures ranged from primitive reflexive behaviors such as tongue-thrusting, mouthing objects, or producing identical bilateral hand movements, to self-abusive gestures such as hitting oneself with an object. A variety of meanings could be attributed to most of these gestures, ranging from indications of pleasure (noted in the head-bobbing of Subject G and the "wing-flapping" behavior of Subject H), to frustration or protest (self-abuse). Some behaviors defied interpretation, such as Subject C's hand-gazing and Subject

Table 7

Self-Stimulatory Behaviors or Atypical Habitual Gestures Produced by Subjects

| LA | n | Eyes | Head | Mouth | Hands | Objects | Abusive |
|---|---|---|---|---|---|---|---|
| <8 | 49 | 9 | | 12 | 22 | 2 | 4 |
| >8 | 158 | 15 | 51 | 8 | 43 | 16 | 25 |
| T | 207 | 24 | 51 | 20 | 65 | 18 | 29 |

Note. Individual behaviors are shown in Appendix C. Self-abusive behaviors noted were limited to mild hitting of self against objects or objects against self. Body rocking, exhibited 14 times by Subject C, was not included in the total.

E's habit of leaning toward the speaker in order to bump foreheads. Of the 207 behaviors of this type noted, more (158) were produced by the LA >8 subjects.

The variety of hand gestures noted in Table 8 included reaching, touching, searching, grasping, accepting, refusing, extending, retracting, releasing, turning, placing, pushing, pulling, dropping, transferring, trading, and throwing. These involved hands or arms exclusively, and sometimes involved objects. Instances of functional or conventional use of objects, such as brushing one's hair with a hairbrush, were also included.

More hand gestures were consistently produced by the LA >8 subjects (207) than by the LA <8 subjects (25). Two subjects, E and G (>8), produced a predominance of hand gestures over other behaviors. Subject E produced 80 hand gestures; Subject G produced 104. Only the LA >8 subjects exhibited functional use of objects. (Raw data for Table 8 is available in Appendix C.)

Table 9 lists the perceived meanings or communicative intents of subject responses to the stimulus protocol. Meanings rather than communicative intents were more often assigned to the behaviors reflecting gross motor movements. Whole-body responses were interpreted as reflexive, passive, and protesting, and were more often produced by the LA <8 subjects. Attitudinal interpretations were applied often to facial expression, and also to some whole-body responses. Attitudes included pleasure or excitement, agitation, disappointment, or frustration, and anticipation or curiosity. Self-stimulatory behaviors, and gestures described as reciprocal

Table 8

Hand Gestures Produced by Subjects

| LA | n | Toward object | Touch object | Touch speaker | Search environment |
|---|---|---|---|---|---|
| <8 | 8 | 5 | 3 | | |
| >8 | 55 | 9 | 16 | 17 | 13 |
| T | 63 | 14 | 19 | 17 | 13 |

| | | Grasp Object | Grasp speaker | Accept object | Refuse/ release |
|---|---|---|---|---|---|
| <8 | 7 | 2 | | 5 | |
| >8 | 43 | 16 | 6 | 17 | 4 |
| T | 50 | 18 | 6 | 22 | 4 |

| | | Extend object to speaker | Extend/release object | Extend/retract object |
|---|---|---|---|---|
| >8 | 19 | 7 | 11 | 1 |

Note. Hand gestures are shown according to totals for <8 and >8 month LA subjects.

(table continues)

| | | Object manipulation | | | |
|---|---|---|---|---|---|
| LA | n | Turn over | Hold to ear | Put down | Push over |
| >8 | 14 | 4 | 6 | 2 | 2 |
| | | Let drop | Drop/ retrieve | Push along | Push away |
| <8 | 5 | 3 | | | 2 |
| >8 | 22 | 12 | 5 | 2 | 3 |
| T | 27 | 15 | 5 | 2 | 5 |
| | | Transfer | Trade | Throw | Nonspecific |
| >8 | 24 | 1 | 3 | 1 | 19 |
| | | Functional use | | Other postures | |
| <8 | 5 | 3 | | 2 | |
| >8 | 30 | 18 | | 12 | |
| T | 35 21 | 14 | | | |

Table 9

Meanings of Behaviors and Communicative Intents of Subject Responses

| Meanings of Pre-Intentional Communicative Behaviors | | | | |
|---|---|---|---|---|
| LA | n | Reflexes | Passiveness | Protest |
| <8 | 26 | 17 | 4 | 5 |
| >8 | 20 | 7 | 4 | 9 |
| T | 46 | 24 | 8 | 14 |

| | | Attention to: | | Withdrawal of |
|---|---|---|---|---|
| | | Speaker | Object | Attention |
| <8 | 249 | 116 | 116 | 17 |
| >8 | 298 | 86 | 189 | 23 |
| T | 547 | 202 | 305 | 40 |

Note. Numbers of responses shown are totals for <8 and >8 month LA subject groups. Attention refers to visual attention. Meanings of individual behaviors are listed in Appendix C.

(table continues)

| LA | n | Attitudes | | |
|---|---|---|---|---|
| | | Pleasure/ excitement | Agitation/ disappointment/ frustration | Anticipation/ curiosity |
| <8 | 11 | 10 | 1 | |
| >8 | 16 | 5 | 7 | 4 |
| T | 27 | 15 | 8 | 4 |

| | | Self-stimulation/ self-entertainment | Reciprocal vocal/gestural response |
|---|---|---|---|
| <8 | 113 | 17 | 96 |
| >8 | 126 | 56 | 70 |
| T | 239 | 73 | 166 |

Note. Self-stimulatory or self-entertaining behaviors were produced regardless of presence of speaker. Reciprocal responses were vocalizations or gestures produced in apparent response to speaker, and tended to be produced during 15-second pauses in stimulus protocol.

(table continues)

Meanings of Intentional Communicative Behaviors

| LA | n | Request for attention | Request for object/action |
|---|---|---|---|
| <8 | 1 | | 1 |
| >8 | 34 | 25 | 9 |
| T | 35 | 25 | 10 |

| LA | n | Request for reassurance | Comment on object/action |
|---|---|---|---|
| <8 | 12 | 1 | 11 |
| >8 | 55 | 8 | 47 |
| T | 67 | 9 | 58 |

vocal or gestural responses were assumed to carry at least borderline intentionality and were more often produced by the LA >8 subjects. Clearly intentional communicative behaviors, which were produced almost exclusively by the LA >8 subjects, included requests for attention, actions, or objects, and comments on actions or objects, and often relied on hand gestures to convey their meaning.

As a group, the six LA <8 subjects produced a predominance of behaviors lacking in intentionality, 399 pre-intentional behaviors to 13 intentional behaviors. The six LA >8 subjects not only produced more behaviors of both types (460 pre-intentional and 89 intentional), but also produced more pre-intentional behaviors than the lower functioning, pre-intentional group.

Two subjects, B and J, both LA <8, produced five protesting behaviors, compared to nine protesting behaviors produced by two of the higher-functioning subjects (G and E). Two other lower-functioning subjects, D and J, produced a total of seven requesting or commenting behaviors, compared to the six higher-functioning subjects who together produced 89 requesting and commenting behaviors. Subject H, with language age under and mental age over eight months, was not counted in either group above, but did produce a total of six commenting behaviors. (Raw data for Table 9 is available in Appendix C.)

Table 10 offers a comparison of the responses of the male subjects with those of the female subjects. The male subjects as a group produced 1000 total behaviors (pre-intentional and intentional combined) compared to the female subjects' 658 combined behaviors.

Table 10

Comparison of Male and Female Subjects' Communicative Behaviors

| | | | Male Subjects | | | | |
|---|---|---|---|---|---|---|---|
| S | LA | n | Voc. | Body | Fac. | SS/A | Hand |
| D | <8 | 100 | 9 | 17 | 73 | 0 | 1 |
| G | >8 | 164 | 18 | 7 | 0 | 35 | 104 |
| K | >8 | 160 | 53 | 19 | 79 | 7 | 2 |
| C | >8 | 212 | 5 | 12 | 94 | 82 | 19 |
| H | <8 | 191 | 73 | 18 | 84 | 14 | 2 |
| I | >8 | 173 | 11 | 20 | 107 | 33 | 2 |
| Total | | 1000 | 169 | 93 | 437 | 171 | 130 |

(table continues)

| | | | Female Subjects | | | | |
|---|---|---|---|---|---|---|---|
| S | LA | n | Voc. | Body | Fac. | SS/A | Hand |
| F | <8 | 70 | 5 | 36 | 29 | 0 | 0 |
| L | <8 | 91 | 9 | 18 | 49 | 15 | 0 |
| B | <8 | 39 | 1 | 8 | 30 | 0 | 0 |
| J | <8 | 198 | 63 | 26 | 67 | 20 | 22 |
| A | >8 | 66 | 37 | 4 | 25 | 0 | 0 |
| E | >8 | 194 | 27 | 7 | 65 | 15 | 80 |
| Total | | 658 | 142 | 99 | 265 | 50 | 102 |

However, four of the six male subjects also were in the LA >8 intentional group; only two of the six female subjects were intentional communicators. The male subjects as a group specifically produced more facial and self-stimulatory/atypical (SS/A) gestures than did the female subjects, but the difference can be accounted for in the totals of male Subject C, who produced 94 facial and 82 SS/A gestures, and Subject I, who alone produced 107 facial gestures.

Subjects were listed in order of chronological age, from oldest (34) to youngest (18) in Table 11. If the subjects are subdivided into three groups according to age, it can be seen that the oldest group did produce fewest total behaviors, with the two younger groups producing nearly the same number of behaviors. The four oldest subjects and their ages were A (34), B (33), C (29), and D (28); together they produced 417 behaviors. The middle group, E, F, G, and H, all age 25, produced 619 behaviors. The youngest group, I (21), J (20), K and L (both 18), together produced 622 behaviors.

Referring back to Table 1, most of the 12 subjects had been admitted to the institution at approximately age six. Subject A (from the oldest group) was admitted at age 2, while Subject D (from the oldest group) and Subject I (from the youngest group) had not been admitted until ages 12 and 17 respectively. These exceptions make the average ages of admission of the three CA subgroups noncomparable. Referring again to Table 1, the oldest CA subgroup had been institutionalized for an average of 24.25 years, the middle

Table 11

Responses of Subjects Listed in Order of Chronological Age

| S | CA | n | Voc. | Body | Facial | SS/A | Hand |
|---|---|---|---|---|---|---|---|
| A | 34 | 66 | 37 | 4 | 25 | 0 | 0 |
| B | 33 | 39 | 1 | 8 | 30 | 0 | 0 |
| C | 29 | 212 | 5 | 12 | 94 | 82 | 19 |
| D | 28 | 100 | 9 | 17 | 73 | 0 | 1 |
| E | 25 | 194 | 27 | 7 | 65 | 15 | 80 |
| F | 25 | 70 | 5 | 36 | 29 | 0 | 0 |
| G | 25 | 164 | 18 | 7 | 0 | 35 | 104 |
| H | 25 | 191 | 73 | 18 | 84 | 14 | 2 |
| I | 21 | 173 | 11 | 20 | 107 | 33 | 2 |
| J | 20 | 198 | 63 | 26 | 67 | 20 | 22 |
| K | 18 | 160 | 53 | 19 | 79 | 7 | 2 |
| L | 18 | 91 | 9 | 18 | 49 | 15 | 0 |

CA subgroup for 18.5 years, and the youngest CA subgroup for 10.25 years. Although the subgroup institutionalized longest produced the fewest communicative behaviors, the two younger subgroups differed in institutionalization time by 8.25 years but produced nearly the same number of communicative behaviors.

Comparison of the subjects' mental ages as determined by the CABS and language ages as determined by the GSAI indicates substantial agreement between mental age and language age for subjects in this study (Table 12), except for Subject H. Five subjects with language ages below eight months also had mental ages below eight months: F and L (MA one month), B (MA three months), and D and J (MA five months). Six subjects with language ages above eight months also had mental ages above eight months: A and G (MA nine months), K (MA ten months), C (MA 12 months), I (MA 16 months), and E (MA 19 months). Subject H's mental age of 15 months is not in agreement with his language age of <8 months.

Table 13 displays the total communicative behaviors of the two subject groups according to language ages, <8 and >8. The LA <8 group produced 689 behaviors, predominantly vocalizations (160), body gestures (123), and facial gestures (332). Fewest behaviors for the LA <8 group were SS/A gestures (49) and hand gestures (25).

The LA >8 group produced 969 communicative behaviors, with high numbers in four types of behaviors: vocalizations (151), facial gestures (370), SS/A gestures (172), and hand gestures (207). Body gestures were the fewest noted (69). Both groups produced more facial gestures than other behaviors. The >8 group produced far

Table 12

Comparison of Subjects' Mental and Language Ages

| Subject | Mental age (months) | Language age (months) |
|---|---|---|
| Mental/language ages under eight months | | |
| F | 1 | <8 |
| L | 1 | <8 |
| B | 3 | <8 |
| D | 5 | <8 |
| J | 5 | <8 |
| Mental/language ages over eight months | | |
| A | 9 | >8 |
| G | 9 | >8 |
| K | 10 | >8 |
| C | 12 | >8 |
| H | 15 | <8 |
| I | 16 | >8 |
| E | 19 | >8 |

Note. Subject H obtained a mental age score of 15 months but a language age score of less than eight months.

Table 13

Comparison of Communicative Behaviors Between Subjects with Language Ages Above and Below Eight Months

| | <8 Months Language Age | | | | | | |
|---|---|---|---|---|---|---|---|
| Behavior | n | F | L | B | D | J | H |
| Vocalizations | 160 | 5 | 9 | 1 | 9 | 63 | 73 |
| Body gestures | 123 | 36 | 18 | 8 | 17 | 26 | 18 |
| Facial gestures | 332 | 29 | 49 | 30 | 73 | 67 | 84 |
| Self-stimulatory/ atypical gestures | 49 | 0 | 15 | 0 | 0 | 20 | 14 |
| Hand gestures | 25 | 0 | 0 | 0 | 1 | 22 | 2 |
| Total gestures | 689 | 70 | 91 | 39 | 100 | 198 | 191 |

(table continues)

| | >8 Months Language Age | | | | | | |
|---|---|---|---|---|---|---|---|
| Behavior | n | A | G | K | C | I | E |
| Vocalizations | 151 | 37 | 18 | 53 | 5 | 11 | 27 |
| Body gestures | 69 | 4 | 7 | 19 | 12 | 20 | 7 |
| Facial gestures | 370 | 25 | 0 | 79 | 94 | 107 | 65 |
| Self-stimulatory/ atypical gestures | 172 | 0 | 35 | 7 | 82 | 33 | 15 |
| Hand gestures | 207 | 0 | 104 | 2 | 19 | 2 | 80 |
| Total gestures | 969 | 66 | 164 | 160 | 212 | 173 | 194 |

more hand and SS/A (predominantly fine motor) gestures than the <8 group. The <8 group was noted to produce more body (gross motor) gestures.

Table 14 shows subject vocalizations categorized according to oral motor abilities in regard to nutritional intake. Five subjects, F, L, D, J, and K, received nutrients non-orally due to lack of oral motor skills, among other problems. All but Subject J had been previously fed orally, but medical problems such as choking and aspiration pneumonia necessitated gastrostomy placement for safety. Subject J's gastrostomy was performed shortly after birth due to failure to thrive, therefore precluding any oral experience with food. Subject K's gastrostomy surgery was most recent, i.e., feedings were oral up to less than a year prior to this study. The majority of vocalizations produced by the subjects who received non-oral feedings consisted of nonspeech-like sounds and single vowel-like segments.

Subjects A and B, who received pureed food due to lack of oral motor ability to handle food of coarser texture, also produced primarily nonspeech-like sounds and single vowel-like segments. Subject H, whose food was ground therefore requiring somewhat better oral motor skill, produced the largest variety of vocalizations including multiple vowel-like segments and combinations of vowel-like and consonant-like utterances (VC, VCV, CV, and CVV). Subject G, who received a diet of chopped food (larger chunks than ground), produced single vowel-like and consonant-like segments, but no consonant/vowel-like segment combinations.

Table 14

Comparison of Subject Vocalizations According to Oral Motor Abilities for Nutritional Intake

| | | Subjects fed non-orally | | | | |
|---|---|---|---|---|---|---|
| Response | n | F | L | D | J | K |
| NS | 15 | 2 | 8 | 4 | | 1 |
| V | 111 | 3 | | 3 | 61 | 44 |
| VV | 0 | | | | | |
| VVV | 0 | | | | | |
| C | 2 | | 1 | | | 1 |
| CC | 0 | | | | | |
| VC | 0 | | | | | |
| VCV | 2 | | | | | 2 |
| CV | 9 | | | 2 | 2 | 5 |
| CVV | 0 | | | | | |
| CVCV | 0 | | | | | |
| Words | 0 | | | | | |
| Totals | 139 | 5 | 9 | 9 | 63 | 53 |

Note. Subjects are listed across top in order of increasing mental age. Vocal responses are listed in first column in order of increasing complexity.

(table continues)

| | | Subjects assisted with altered diets | | | |
|---|---|---|---|---|---|
| | | Pureed | | Ground | Chopped |
| Response | n | A | B | H | G |
| NS | 19 | 15 | | 4 | |
| V | 62 | 21 | 1 | 34 | 6 |
| VV | 10 | | | 10 | |
| VVV | 4 | | | 4 | |
| C | 10 | | | | 10 |
| CC | 2 | | | | 2 |
| VC | 1 | | | 1 | |
| VCV | 2 | | | 2 | |
| CV | 16 | 1 | | 15 | |
| CVV | 3 | | | 3 | |
| CVCV | 0 | | | | |
| Words | 0 | | | | |
| Totals | 129 | 37 | 1 | 73 | 18 |

Note. Subjects are listed across top according to increase in coarseness of food texture. Vocal responses are listed in first column in order of increasing complexity.

(table continues)

| | | Subjects who self-feed regular diets | | |
|---|---|---|---|---|
| Response | n | C | I | E |
| NS | 6 | | 3 | 3 |
| V | 4 | | 4 | |
| VV | 0 | | | |
| VVV | 0 | | | |
| C | 2 | | | 2 |
| CC | 6 | | | 6 |
| VC | 0 | | | |
| VCV | 0 | | | |
| CV | 1 | | | 1 |
| CVV | 0 | | | |
| CVCV | 4 | | 4 | |
| Words | 20 | 5 | | 15 |
| Totals | 43 | 5 | 11 | 27 |

Note. Subjects are listed across top in order of increasing mental age. Vocal responses are listed in first column in order of increasing complexity.

Subjects C, I, and E, who were able to eat regular, unaltered food without assistance, produced fewer vocalizations overall; however, each produced consonant/vowel-like segment combinations or recognizable words.

# CHAPTER V

## DISCUSSION

Of the five types of communicative behaviors considered in this study (vocalizations, body gestures, facial gestures, self-stimulatory/atypical habitual gestures, and hand gestures), facial gestures were the most frequently produced (702). Of the facial gestures noted, the greatest number (391) involved directed eyegaze toward speaker or stimulus objects, which may have implications for assessment of language comprehension in subjects such as these. Golinkoff, Hirsh-Pasek, Cauley, and Gordon (1986) introduced an assessment procedure for language comprehension in infants and young children, which relied on differential visual fixation to indicate linguistic comprehension. The method required a minimum of motor movement and no speech production, and could well be useful in assessing motorically-impaired subjects such as those in this study.

Sensorimotor skills that underlie cognitive development are known to be gained through experience with the environment: exploration through movement and manipulation (Piaget, cited in McLean, et al., 1981). Many test instruments available for evaluation of mental, adaptive, and communicative skills of low-functioning individuals rely heavily on the performance of motor skills for scoring test items. A low-functioning individual with motor deficits is at a double disadvantage in a testing situation:

(a) in not having had the motor skills with which to explore and manipulate his environment in order to build his cognitive and language skills, and (b) in not having the motor skills with which to convey to an examiner what he may have learned despite his motor deficits.

Test items, including many on the GSAI, that rely on performance of motor skills are therefore first testing the presence of motor skills, and may not be tapping the cognitive or language skills they were designed to assess. McLean, et al., 1981, noted that even a subject who is not limited in motor performance is first being tested on his compliance with the test situation. Not performing a test item could indicate lack of willingness to perform as well as lack of ability to perform.

The subjects in this study were evaluated with the GSAI since it seemed to be the most appropriate instrument available and was normed on subjects with severe and profound mental retardation. However it was not designed for individuals with severe motor deficits such as result from cerebral palsy. This fact must be kept in mind when using it to assess pre-linguistic skills of individuals such as the subjects in this study.

## Vocalizations

Stark (1979) noted that early researchers who described vocalizations produced during an infant's first year, discovered a trend for vowel and consonant development according to place of production. Irwin and Chen, Fisichelli, and Lewis (cited in Stark,

1979), noted that back consonants tended to develop before front consonants, in contrast to front vowels which tended to develop before back vowels. This trend was also reported by Smith and Oller (cited in Stark, 1979).

Except for the consonant-like segment described as voiceless glottal fricative, and the consonants in Subject E's production of "Thank you," consonant-like segments produced by subjects in this sample resembled front consonants only (see raw data for Table 4 in Appendix C). Since vocal development for these subjects has not been followed longitudinally, it cannot be determined whether or not their productions fall in line with the trend noted above for typically-developing infants. Kent and Bauer (1984) restated the caution of Kent and Murray (cited in Kent and Bauer, 1984), that "to consider all occurrences of breathy phonation and glottalization as consonants can greatly inflate consonant inventories of infant vocalizations." The voiceless glottal fricative segments noted in this study were usually initial productions, and so could also have been considered breathy vowel initiations in most instances, except for Subject E's word "Hey."

In regard to the trend noted above for vowel sounds to typically develop from front to back, all subjects in this study regardless of language or mental age produced more back than central or front single vowel-like segments. One hundred thirty-three single back vowel-like segments were produced, as opposed to 19 front and 25 central single vowel-like segments. All subjects who produced front vowel-like segments also produced back vowel-like

segments. Therefore, it cannot be assumed that the lower MA and LA subjects produced only early-developing sounds. Again, without longitudinal data on vocal development, it cannot be determined whether these subjects followed the noted trend in vowel development.

Types of speech-like sounds were considered in this study primarily in regard to place of production. Locke (cited in Fletcher and Garman, 1979) suggested that normally-developing infants have preferences for stop, nasal, and glide consonants because of preferences for the tactile-kinesthetic feedback from the oral motor movements that result in these consonants rather than because of how these consonants sound. Subjects with multiple handicaps such as those in this study, due to cerebral palsy or other physical reasons, may also produce sounds due to preference of or ability to produce certain oral motor movements that result in particular sounds.

Kent and Murray (cited in Kent and Bauer, 1984), described the vocalic and consonantal nature of infant utterances, but excluded reflexive or vegetative nonspeech-like sounds such as breathing noise or coughs. Others such as Zlatin, and Stark, Rose, and McLagen (cited in Stark, 1979), used such broad descriptive terms as "non-cry" utterances. Martin (cited in Stark, 1979), however, described "vocants" and "closants" as respective precursors to vowels and consonants. Martin (cited in Stark, 1979), also described utterances characterized as breathing noise, including nasal breathing, laugh, cough, sob, sneeze, and squeal.

A few vocalizations described in this study were noted as being nonspeech-like, and were included if meaning could be attributed to them. Subject A (>8) produced 15 of the noted 27 breathing sounds as part of a vocal warm-up routine typically exhibited before beginning to speak. Subject A did not, however, complete the routine to the point of speaking during the video-taping sessions for this study. Subject L (<8) produced the eight high-pitched squeaks, signalling a state of excitement.

Vocalizations of subjects in this study can also be described in terms of Stark's (1979) five hierarchical stages, through which the vocalizations of typically-developing infants progress prior to the production of first words: (I) reflexive crying and vegetative sounds (predominating from 0 to 8 weeks), (II) cooing and laughter (8 to 20 weeks), (III) vocal play (16 to 30 weeks), (IV) reduplicated babbling (25 to 50 weeks), and (V) non-reduplicated babbling and expressive jargon (9 to 18 months). Stark attributed these stages to growth of the infant's vocal tract anatomy and maturation of the central nervous system. Stark also noted that in Stage IV, infants begin to use gestures such as reaching, pointing, grasping, and rejection in addition to vocalizations to communicate with others.

Most of the vocalizations in this sample were similar to descriptions of Stark's stage II (cooing and laughter) in which sounds are mostly vowel-like but may contain brief consonant-like segments, and stage III (vocal play) in which pitch variations, syllabic nasal consonants, and fricative-like noises are added to

the previously-produced vowel-like sounds. The subjects with LA <8 and MA's of one to three months produced only 15 vocalizations, 14 of which were vowel-like segments only. As subjects increased in MA (Table 4), not only did more consonant-like segments begin to be produced, but also more variety in vowel-like and consonant-like combinations were noted.

Only subjects C and I, both with LA >8 and MA's of 12 and 16 months respectively, exhibited CVCV syllable-like vocalizations (including C's "Mama," also described as a word) which would resemble Stark's stage IV (reduplicated babbling). Subjects C and I additionally produced non-vocal gestures including the reaching, grasping, and signals of rejection also noted in Stark's stage IV. Subject C produced only 19 hand gestures as opposed to 94 facial gestures. However, of the 82 SS/A gestures produced by Subject C, 38 involved the hands. Subject I produced 107 facial gestures, and only two hand gestures, but used body or eye movements (looking or turning away) as signals of rejection. Subjects C and E, both with LA >8 and MA's of 12 and 19 months respectively, together produced a total of 20 words (C's "Mama" five times, E's "Thank you" seven times, and "Hey" eight times), as in Stark's stage VI (first words). Subject E, who produced the most words, predominated in hand gestures (80).

The subjects' vocalizations can be further described according to Crystal's (in Fletcher and Garman, 1979) five stages of prosodic development in infant vocalizations. Stage I (birth to six months) consists of a period of biologically determined vocalizations (cry)

and a period of differentiated vocalizations to which attitudinal interpretations (such as pleasure or recognition) can be applied. Subject L's high-pitched squeaks, presumed to be signals of excitement, could fall into this category.

In stage II (beginning at two to three months) an infant is said to become aware of prosodic contrasts in adult utterances directed to him. In stage III (beginning at about six months) the increasingly varied vocalizations of the infant come to resemble the prosodic patterns of the language spoken in the infant's environment, and parents begin to overlay meaning on the vocalizations based on their likeness to adult speech. This attribution of meaning to vocalizations could be clearly observed in staff interactions with the subjects, and probably was influential in the intelligence testing of Subject H. Subject H differed from all other subjects in that the CABS mental age score of 15 months was not in line with the GSAI language age score of less than eight months. Subject H, who produced the greatest number of vocalizations (73), was incidentally noted to be popular with staff, who responded to the vocalizations as if they were meaningful, as would a parent of a pre-intentional child. It was conjectured that Subject H's social nature and high level of vocal responsiveness to staff may have led to a false high score on the CABS, which was scored at least partially from staff interview.

In Crystal's stage IV (the second half of the first year), such features as pitch, rhythm and pause characteristic of the adult language are readily discernible in the infant's vocalizations.

These features would also tend to influence staff to respond to the perceived meaning of client vocalizations. During stage IV, the prosodic features are signals of joint participation between infant and adult in action sequences, such as games and beginning turn-taking. Subjects J and H (<8) and A, K, and E (>8), who collectively produced most of the vocalizations, were noted in particular to respond vocally to the researcher in a turn-taking fashion during the protocol routine. A substantial number (166) of reciprocal vocal or gestural responses to the speaker noted during the 15-second pauses in the protocol routine was noted. Although many of these behaviors were produced by the non-intentional subjects, this reciprocal interaction was considered to be at least borderline intentional.

Within stage IV, Crystal noted stages of tonal development (falling, level, or rising pitch direction of vocalizations) among subjects in his studies and those of Menn (cited in Crystal, 1979) and Halliday (cited in Crystal, 1979). Crystal also noted the variety of meanings associated with pitch direction. Rising tones were associated with offering, requesting, attention-getting, curiosity, and with utterances after which a response was expected. Subject C's "Mama" was always spoken with higher pitch as well as greater stress on the second syllable. Subject K's pitch escalation on many of his vocalizations clearly indicated his desire for attention.

A low rising tone was associated with instituting or maintaining social interaction. Many of Subject A's brief

vocalizations had a slight rising contour. Their frequency and timing also suggested an attempt to maintain the interaction with the researcher.

High rising tones were associated with a child's instrumental use of adults to obtain objects or services, in playful or anticipatory contexts, or "intensification" contexts in which the child repeats an utterance after failing to get a response. When subject J (<8) produced the typically-noted rising-falling vocalization twice in close succession, the second vocalization was always higher in pitch than the first.

Falling tones were associated with utterances not requiring a response (such as labels). High falling tones were associated with surprise, recognition, insistence, and greetings. Some of Subject K's vocalizations seemed insistent in requesting attention from the researcher. High rising-falling tones were associated with emphasis on achievement or impressiveness. Falling-rising tones were associated with warning contexts ("be careful"), or with face-to-face playful interactions.

Crystal's stage IV of prosodic development also noted contrasts in loudness, duration, muscular tension and rhythmicality. Subject K's intensity was noted to increase with repeated vocalizations to the researcher during the 15-second pauses. Subject I's CVCV utterances were notably rhythmical, and seemed to be attempts to imitate the noise of the Armatron.

Stage V dealt with tonic contrastivity of multi-word utterances. Subject E's "Thank you" was always spoken with a rising

tone on "Thank" and a falling tone on "you."

Twenty of the vocalizations noted in this study were described as "words" because they sounded like words. They could not, however, be described as true words which were said by McLean, et al., (1981) to be abstract or symbolic, and used to represent a referent independent of the actual occurrence of the referent. They also could not be described as proto-words, borrowed from Halliday (cited in McLean, et al., 1981) and Leonard (cited in McLean, et al., 1981), to mean "words or sound combinations that are produced consistently as integral components of Gestalt referent events, and which appear to be yoked to the occurrence of those events."

The "words" described in this study seemed to be used to convey a meaning or intent, but were not necessarily connected linguistically with the meaning or intent conveyed. They were used repeatedly in different situations, and only sometimes happened to be appropriate. Subject E's seven productions of "Thank you" were occasionally spoken upon accepting an object from the researcher, but were also used when during attempts to give the researcher an object.

## Gestures

The whole-body gestures noted in this study were considered similar in quality to the total response patterns of movement exhibited by newborns and very young infants. More whole-body gestures were produced by the non-intentional (<8) subjects with lowest mental ages (1 to 5 months) than by other subjects. As these

gestures shifted in quality toward body orientation postures, which appeared to require more physical and mental effort, the intentional (>8) subjects began to predominate. A general observation was made that the subjects with lower mental ages were also the most severely impaired in all aspects of development, and tended to resemble young infants in their behaviors.

In regard to facial expressions, the eye and mouth movement behaviors, which carried meaning but not intentionality, were more often produced by the non-intentional subjects. Ten of the 12 subjects produced more directed eyegaze gestures than any other type of communicative facial gesture. Subject F, who was visually impaired, produced more simple eye movements, and Subject G, who was blind and hearing impaired, produced no discernible facial gestures. Reasons for this lack of facial communication appeared to be not only Subject G's blindness, which precluded knowledge of other people's facial expressions, but also Subject G's habitual chin-on-chest head position, which prevented the researcher from seeing any facial expressions that may have occurred.

Subject G made up for the lack of communicative facial gestures, however, by producing 104 communicative and often intentional hand gestures. The other high totals in hand gesture production were 80, produced by Subject E, and 22, produced by Subject J. Hand gestures, which require fine motor ability, were more often produced by the intentional subjects. Only four subjects demonstrated functional or conventional use of objects, and only one of these, Subject J, was non-intentional. Subject J was the only

non-intentional subject to be free of motor impairments.

Self-stimulatory or atypical habitual gestural behaviors were of two types: (a) aberrant gestures which appeared to be meaningless, but were consistently produced by some subjects, sometimes as part of a repetitive series of behaviors, and (b) primitive reflexes or motions that can be identified in newborns or very young infants, that had not distinguished in these developmentally disordered subjects.

Examples of aberrant gestures noted include Subject C's hand-gazing, repeated palm-to-back hand-flipping, head-jerking, and body rocking. Since Subject C also produced exclusively the CVCV vocalization "Mama," these repetitive hand gestures may be related to the phenomenon of babbling with hands produced by deaf infants. Other aberrant gestures included Subject I's habitual rotation of eyes upward coupled with lateral head swinging; Subject H's "wing-flapping" signal of excitement, produced with both hands at shoulder height making quick, repeated vertical motions; and Subject G's habit of entangling arms through clothing, which appeared to be for security. Subject G also produced the most instances of self-abuse, and the entangled arms sometimes appeared to be a form of self-restraint. Subject J's fascination with string resembled intensely-focused behaviors reportedly produced by autistic individuals.

Examples of primitive behaviors, which are not aberrant in very young children but are viewed as aberrant in adults, include Subject K's strong extensor tongue thrust which was produced more often at the end of an object presentation when the researcher's attention

was diverted from Subject K, and may have been a signal of boredom. Other examples were mouthing objects in exploration of them, Subject H's lack of separate hand movement (whatever one hand did, the other hand mirrored), and Subject B's mouth-opening response to any tactile stimulation of the face.

Carpenter, et al. (1983), studied six infants who displayed the following sequence of communicative intents with median ages of acquisition: protesting (<8 months), request for action (9 months), request for object (9 months), comment on action (9.5 months), comment on object (10.5 months), and answering (>15 months).

The non-intentional communicators in this study predominated only in behaviors showing reflexes, passiveness, and protesting. Only three non-intentional subjects, D, J, and H, produced 13 requesting and commenting behaviors, while 89 requests and comments were produced by all six of the intentional communicators.

Carpenter, et al. (1983), in a study of children's development of communicative intentions, reviewed Bates' (cited in Carpenter, et al., 1983), observation that developmental shifts in early communicative intents may be closely related to cognitive development. Carpenter, et al. (1983), also referenced other researchers, Dore, Ingram, and Greenfield and Smith (cited in Carpenter, et al., 1983), to suggest that the level of communicative development of a child of two years or younger is evidenced more by the number of communicative intents used than by the child's lexical or syntactic advances.

The subjects in this study with documented mental and language ages above the eight-month cut-off point did exhibit a greater number of communicative intents than the subjects functioning lower than the eight-month point. The number of reciprocal vocal or gestural responses to the speaker noted during the 15-second pauses, with at least borderline intentionality, was also substantial (166). The 399 pre-intentional communicative behaviors produced by the non-intentional (LA <8) subjects was somewhat less than but comparable to the 460 pre-intentional behaviors produced by the intentional (LA >8) subjects (Table 9). However, when the number of intentional communicative behaviors are totaled for each subject group, the non-intentional group produced far fewer (13) than did the intentional group (89).

The quality of the behaviors produced by the subjects is also reflected in the groupings (pre-intentional vs. intentional) of the behaviors. Most of the behaviors listed as pre-intentional are those associated with systemic reactions (startle or other reflexes) and affective responses which can be seen in facial expressions (pleasure or displeasure). The intentional behaviors displayed by the subjects were clearly associated with a communication dyad: commenting, requesting, and checking (notably Subject G's habit of touching the researcher periodically, which served no other function except reassurance of the researcher's whereabouts; G was the only subject who was both blind and hearing-impaired).

The subjects were subdivided in different ways in order to highlight various other aspects, such as gender, chronological age,

mental age, language age, and oral motor skills, and to relate any outstanding features to presence or absence of communicative intentionality. Since few consistent relationships were observed by grouping subjects according to these aspects, relationships were revealed primarily on a case by case basis. This lack of consistency was no doubt due to the multitude of interrelated conditions superimposed on the subjects' communicative development by their many severe, developmental disorders.

A comparison of subject responses by male versus female groupings resulted in more communicative behavior productions by the male group; however, the six-member male group also contained four intentional subjects and only two non-intentional subjects. Since the intentional subjects as a group produced more communicative behaviors, it cannot be stated that male subjects produced more behaviors because they were male.

Chronological age appeared to have some affect on the performances of the oldest subjects (ages 28 to 34), which may also have resulted from their having been institutionalized longer. The eight younger subjects (ages 18 to 25), although subdivided into two groups which differed by more than eight years' institutionalization time, produced virtually the same number of communicative behaviors.

A striking similarity was noted between the mental age and language age scores of 11 of the 12 subjects. Except for Subject H, whose difference could be reasonably explained, all non-intentional subjects, with less than eight-month language ages, also had mental

ages of less than eight months. Conversely, all subjects with language ages over eight months also obtained mental age scores over eight months.

The final aspect of development examined was oral motor skill and its effect on subject vocalizations. Subjects with the least oral motor abilities produced primarily the least complex vocalizations. Only subjects who could feed themselves regular, unaltered food produced recognizable words.

As expected, the non-intentional subjects produced more non-intentional than intentional communicative behaviors. However, the intentional subjects not only produced more intentional communicative behaviors overall, but also produced more non-intentional behaviors than the non-intentional communicators. The effect of greater than eight-months language age was definitely notable even in globally-disordered subjects with IQ scores of less than 20.

Since these subjects spontaneously produced behaviors that contained communicative intentionality, it is fair to assume that they not only have something to communicate, but also have the desire to communicate. What is lacking, and what can possibly be provided through adaptive technology, is the means to communicate with others in a conventional, understandable way. Through experience, and considering information gained from interview of the subjects' interdisciplinary team members, it is apparent that virtually no gains in speech and language skills have been made by the subjects, at least in the five years prior to this study.

However, progress in understanding their existing communicative abilities, which had been missed in many years of institutionalization during which little or no stimulation was provided, has been made in the last five years through communicative intervention. Such intervention is therefore considered worthwhile; however, it should be directed toward enabling the subjects to better use their existing speech or language abilities in more conventional ways, or gearing adaptive technology to their existing abilities. Subjects such as those in this study who produced intentional communicative behaviors should be at least considered as potential candidates for training with augmentative/alternative communication options.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

Communicative behaviors, produced in response to a stimulus protocol by twelve adult subjects with profound mental retardation and multiple sensory and motor handicaps, were examined and categorized as to presence or absence of communicative intentionality, which develops in the normal child at approximately eight to nine months. Subjects with language ages of eight months or less produced gestural communicative behaviors similar in type and quality to those seen in normal infants under eight months. The majority of those behaviors were judged to be lacking in intentionality, i.e., they were produced in reaction to stimuli without regard to the presence of a message receiver. In contrast, subjects with mental and language ages over eight months produced more behaviors overall, and more behaviors with clear communicative intent directed toward a message receiver. It appeared that the intentional subjects would be better candidates for augmentative/ alternative communicative options and should be given consideration for such training.

Vocalizations of subjects were less similar to normal, and tended to be less complex and produced in less variety than the vocalizations of normally-developing infants. Recognizable words were produced by the two of the three subjects who were intentional communicators, and who had mental ages of at least 12 months.

Comparisons of subject responses were made according to sex, chronological age, mental age, language age, and oral motor skill level. Sex did not appear to have a particular impact on the subjects' responses, but could not be clearly separated from the effect of language age. More male subjects were intentional communicators than female subjects; therefore, as a group the male subjects produced more intentional communicative behaviors.

Chronological age appeared to have an appreciable effect on only the oldest subjects, as they produced fewer communicative behaviors as a group. However, those subjects had also been institutionalized longest as a group, and the effects of institutionalization could not be considered separately from the effects of age in this study.

Mental age was a primary factor in subject performance and was in close agreement with language age. Except for one subject, whose difference could be reasonably explained, all the subjects with mental ages of less than eight months, as determined by administration of the CABS, also exhibited language ages of less than eight months, as determined by administration of the GSAI.

The effect of oral motor skill level apparently contributed to the quality of vocalizations produced by the subjects. The subjects with least oral motor skill produced the least complex and difficult vocalizations, and the subjects with sufficient oral motor skill to eat regular diets could produce recognizable words.

Future research with subjects like those in this study could reveal whether such subjects can respond to communicative

intervention. Research should be directed toward augmentative/ alternative communication options, as progress in speech and language development in subjects such as these may not be attainable.

The effects of early institutionalization versus being raised at home with family influence could be further examined in regard to communicative development. The differential effects of various medical diagnoses regarding communicative development should be studied. Family intervention as well as singular intervention for children with communicative disabilities should be continually evaluated.

The effects of integration of services offered by physical, occupational, speech-language, and other therapists from related fields, on the development of communicative abilities of infants with developmental disorders should be studied. Research on ways therapists in related health fields can best work together, and what each discipline can learn from the others should be examined.

Public laws 94-142 and 99-457 mandate global services beginning at birth for children with handicaps, and a nationwide trend to deinstitutionalize individuals with mental retardation continues. Increasingly, as implementation of these processes becomes reality, and as technological advances in augmentative/alternative communication occur, speech-language pathologists in some settings will be charged with providing treatment for individuals who lack readiness for communication therapy in the traditional sense. Treatment will necessarily be provided entirely from a habilitative

point of view, unlike rehabilitating a client who has lost communicative skills, and unlike helping a young client close a developmental gap.

The speech-language pathologist will require an understanding of the abilities as well as the disabilities of clients like the subjects in this study, to effectively engineer the combination of treatment methods and technology which could bridge their communication gap.

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# APPENDIXES

# APPENDIX A

## CABS AND GSAI TEST FORMS

# CALIFORNIA ADAPTIVE BEHAVIOR SCALE

Organization: _____ (Code _____) Name _____ (Code _____)

Address _____ Date of Birth _____

City _____ State _____ Zip _____ Informant Name _____ (Code _____)

Phone _____ Examiner Name _____ (Code _____)

Signature: _____ Date Prepared: _____ Date Sent: _____ Contract No.: _____

**INSTRUCTIONS:** Select the highest level of performance in each area. Assume independent functioning unless otherwise indicated. Put the number of the item in the blank space next to each title.

**1. TOILETING** _____
01. Uses toilet before going out
02. Flushes without supervision
03. Wipes without supervision
04. Wipes with instructions/directions
05. Cares for self at toilet
06. Goes by self, occasional accidents
07. Habit trained
08. Indicates need to use toilet
09. Has regular movements
10. Urinates in toilet
11. Remains on toilet supervised
12. Shows discomfort at being wet/soiled
13. maintained by caretaker.

**2. DRESSING** _____
01. Purchases entire wardrobe
02. Purchases small clothing items
03. Dresses self completely
04. Dresses neatly without reminder
05. Removes pullover shirt
06. Puts on shoes
07. Puts on coat/dress
08. Removes coat/dress
09. Removes socks
10. Maintained by caretaker.

**3. FASTENING** _____
01. Zips jacket zippers
02. Ties shoelaces
03. Laces shoes
04. Buckles and unbuckles
05. Buttons
06. Unlaces
07. Unbuttons
08. Maintained by caretaker.

**4. EATING** _____
01. Has complete eating skills
02. Cuts meat with knife and fork
03. Uses napkin appropriately
04. Sets table appropriately
05. Spreads soft foods with knife
06. Spreads butter
07. Serves self
08. Holds cup by handle
09. Uses straw appropriately
10. Gets drink/pours from pitcher
11. Eats appropriately with fork
12. Unwarps candy
13. Discriminates edible substances
14. Eats appropriately with spoon
15. Drinks from cup/glass unaided
16. Chews/masticates food
17. Does not drool
18. Drinks from cup/glass assisted
19. Holds spoon with palmar grasp
20. Maintained by caretaker.

**5. BATHING** _____
01. Showers
02. Bathes unaided
03. Empties and cleans tub
04. Bathes with minimal verbal prompts
05. Adequately cleans nose
06. Washes face thoroughly
07. Dries body thoroughly
08. Washes hands thoroughly
09. Washes body thoroughly
10. Dries hand thoroughly
11. Soaps washcloth
12. Applies soap to body parts
13. Applies soap to hands
14. Places hands in water
15. Maintained by caretaker.

**6. GROOMING** _____
01. Shaves without reminder
02. Grooms independently
03. Uses lipstick
04. Combs/brushes hair adequately
05. Shampoos
06. Combs/brushes, but not to style
07. Blows nose unaided
08. Blows nose aided
09. Wipes nose
10. Puts comb/brush through hair
11. Allows hair to be washed
12. "Combs" with assistance
13. Maintained by caretaker.

**7. TOOTHBRUSHING** _____
01. Uses water pik effectively
02. Uses dental floss effectively
03. Brushes teeth correctly
04. Knows when to brush teeth
05. Puts toothpaste on brush
06. Rinses mouth
07. Brushes teeth with minimal verbal prompts
08. Makes brushing strokes
09. Puts toothbrush in mouth
10. Holds toothbrush
11. Maintained by caretaker.

**8. PERSONAL INTERACTION** _____
01. Dates
02. Relates comfortably with opposite sex
03. Empathizes with others
04. Practices most social conventions
05. Engages in imaginary play
06. Follows rules
07. Sustains interest for 90 minutes
08. Initiates interaction
09. Responds to verbal greetings
10. Expresses affection without cues
11. Gives eye contact when called
12. Gestures to make needs known
13. Shows affection when cued
14. Demands personal attention
15. Reaches for familiar persons
16. Minimal. Does not enjoy personal interaction.

**9. GROUP PARTICIPATION** _____
01. Active member of a team or club
02. Enjoys social gatherings
03. Enters competitions/tournaments
04. Plays seasonal sports
05. Active in 4H or scouts
06. Plays preadolescent games
07. Observes group routines
08. Plays follow the leader
09. Plays competitive exercise games
10. Sings in groups
11. Plays loosely structured group games
12. Knows to wait turn
13. Plays with peers
14. Parallel plays
15. Enjoys social walks
16. Minimal. Does not engage in group activities.

**10. RECEPTIVE LANGUAGE** _____
01. Uses newspaper for information
02. Reads and understands "how
03. Recognizes basic sight vocabulary
04. Reads on preprimer level
05. Carries out 3 successive commands
06. Reads by way of pictures
07. Follows directions with 2 prepositions
08. Identifies action in pictures
09. Identifies objects by function
10. Listens to simple stories
11. Follows 2 simple related successive commands
12. Points to body parts when named
13. Points to common objects
14. Knows own name
15. Understands simple commands
16. Orients to sound
17. Minimal

**11. EXPRESSIVE LANGUAGE** _____
01. Corresponds regularly by letter
02. Writes simple stories or poems
03. Makes long distance telephone calls
04. Writes occasional short letters
05. Writes with pencil
06. Can tell familiar story
07. Repeats songs and rhymes
08. Prints simple words
09. Uses compound sentences
10. Uses past tense
11. Relates experiences
12. Act out short stories
13. Gives own full name
14. Uses short sentences or phrases
15. Names familiar objects
16. Gestures to make needs known
17. Imitates words
18. Babbles, makes sounds like words
19. Vocalizes
20. Minimal. Does not attempt words.

12. LEISURE TIME _____
01. Follows current events
02. Develops special hobbies
03. Plays tennis, basketball, chess, etc
04. Enjoys various reading material
05. Reads on own initiative
06. Tries new ways of doing things
07. Beats rythm
08. Plays follow the leader
09. Plays checkers, cards, dominoes, etc.
10. Paints
11. Rides simple play vehicles
12. Completes ring on pegboard
13. Builds with blocks
14. Creates with sand, mud, clay
15. Cuts with scissors
16. Initiates own play activities
17. Kicks ball
18. Carries familiar objects
19. Plays alone for up to 30 minutes
20. Does not engage in usual leisure activities.

13. GROSS MOTOR _____
01. Washes, irons clothes
02. Rides vehicles
03. Dances
04. Rides tricycles
05. Skips alternating feet
06. Jumps over objects
07. Walks downstairs
08. Climbs
09. Balances in place on each foot
10. Jumps in place
11. Runs
12. Walks upstairs
13. Walks
14. Stands by self
15. Moves about on floor
16. Pulls self upright
17. Sits
18. Rolls over
19. Balances head
20. Does not move.

14. PERCEPTUAL MOTOR _____
01. Draws complex designs from memory
02. Uses can opener
03. Cuts and pastes
04. Colors to line neatly
05. Fastens shoes completely
06. Draws with pencil or crayon
07. Draws triangle accurately
08. Draws square accurately
09. Does simple 2 - 4 piece puzzles
10. Catches
11. Throws a ball
12. Assembles simple objects
13. Turns knob/unscrews
14. Turns pages one by one
15. Disassembles simple objects
16. Unwraps candy/packages
17. Transfers objects
18. Reaches for nearby objects
19. Grasps objects within reach
20. Minimal.

15. PREVOCATIONAL _____
01. Uses simple tools
02. Assembles toys, models and kits
03. Matches by amount/number
04. Cleans up after activity
05. Sews, nails, saws, unlocks, starts record
06. Runs errands
07. Sorts by color
08. Strings beads
09. Matches shapes
10. Matches colors
11. Puts beads in box
12. Attends to task for 30 minutes
13. Occupies self unatended
14. Minimal.

16. VOCATIONAL _____
01. Maintains a job
02. Builds and repairs
03. Complies with safety rules
04. Finds job through want ads/agencies
05. Fills out job application unaided
06. Performs responsible tasks for pay
07. Fills out job application assisted
08. Does odd jobs for pay
09. Knows basic sight vocabulary
10. None. See Prevocational domain.

17. ACADEMIC _____
01. Does simple creative work
02. Uses fractions
03. Names days of the week
04. Tells time to half hour
05. Adds to 10
06. Copies words
07. Prints first name
08. Names primary colors
09. Counts to 25
10. Counts to 4
11. Counts to 3
12. Compares sizes
13. Counts to 2
14. Scribbles
15. Marks
16. Minimal academic skills.

18. TRANSLOCATION _____
01. Goes out at night unrestricted
02. Goes to distant towns/cities alone
03. Goes out unsupervised in daytime
04. Goes to nearby towns/cities alone
05. Drives with supervision
06. Uses map to locate self
07. Goes about home town unrestricted
08. Goes to school unattended
09. Goes about neighborhood unattended
10. Goes about residence
11. Overcomes simple obstacles
12. Does not translocate independently

19. MONEY HANDLING _____
01. Earns own spending money
02. Budgets allowance/eanings
03. Makes purchases by mail
04. Buys small articles
05. Changes up to a dollar
06. Names quarters, half dollar, dollar
07. Changes up to .25
08. Adds to 10
09. Is trusted with money
10. Names penny, nickle, dime
11. Does not handle money.

20. PERSONAL MANAGEMENT _____
01. Purchases entire wardrobe
02. Assumes care for clothing
03. Selects proper clothes for all occasions
04. Budgets time
05. Selects clothes for weather
06. Knows own address
07. Knows own phone number
08. Tells caretakers name
09. Tells own age
10. Tells first and last name
11. Tells first name
12. Asserts own will
13. Exercises minimal personal management.

21. HOME MANAGEMENT _____
01. Keeps food from spoiling
02. Plans 3 meal day
03. Washes, irons, dries
04. Keeps own room neat and clean
05. Cooks simple meals
06. Decorates own room
07. Follows recipes
08. Cooks hotdogs, eggs, snacks
09. Seasons food to taste
10. Adequate table manners
11. Does routine household tasks
12. Empties and cleans tub
13. Answers phone
14. Cleans up after eating
15. Makes sandwich
16. Helps at little household tasks
17. Imitates housework
18. Does not manage home environment.

22. HEALTH CARE _____
01. Manages personal health care
02. Knows basic first aid
03. Sees to own medication
04. Follows safety rules
05. Recognizes symptoms of illness
06. Takes own medication for short periods
07. Treats minor injuries with help
08. Knows when to brush teeth
09. Adjusts water temperature
10. Localizes sites of discomfort
11. Keeps nose clean
12. Indicates when sick or injured
13. Avoids simple hazards
14. Uncomfortable when soiled or wet
15. Maintained by caretaker.

23. COMMUNITY AWARENESS _____
01. Uses public transport: complex route
02. Uses phonebook to locate others
03. Uses public transport: direct route
04. Buys complete meals
05. Uses library
06. Buys fast foods
07. Uses toilet before going out
08. Buys small snacks
09. Goes to school by self
10. Has minimal community awareness.

24. RESPONSIBILITY _____
01. Outlines future plans
02. Supplements allowance with earning
03. Performs responsible tasks
04. Saves for large purchase
05. Responsible for others
06. Does small jobs for pay
07. Responsible for pet
08. Teaches younger person
09. Goes to bed regularly
10. Plans immediate future
11. Respects property
12. Runs errands
13. Puts toys away after using
14. Takes care of materials
15. Exercises minimal responsibility.

## GENERIC SKILLS ASSESSMENT INVENTORY

Key: ⊕ subsumed/assumed
+ skill consistently demonstrated
± skill inconsistent; needs further expansion
- skill not demonstrated
NA not appropriate

Object Relationships:

| # | Skill | Comment | reported | evoked | observed |
|---|---|---|---|---|---|
| 1A | Orients briefly to objects | | | | |
| 1B | Attends to objects at least 5 sec. | | | | |
| 1C | Visually tracks objects | | | | |
| 2A | Shifts attention between 2 objects | | | | |
| 2B | Reaches, captures & holds objects | | | | |
| 2C | Grasps & manipulates objects | | | | |
| 3A | Differential actions on objects | | | | |
| 3B | Combinatorial actions on objects | | | | |
| 3C | Direct means to ends | | | | |
| 3D | Indirect means to ends | | | | |
| 3E | Primitive tool use | | | | |
| 3F | Functional use of objects | | | | |
| 4A | Conventional tool use | | | | |
| 4B | Complex combinatorial actions | | | | |

Representation:

| | | | | | |
|---|---|---|---|---|---|
| 2A | Locates object to auditory cue | | | | |
| 2B | Locates visibly hidden object | | | | |
| 3A | Searches for object hidden visibly in optional places | | | | |
| 3B | Selects identical object from three | | | | |
| 4A | Matches photo to object & object to photo | | | | |
| 4B | Matches pantomimed action to object | | | | |
| 4C | Perceptual class concepts | | | | |
| 4D | Functional class concepts | | | | |

Generic Skills Assessment Inventory
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Dyadic Interaction:

| # | Skill | Comment | reported | evoked | observed |
|---|---|---|---|---|---|
| 1A | Tolerates proximity | | | | |
| 1B | Returns gaze | | | | |
| 2A | Attends to speaker | | | | |
| 2B | Releases/accepts objects | | | | |
| 2C | Playful interaction | | | | |
| 3A | Evokes attention for communicating | | | | |
| 3B | Maintains joint focus | | | | |
| 3C | Waits turn | | | | |
| 3D | Fills turn | | | | |
| 3E | Establishes joint focus | | | | |
| 4A | Establishes joint referent using conventional gestures or single words/signs | | | | |
| 4B | Answers simple questions | | | | |
| 4C | Maintains joint referent/topic | | | | |
| 4D | Peer interaction | | | | |

Expressive Communication:

| | | | | | |
|---|---|---|---|---|---|
| 1A | Reactive behaviors | | | | |
| 1B | If 1A is + or ±) 1A behaviors interpreted as signals of: 1) pleasure, comfort | | | | |
| | 2) displeasure, discomfort | | | | |
| | 3) other | | | | |
| 2A | Purposeful behaviors | | | | |
| 2B | If 2A is + or ±) 2A behaviors interpreted as signals of: 1) desire for specific actions or entities | | | | |
| | 2) protest or rejection | | | | |
| | 3) interest in actions or entities | | | | |
| | 4) desire for attention to self | | | | |
| | 5) other | | | | |

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| # | Skill | Comment | reported | evoked | observed |
|---|---|---|---|---|---|
| 3A | Gets attention prior to producing behavior to communicate; is persistent | | | | |
| 3B | (If 3A is + or ±) intentions expressed: 1) request specific entity or action | | | | |
| | 2) protest or rejection | | | | |
| | 3) direct receiver's attention to self | | | | |
| | 4) direct receiver's attention to external entity or event | | | | |
| | 5) other | | | | |
| 4A | Conventional gestures and/or intonated vocalizations | | | | |
| 4B | (If 4A is + or ±) intentions expressed: 1) request specific entity or action | | | | |
| | 2) protest or rejection | | | | |
| | 3) direct receiver's attention to self | | | | |
| | 4) direct receiver's attention to external entity or event | | | | |
| | 5) greeting | | | | |
| | 6) answer or reply | | | | |
| | 7) request information or confirmation | | | | |
| | 8) other | | | | |
| 4C | (If 4A is + or ±) uses these conventional signals: 1) point | | | | |
| | 2) give | | | | |
| | 3) show | | | | |
| | 4) request | | | | |
| | 5) wave | | | | |
| | 6) head nod or shake | | | | |
| | 7) appropriately intonated vocalization | | | | |
| | 8) other | | | | |

Generic Skills Assessment Inventory
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| # | Skill | Comment | reported | evoked | observed |
|---|---|---|---|---|---|
| 4D | At least 5 true words/signs | | | | |
| 4E | (If 4D is + or ±) words or signs used to express: | | | | |
| | 1) request specific action or entity | | | | |
| | 2) protest or rejection | | | | |
| | 3) direct receiver's attention to self | | | | |
| | 4) direct receiver's attention to external entity or event | | | | |
| | 5) greeting | | | | |
| | 6) answer/reply | | | | |
| | 7) request information or confirmation | | | | |
| | 8) other | | | | |

Comprehension and Imitation:

| | | | | | |
|---|---|---|---|---|---|
| 1A | Responds to intonation | | | | |
| 2A | Anticipates routine event | | | | |
| 2B | Continue movement | | | | |
| 2C | Responds to ritualized utterances | | | | |
| 3A | Responds to conventional gestures | | | | |
| 3B | Imitates action on objects | | | | |
| 3C | Responds to action gestures | | | | |
| 3D | Imitates motion | | | | |
| 3E | Comprehends label of present object | | | | |
| 4A | Comprehends labels of absent objects/ actions | | | | |
| 4B | Comprehends 2 or more terms in utterance | | | | |

# APPENDIX B

## SCRIPTS FOR STIMULUS PROTOCOL

Script for Stimulus Protocol (Session 1)

Introduction

1. "Hi, (name). How are you doing this morning/afternoon?" (15 sec.)

2. "What have you been doing today?" (15 sec.)

3. "I need for you to work with me for a few minutes, and I have some things to show you." (15 sec.) Stop.

Object #1: Hairbrush (familiar stationary object)

4. (Present brush.) "First I have something that you've seen before. This is something you would use every day. What is this?" (15 sec.)

5. "This is a hairbrush, isn't it? What do you do with a hairbrush?" (15 sec.)

6. (Pantomime brushing hair.) (15 sec.)

7. "You brush your hair with it, don't you? This is my hairbrush, and you have your own brush down in your room. My brush is pink. What color is yours?" (15 sec.)

8. (Put brush down.) Stop.

Object #2: Roll-Up Candle (unfamiliar stationary object)

9. "OK, take a look at this. This is about as strange as anything ever looks, don't you think so?" (15 sec.)

10. "This is a long, thin red candle that comes in a roll, and a black wrought-iron candle holder." (15 sec.)

11. "Let me show you how it works. You stick the red candle up inside this hole, and pull it out the top. Then you take a match and light the wick, and the candle flame

burns up here." (15 sec.)

12. "As the candle burns down, the wax melts. When you need more of the candle to burn, you turn the handle on the side, and it unrolls more of the candle. Then you push it up the hole to the top, and you have more of the candle to burn." (15 sec.)

13. "Let me turn it around and show you the back. Isn't that strange? A different sort of candle, isn't it?" (15 sec.) Stop.

Object #3: Fan (familiar moving/sound-producing object)

14. (Present fan.) "Ok, now let's look at something else. This is something you've seen before, isn't it? When you turn it on like this, it blows air on you and keeps you cool." (Turn on fan to oscillate.) (15 sec.)

15. "What is this?" (15 sec.)

16. "It's a fan, isn't it?" (15 sec.)

17. (Turn fan off.) (15 sec.)

18. "Do you want the fan back on?" (15 sec.)

19. "Let's turn it back on again." (Turn on.) (15 sec.)

20. "Ok, we'll turn it off now and put it away." (Put fan down.) (15 sec.) Stop.

Object #4: Music Box (unfamiliar moving/sound-producing object)

21. "Ok, next I have something new to show you that I don't think you've ever seen before." (Present music box.)

(15 sec.)

22. "What do you think this is?" (Show box; open, turn over, etc.) (15 sec.)

23. "What does it look like? It has a rainbow on the top, and the lid comes off." (Continue to show box.) (15 sec.)

24. "Let me show you how it works. Watch what happens. See this handle? You turn the handle...and listen." (Wind handle 1/2 turn from vertical position.) (30 sec.)

25. "It's a music box, isn't it? It plays `Over the Rainbow' from the movie `Wizard of Oz.' Have you seen that movie? I'll bet you have." (15 sec.)

26. "Have you heard that song before? Shall we play a little more of it?" (Wind handle 1/2 turn from horizontal position.) (65 sec.)

27. "Did you like the music box?" (15 sec.) Stop.

Ending

28. "That's all I have to show you today. Thank you for coming to work with me." (15 sec.)

29. "I'll take you back downstairs now. Are you ready to go?" (15 sec.) Stop.

Script for Stimulus Protocol (Session 2)

Introduction

30. "Hi, (name). How are you today?" (15 sec.)

31. "Have you been busy this week?" (15 sec.)

32. "I need for you to work with me again, and I have some new things to show you this time." (15 sec.)

33. "Okay, here we go."

Object #5: Spoon (familiar stationary object)

34. "Here's something you're very familiar with." (Present spoon.) (15 sec.)

35. "This is a spoon, isn't it?" (15 sec.)

36. "We use a spoon to eat with, don't we? ... We use it to bring the food from our plates...up to our mouths to eat. We dip it into food like this (pantomime)...and bring it up like this (pantomime) ... And if you need help using a spoon...someone is there to help you, right?" (15 sec.)

37. "We'll use this spoon in a few minutes. We're going to make something to eat." (15 sec.) Stop.

Object #6: Blue and white tin (unfamiliar stationary object)

38. "Let me show you this. It's a blue and white metal can called a tin." (15 sec.)

39. "It has a lid that comes off (take off). Look inside; anything in there?" (15 sec.)

40. "There's nothing in it right now. But you could use it to hold things, or you could leave the lid off and put flowers in it." (15 sec.)

41. "You can put things inside it, or you can leave the lid on, and use the tin for a decoration by itself." (15 sec.)

42. "Ok, now we're going to do something fun." Stop.

Object #7: Blender (familiar moving/sound-producing object)

43. (Present blender and set up.) "You know what this is, don't you?" (15 sec.)

44. "We're going to make something we can taste... We've done this before in the 2-East kitchen." (15 sec.)

45. "Here's what we're going to put into the blender... I brought vanilla ice cream...and chocolate syrup... Let's make a milkshake...and then we can have some..." (15 sec.)

46. "First we make sure the glass is tight on the blender... Then we take off the lid...get a scoop of ice cream...put it in... Do you like chocolate?... Shall I add some chocolate syrup to your milkshake?" (15 sec.)

47. "I'll put in some chocolate for you...not very much...because we're only making a small milkshake, aren't we?" (15 sec. while putting on lid, etc.)

48. "Now we have to turn it on and blend it, don't we? Would you like to push the switch?" (15 sec.)

49. "That's good. Let me help you..." (15 sec. blender running...)

50. "Ok, that's good. I think our milkshake is done." (15 sec.)

51. "Would you like a taste now? I have a bowl, and we have our spoon....Let me get you a bite to taste..." (15 sec.)

52. "Do you like the milkshake we made?" (15 sec.) Stop.

Object #8: Armatron (unfamiliar moving/sound-producing object)

53. "Now, let me show you this. This is something that's going to be really strange-looking. This is called `Armatron.' It's a robot arm that I can operate with these controls." (Point out.) (15 sec.)

54. "Ok, watch this. Watch me work the controls. First we have to turn it on." (15 sec.)

55. "What do you think? It's noisy, isn't it?" (15 sec.)

56. "Here it comes." (15 sec.)

57. "Ok, I have a block right here. I'll see if I can make it pick up the block." (15 sec.)

58. "We're gonna see if I can pick up the block, ok?" (15 sec.)

59. "Ok, now it has the block in its jaws...and I'll make it clamp." (5 sec.)

60. "Ok, it clamped on. Now we'll pick up the block." (15 sec.)

61. "Now I'll make it open its jaws...and hand me the block." (15 sec.)

62. "Ok, we found out how Armatron worked, didn't we?" (15 sec.) Stop.

Ending

63. "That's all I have to show you today. Thank you for coming to work with me." (15 sec.)

64. "I'll take you back downstairs now. Are you ready to go?" (15 sec.) Stop.

# APPENDIX C

## RAW DATA FOR TABLES 4, 5, 6, 7, 8, AND 9

Table 15

Raw Data for Table 4-Vocalizations of Subjects

| | | | Non-speech-like sounds | | | |
|---|---|---|---|---|---|---|
| S | LA | n | Breathing | Gutteral | Growl | Squeak |
| F | <8 | 2 | 2 | | | |
| L | <8 | 8 | | | | 8 |
| D | <8 | 4 | 4 | | | |
| A | >8 | 15 | 15 | | | |
| K | >8 | 1 | | 1 | | |
| H | <8 | 4 | 1 | 1 | 2 | |
| I | >8 | 3 | 2 | 1 | | |
| E | >8 | 3 | 3 | | | |
| Totals | | 40 | 27 | 3 | 2 | 8 |

Note. Subjects (S) are listed in first column in order of increasing mental age. Language age (LA) for each subject is shown as less than 8 months (<8) or greater than 8 months (>8).

(table continues)

| | | | Single vowel-like elements (V) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | High | Mid | Low | High | Mid | Low | |
| S | LA | n | Front | | | Central | | Back | |
| F | <8 | 3 | | | | | 3 | | |
| B | <8 | 1 | | | | 1 | | | |
| D | <8 | 3 | | | | 1 | | 2 | |
| J | <8 | 61 | 1 | 9 | | | | 51 | |
| A | >8 | 21 | | | | 11 | 1 | 9 | |
| G | >8 | 6 | | | | | | 4 | 2 |
| K | >8 | 44 | 1 | | | | | 37 | 6 |
| H | <8 | 34 | 1 | 2 | 5 | 8 | 1 | 12 | 5 |
| I | >8 | 4 | | | | 4 | | | |
| Totals | | 177 | 3 | 11 | 5 | 25 | 2 | 118 | 13 |
| | | | | 19 | | 25 | | 133 | |

Note. The terms high, mid, low, front, central, and back refer to tongue positions, which help shape the various vowel-like sounds.

(table continues)

| S | LA | n | Vowel-like element combinations (VV and VVV) | | | |
|---|---|---|---|---|---|---|
| | | | Cen./LB | HB/HF | HB/LF | HB/HB |
| H | <8 | 8 | 4 | 1 | 2 | 1 |
| | | | LB/LF | LB/LB | LF/LB/Cen. | LB/HF/LF |
| H | <8 | 4 | 1 | 1 | 1 | 1 |
| | | | LB/LF/Cen. | | LB/HB/LF | |
| H | <8 | 2 | 1 | | 1 | |
| Total | | 14 | | | | |

Note. Tongue positions are abbreviated as follows:

Cen. = central, H = high, L = low, B = back, F = front.

(table continues)

| | | | Single consonant-like elements and combinations (C and CC) | | | |
|---|---|---|---|---|---|---|
| | | | Nasalized | | VGF + | |
| S | LA | n | Ling.-alv. | Bilab. | Nas. | bilab. |
| L | <8 | 1 | | 1 | | |
| G | >8 | 12 | 2 | 8 | | 2 |
| K | >8 | 1 | | 1 | | |
| E | >8 | 8 | | 2 | | 6 |
| Totals | | 22 | 2 | 12 | | 8 |

Note. Consonant-like elements noted are described as to place and manner of airstream constriction: nasalized lingua-alveolar, nasalized bilabial, and voiceless glottal fricative.

(table continues)

| | | | Vowel-like and consonant-like element combinations (VC and VCV) | | | |
|---|---|---|---|---|---|---|
| S | LA | n | Central V + liquid C | High front V + lingua-alveolar C + high front V | | |
| H | <8 | 1 | 1 | K | >8 | 1 |
| 1 | | | | | | |
| | | | Central V + liquid C + low back V | Low back V + nasalized bilabial C + central V | | |
| H | <8 | 2 | 1 | 1 | | |
| | | | Low back V + lingua-alveolar C + low back V | | | |
| K | >8 | 1 | 1 | | | |

(table continues)

| | | | Consonant-like and vowel-like element combinations (CV & CVV) | | | |
|---|---|---|---|---|---|---|
| | | | Voiceless glottal fricative C + | | | |
| S | LA | n | LF V | Cen. V | HB V | LB V |
| D | <8 | 1 | | 1 | | |
| J | <8 | 2 | | 2 | | |
| A | >8 | 1 | | 1 | | |
| K | >8 | 1 | | | 1 | |
| H | <8 | 5 | 1 | | | 4 |
| E | >8 | 1 | | 1 | | |
| Totals | | 11 | 1 | 5 | 1 | 4 |

| | | | Voiced labio-dental fricative C + | | | |
|---|---|---|---|---|---|---|
| | | | | | HB V + | HB V + |
| | | | LF V | LB V | HF V | Cen. V |
| H | <8 | 12 | 4 | 6 | 1 | 1 |

(table continues)

| | | | Nas. ling.-alv. C + central V or VV | | Nas. bilab. C + high back V |
|---|---|---|---|---|---|
| D | <8 | 1 | 1 | | |
| K | >8 | 4 | | | 4 |
| H | <8 | 1 | | 1 | |
| Totals | | 6 | 1 | 1 | 4 |

| | | | Consonant-like and vowel-like element combination (CVCV) | | |
|---|---|---|---|---|---|
| S | LA | n | Voiced lingua-alveolar C + high front V | | |
| I | >8 | 4 | | 4 | |
| | | | Words: "Mama" | "Thank You" | "Hey" |
| C | >8 | 5 | 5 | | |
| E | >8 | 15 | | 7 | 8 |

(table continues)

Total Vocalizations of Subjects

| S | n | F | L | B | D | J | A | G | K | C | H | I | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NS | 40 | 2 | 8 | | 4 | | 15 | | 1 | | 4 | 3 | 3 |
| V | 177 | 3 | | 1 | 3 | 61 | 21 | 6 | 44 | | 34 | 4 | |
| VV | 10 | | | | | | | | | | 10 | | |
| VVV | 4 | | | | | | | | | | 4 | | |
| C | 14 | | 1 | | | | | 10 | 1 | | | | 2 |
| CC | 8 | | | | | | | 2 | | | | | 6 |
| VC | 1 | | | | | | | | | | 1 | | |
| VCV | 4 | | | | | | | | 2 | | 2 | | |
| CV | 26 | | | | 2 | 2 | 1 | | 5 | | 15 | | 1 |
| CVV | 3 | | | | | | | | | | 3 | | |
| CVCV | 4 | | | | | | | | | | | 4 | |
| Words | 20 | | | | | | | | | 5 | | | 15 |
| T | 311 | 5 | 9 | 1 | 9 | 63 | 37 | 18 | 53 | 5 | 73 | 11 | 27 |

Note. NS = Non-speech. Subjects are listed across top in order of increasing mental age.

Table 16

Raw Data for Table 5-Body Gestures Produced by Subjects

| | | Body responses | | | | |
|---|---|---|---|---|---|---|
| S | n | Total | Startle | Quiet | Comply | Resist |
| F | 24 | 20 | 2 | | 1 | 1 |
| L | 7 | 4 | | | 2 | 1 |
| B | 7 | 5 | | 1 | 1 | |
| D | 14 | 12 | | | 2 | |
| J | 2 | | | 1 | 1 | |
| A | 4 | 2 | | | 2 | |
| G | 5 | 2 | | | 3 | |
| K | 12 | 10 | | 1 | 1 | |
| C | 1 | | | | 1 | |
| H | 16 | 12 | | 3 | 1 | |
| I | 4 | 3 | | | 1 | |
| T | 96 | 70 | 2 | 6 | 16 | 2 |

Note. Total body response = generalized body movement. Startle = reflexive reaction; quieting = generalized relaxation and cessation of movement. Compliance = overall attitude of acceptance; resistance = attitude of refusal.

(table continues)

| | | Body orientation | | | |
|---|---|---|---|---|---|
| | | Toward | Turn | Lean toward S | |
| object/speaker | n | away | speaker | | |
| F | 12 | | 12 | | |
| L | 11 | | 4 | 7 | |
| D | 3 | | | 3 | |
| K | 3 | | 3 | | |
| C | 11 | | 2 | 8 | 1 |
| I | 9 | | 1 | 8 | |
| E | 7 | | | 5 | 2 |
| T | 56 | | 22 | 31 | 3 |

Note. Body orientation refers to rotation of the body toward the stimulus so that facial and body positions suggest an attitude of attending to the stimulus.

(table continues)

| | | Other body gestures | | | |
|---|---|---|---|---|---|
| | | Raise head | Rock | Slump | Reposition |
| B | 1 | 1 | | | |
| J | 24 | | 11 | 9 | 4 |
| G | 2 | | | | 2 |
| K | 4 | 4 | | | |
| H | 2 | 2 | | | |
| I | 7 | | | | 7 |
| T | 40 | 7 | 11 | 9 | 13 |

Note. Subjects B, K, and H raised their heads from a chin-on-chest position so that their eyes met the speaker's or the target object. Subject J occupied a rocking chair during both sessions, and rocked occasionally. Slumping and repositioning refers to body position in chair.

(table continues)

Table 17

Raw Data for Table 6-Facial Gestures Produced by Subjects

| | | Facial Movement | | | |
|---|---|---|---|---|---|
| | | Eyes | | | Mouth |
| S | n | Open | Shift/blink | Widen | Open/close |
| F | 26 | 1 | 19 | 2 | 4 |
| L | 10 | | 10 | | |
| B | 11 | 5 | 2 | | 4 |
| D | 17 | | 8 | | 9 |
| J | 3 | | 3 | | |
| A | 6 | | 4 | | 2 |
| H | 18 | | 10 | 5 | 3 |
| I | 9 | | 9 | | |
| E | 1 | | 1 | | |
| T | 101 | 6 | 66 | 7 | 22 |

(table continues)

| | | Directed eyegaze | | | | |
|---|---|---|---|---|---|---|
| S | n | Speaker | Obj. | Away | Env. | Inter. |
| F | 2 | | | | 2 | |
| L | 35 | 18 | 12 | 2 | 3 | |
| B | 16 | 5 | 5 | 2 | 2 | 2 |
| D | 39 | 19 | 14 | | 1 | 5 |
| J | 50 | 15 | 11 | 18 | 4 | 2 |
| A | 17 | 1 | 12 | | 2 | 2 |
| K | 49 | 21 | 24 | 3 | | 1 |
| C | 57 | 17 | 25 | 11 | | 4 |
| H | 38 | 13 | 15 | 2 | 8 | |
| I | 58 | 18 | 19 | 16 | 3 | 2 |
| E | 46 | 16 | 22 | 2 | 2 | 4 |
| T | 407 | 143 | 159 | 56 | 27 | 22 |

Note. Eyegaze of subjects was directed at various times toward the speaker, the target object, purposely away from the speaker or object, to nonspecific points in the environment, and intermittently between speaker or object and other points.

(table continues)

| S | n | Dual regard | |
|---|---|---|---|
| | | Speaker/object | Object/object |
| L | 2 | 1 | 1 |
| D | 11 | 9 | 2 |
| A | 2 | | 2 |
| C | 3 | 2 | 1 |
| H | 13 | 13 | |
| I | 3 | 2 | 1 |
| E | 6 | 4 | 2 |
| T | 40 | 31 | 9 |

Note. Dual regard refers to alternating visual attention between speaker and object or between two objects.

(table continues)

| | | Facial expression (positive affect) | | | |
|---|---|---|---|---|---|
| S | n | Smile | Brow lift | Quizzical | Nose wrinkle |
| F | 1 | 1 | | | |
| L | 2 | | 2 | | |
| B | 3 | 3 | | | |
| D | 6 | 6 | | | |
| J | 14 | 12 | | | 2 |
| K | 28 | 28 | | | |
| C | 30 | 28 | 2 | | |
| H | 14 | 14 | | | |
| I | 31 | 31 | | | |
| E | 12 | 10 | | 1 | 1 |
| T | 141 | 133 | 4 | 1 | 3 |

(table continues)

| | | Facial expression (negative affect) | | | |
|---|---|---|---|---|---|
| S | n | Downcast | Frown | Grimace | Pout |
| K | 2 | | | 2 | |
| C | 4 | 3 | | | 1 |
| H | 1 | | | 1 | |
| I | 6 | 4 | 2 | | |
| T | 13 | 7 | 2 | 3 | 1 |

Table 18

Raw Data for Table 7-Self-Stimulatory Behaviors or Atypical Habitual Gestures Produced by Subjects

| | | Eyes | |
|---|---|---|---|
| S | n | Squinting | Upward gaze |
| L | 6 | | 6 |
| J | 3 | | 3 |
| C | 2 | 2 | |
| I | 6 | 6 | 7 |
| T | 24 | 8 | 16 |

| | | Head | | | |
|---|---|---|---|---|---|
| | | Jerking/ Shaking | Bobbing | Swinging | Bumping forehead |
| G | 2 | | 2 | | |
| C | 28 | 28 | | | |
| I | 17 | | | 17 | |
| E | 4 | 3 | | | 1 |
| T | 51 | 31 | 2 | 17 | 1 |

(table continues)

| | | Mouth | | |
|---|---|---|---|---|
| S | n | Mouthing object | Tongue thrust | |
| G | 1 | 1 | | |
| K | 7 | | 7 | |
| T | 8 | | | |
| | | Tongue wiggling | Finger biting | Teeth grinding |
| L | 9 | | | 9 |
| J | 3 | 2 | 1 | |
| T | 12 | | | |

Note. Tongue thrusting was noted when Subject K attempted to retract tongue inside mouth and had difficulty doing so. Subject J's tongue wiggling was noted as quick, lateral motion of tongue inside mouth. Teeth grinding refers to bruxism.

(table continues)

| S | n | Hands | | |
|---|---|---|---|---|
| | | Hand gazing | Hand flipping | "Wing flapping" |
| C | 22 | 12 | 10 | |
| H | 5 | | | 5 |
| I | 2 | 2 | | |
| | | Shirt pulling | Arm up through shirt | |
| J | 2 | 2 | | |
| G | 1 | | 1 | |
| C | 2 | 2 | | |
| | | Identical hand movements | Exhaling against palm | |
| H | 7 | 7 | | |
| C | 1 | | 1 | |
| T | 42 | | | |

(table continues)

| S | n | Patting surface alternating hands | | |
|---|---|---|---|---|
| G | 3 | 3 | | |
| | | Using hands to touch/stroke/pat: | | |
| | | Own face/ hair | Speaker's hand | Own chest |
| J | 6 | 4 | | 2 |
| C | 11 | 6 | 4 | 1 |
| I | 1 | 1 | | |
| | | Grasp/pull release repetition | Body rocking | |
| H | 2 | 2 | | |
| C | 14 | | 14 | |
| T | 37 | | | |

(table continues)

| S | n | Objects | | | |
|---|---|---|---|---|---|
| | | Hold/pat against chest | Suspend/ shake in air | Hit/pat object | Touch object to face |
| G | 3 | | 1 | 2 | |
| C | 2 | 1 | 1 | | |
| E | 11 | | 4 | 3 | 4 |
| T | 16 | 1 | 6 | 5 | 4 |

| S | n | Hit object against self/ self against object | Playing with string |
|---|---|---|---|
| J | 6 | 4 | 2 |
| G | 25 | 25 | |
| T | 47 | 29 | 2 |

Table 19

Raw Data for Table 8-Hand Gestures Produced by Subjects

| S | n | Reach/touch | | | |
|---|---|---|---|---|---|
| | | Toward object | Touch object | Touch speaker | Search environment |
| D | 1 | 1 | | | |
| J | 7 | 4 | 3 | | |
| G | 41 | 3 | 13 | 12 | 13 |
| K | 1 | 1 | | | |
| C | 1 | 1 | | | |
| E | 12 | 4 | 3 | 5 | |
| T | 63 | 14 | 19 | 17 | 13 |

Note. Toward object refers to reaching toward but not touching an object. Search environment refers to Subject G's habit of feeling for any stimuli within arms' reach.

(table continues)

| S | n | Grasp | | | |
|---|---|---|---|---|---|
| | | Object | & pull speaker | Accept object | Refuse/ release |
| J | 7 | 2 | | 5 | |
| G | 22 | 3 | 5 | 12 | 2 |
| C | 4 | 1 | 1 | 2 | |
| E | 17 | 12 | | 3 | 2 |
| T | 50 | 18 | 6 | 22 | 4 |

| | | Object extension | | |
|---|---|---|---|---|
| | | Extend object to speaker | Extend/release object | Extend/retract object |
| E | 19 | 7 | 11 | 1 |

Note. Subjects G and C grasped and pulled the speaker toward themselves indicating requests for speaker's attention and involvement in activity. Object extension refers to grasping object in hand and extending toward speaker.

(table continues)

| | | Object manipulation | | | |
|---|---|---|---|---|---|
| S | n | Turn over | Hold to ear | Put down | Push over |
| G | 7 | 1 | 6 | | |
| K | 1 | | | | 1 |
| E | 6 | 3 | | 2 | 1 |
| | | Let drop | Drop/ retrieve | Push along | Push away |
| J | 5 | 3 | | | 2 |
| G | 11 | 9 | 2 | | |
| E | 11 | 3 | 3 | 2 | 3 |
| | | Transfer | Trade | Throw | Nonspecific |
| G | 16 | | 2 | 1 | 13 |
| E | 8 | 1 | 1 | | 6 |
| T | 65 | | | | |

(table continues)

| S | n | Functional use of object | | |
|---|---|---|---|---|
| J | 3 | 3 | | |
| G | 7 | 7 | | |
| C | 4 | 4 | | |
| E | 7 | 7 | | |
| T | 21 | 21 | | |
| | | Other hand postures | | |
| | | Hand raised/ palm to speaker | Hand extended palm up/ to speaker | Hands clasped |
| C | 10 | 2 | 8 | |
| H | 2 | | | 2 |
| I | 2 | 1 | | 1 |
| T | 14 | 3 | 8 | 3 |

Note. Functional use of objects refers to manipulating an object according to its conventional use, such as using a hairbrush to brush one's hair or taking a spoon to one's mouth.

Table 20

Raw Data for Table 9-Meanings of Behaviors and Communicative Intents of Subject Responses

| Meanings of Pre-Intentional Communicative Behaviors | | | | |
|---|---|---|---|---|
| S | n | Reflexes | Passiveness | Protest |
| F | 8 | 8 | | |
| L | 1 | 1 | | |
| B | 3 | | 2 | 1 |
| D | 2 | | 2 | |
| J | 6 | 2 | | 4 |
| A | 1 | | 1 | |
| G | 6 | | 1 | 5 |
| K | 3 | 3 | | |
| C | 1 | | 1 | |
| H | 6 | 6 | | |
| I | 4 | 3 | 1 | |
| E | 5 | 1 | | 4 |
| T | 46 | 24 | 8 | 14 |

Note. Subjects (S) are listed in first column in order of increasing mental age.

(table continues)

| S | n | Attention to: | | Withdrawal of Attention |
|---|---|---|---|---|
| | | Speaker | Object | |
| F | 37 | 19 | 17 | 1 |
| L | 43 | 17 | 20 | 6 |
| B | 19 | 6 | 11 | 2 |
| D | 60 | 29 | 26 | 5 |
| J | 39 | 19 | 17 | 3 |
| A | 20 | 3 | 15 | 2 |
| G | 47 | 1 | 42 | 4 |
| K | 49 | 23 | 26 | |
| C | 62 | 22 | 30 | 10 |
| H | 51 | 26 | 25 | |
| I | 56 | 26 | 28 | 2 |
| E | 64 | 11 | 48 | 5 |
| T | 547 | 202 | 305 | 40 |

(table continues)

| | | Attitudes | | |
|---|---|---|---|---|
| S | n | Pleasure/ excitement | Agitation/ disappointment/ frustration | Anticipation/ curiosity |
| L | 1 | 1 | | |
| D | 4 | 4 | | |
| J | 1 | | 1 | |
| G | 7 | 4 | 3 | |
| K | 2 | | | 2 |
| C | 6 | 1 | 4 | 1 |
| H | 5 | 5 | | |
| I | 1 | | | 1 |
| T | 27 | 15 | 8 | 4 |

(table continues)

| S | n | Self-stimulation/ self-entertainment | Reciprocal vocal/gestural response |
|---|---|---|---|
| F | 6 | | 6 |
| L | 6 | | 6 |
| B | 2 | | 2 |
| D | 7 | | 7 |
| J | 50 | 12 | 38 |
| A | 23 | | 23 |
| G | 21 | 13 | 8 |
| K | 18 | | 18 |
| C | 20 | 18 | 2 |
| H | 42 | 5 | 37 |
| I | 18 | 18 | |
| E | 26 | 7 | 19 |
| T | 239 | 73 | 166 |

Note. Self-stimulatory or self-entertaining behaviors were not directed toward or in response to the speaker or target object, and were produced regardless of the speaker's or target object's presence. Reciprocal responses were vocalizations or gestures that were exhibited immediately following a verbalization by the speaker, and seemed to be for purpose of filling pauses between speaker's lines.

(table continues)

Meanings of Intentional Communicative Behaviors

| S | n | Request for attention | Request for object/action |
|---|---|---|---|
| J | 1 | | 1 |
| G | 7 | 1 | 6 |
| K | 6 | 4 | 2 |
| C | 15 | 15 | |
| E | 6 | 5 | 1 |
| T | 35 | 25 | 10 |

(table continues)

| S | n | Request for reassurance | Comment on object/action |
|---|---|---|---|
| D | 1 | | 1 |
| J | 5 | 1 | 4 |
| A | 11 | | 11 |
| G | 18 | 8 | 10 |
| K | 3 | | 3 |
| C | 3 | | 3 |
| H | 6 | | 6 |
| I | 7 | | 7 |
| E | 13 | | 13 |
| T | 67 | 9 | 58 |

# APPENDIX D

## CONTRASTS BETWEEN SUBJECT PAIRS

Table 21

Contrasts Between Subject Pairs

| | Subject A | Subject B |
|---|---|---|
| Sex | F | F |
| CA (years) | 34 | 33 |
| Age admitted (years) | 2 | 7 |
| Years in institution | 31 | 26 |
| MA (months) | 9 | 3 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 38 | 1 |
| Body gestures | 4 | 8 |
| Facial gestures | 25 | 31 |
| Self-stim./atypical | 0 | 0 |
| Hand gestures | 0 | 0 |

(table continues)

| | Subject C | Subject D |
|---|---|---|
| Sex | M | M |
| CA (years) | 29 | 28 |
| Age admitted (years) | 5 | 12 |
| Years in institution | 24 | 16 |
| MA (months) | 12 | 5 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 5 | 10 |
| Body gestures | 12 | 17 |
| Facial gestures | 94 | 73 |
| Self-stim./atypical | 82 | 0 |
| Hand gestures | 19 | 1 |

(table continues)

| | Subject E | Subject F |
|---|---|---|
| Sex | F | F |
| CA (years) | 25 | 25 |
| Age admitted (years) | 5 | 6 |
| Years in institution | 19 | 18 |
| MA (months) | 19 | 1 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 30 | 5 |
| Body gestures | 7 | 36 |
| Facial gestures | 65 | 29 |
| Self-stim./atypical | 15 | 0 |
| Hand gestures | 81 | 0 |

(table continues)

| | Subject G | Subject H |
|---|---|---|
| Sex | M | M |
| CA (years) | 25 | 25 |
| Age admitted (years) | 6 | 7 |
| Years in institution | 19 | 18 |
| MA (months) | 9 | 15 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 18 | 73 |
| Body gestures | 7 | 21 |
| Facial gestures | 0 | 84 |
| Self-stim./atypical | 35 | 14 |
| Hand gestures | 107 | 2 |

(table continues)

| | Subject I | Subject J |
|---|---|---|
| Sex | M | F |
| CA (years) | 21 | 20 |
| Age admitted (years) | 17 | 6 |
| Years in institution | 4 | 14 |
| MA (months) | 16 | 5 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 11 | 63 |
| Body gestures | 20 | 26 |
| Facial gestures | 107 | 67 |
| Self-stim./atypical | 33 | 20 |
| Hand gestures | 2 | 22 |

(table continues)

| | Subject K | Subject L |
|---|---|---|
| Sex | M | F |
| CA (years) | 18 | 18 |
| Age admitted (years) | 6 | 6 |
| Years in institution | 12 | 11 |
| MA (months) | 10 | 1 |
| LA (months) | >8 | <8 |
| Responses: | | |
| Vocalizations | 53 | 9 |
| Body gestures | 19 | 18 |
| Facial gestures | 79 | 49 |
| Self-stim./atypical | 7 | 15 |
| Hand gestures | 2 | 0 |

VITA

Anne Charlene Harbour

Candidate for the Degree of

Master of Arts

Thesis: PRE-INTENTIONAL AND INTENTIONAL COMMUNICATION IN PRE-LINGUISTIC PROFOUNDLY MENTALLY RETARDED MULTIHANDICAPPED ADULTS

Major Field: Speech

Area of Specialization: Language Pathology

Biographical:

Personal Data: Born in Enid, Oklahoma, April 8, 1950, the daughter of Robert A. and Neva F. Gauldin. Married to Stephen M. Harbour, December 23, 1972. Four children: Mary Catherine, born May 19, 1975; Stephen J., born January 14, 1978; Jason R., born February 12, 1972; Joseph M., born July 7, 1983.

Education: Graduated from Enid High School, Enid, Oklahoma, in June, 1968; received Bachelor of Science Degree in Speech Pathology from Phillips University in May, 1983; completed requirements for the Master of Arts degree at Oklahoma State University in May, 1991.

Professional Experience: Substitute teacher in special education, Cherokee Park School, September, 1985 to December, 1985; Tutor, Enid Public Schools, January, 1986, to April, 1986; Speech and Hearing Assistant, Oklahoma Department of Human Services, April, 1986, to April, 1991.