1993

Interactional Experience With a Voice Output Communication Aid in Augmented Interactions.

Sandra Koenig Damico
Louisiana State University and Agricultural & Mechanical College

Order Number 9405390

Interactional experience with a voice output communication aid in augmented interactions

Damico, Sandra Koenig, Ph.D.

The Louisiana State University and Agricultural and Mechanical Col., 1993

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300 N. Zeeb Rd.
Ann Arbor, MI 48106

INTERACTIONAL EXPERIENCE WITH A VOICE OUTPUT COMMUNICATION AID IN AUGMENTED INTERACTIONS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of
Communication Sciences
and Disorders

by
Sandra Koenig Damico
B.A., Fort Hays State University, 1977
M.A., University of Kansas, 1980
August 1993

ACKNOWLEDGEMENTS

Throughout my doctoral program, I have developed an appreciation for insightful, clear, and creative thought, and the value and complexity of quality research. Many have offered support, and contributed to my intellectual and emotional growth. I extend my gratitude and regard to you all.

Paul, your support, guidance, and rational thought has turned what seemed like an insurmountable task into a reality. Your friendship, quick-witted humor, and persistence have been valued and reassuring.

George, your quality of thought and keen insight are admirable. You have helped me distinguish the abstract from the simplistic, and have challenged me with individual, creative achievement.

Jan, as a friend, "boss," and supporter, you have played many roles, and have played them well. I appreciate your guidance and enthusiasm, and aspire to your many efforts.

Ray and Hugh, I acknowledge your encouragement and support, as well as the confidence that you both have instilled.

To my friends and family-- whew, what a relief! I can't thank you enough for your patience, endearing words, and support. A special thanks to Denise, Judith, Mary Beth, Pat, Paul, Lee, Alisa, and Jane. You have all

embraced me through the best and the worst of times. Mom and Dad, I have deep gratitude for your love, and instilling in me a sense of achievement and self-esteem.

A special thanks to Jeff Higginbotham, whose suggestions and broad experience in the field of AAC were instrumental in deriving the methodology and measurement techniques used in this research.

To Jack, as a husband, mentor, teacher and companion, you have most influenced my zeal for knowledge and quality of thought. Your assurance and guidance has given substance to my life, and has allowed me to capture a host of opportunities. For this, I will be forever grateful.

When I look back on these years, I will think of you all, and these timeless, abundant gifts.

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ABSTRACT

The primary purpose of this investigation was to study the effects of a Speaking Partner's experience with a voice output communication aid on the interactional strategies used in Nonspeaking Partner (NSP)/Speaking Partner (SP) dyads. A single-subject experimental design was employed, incorporating four interactional dyads of college-level students majoring in Speech-Language Pathology and school-aged adolescents (2 disabled and 2 able-bodied). Each dyad engaged in an information transfer barrier task, consisting of 10-12 maps with a number of referential conflicts. Interactional transcripts were analyzed for quantitative and qualitative differences in turn taking, message formulation, and nine types of Insertion Sequences. Results indicated an increase in rate-enhancement strategies in three out of four dyads. No significant differences were noted in number or length of Message Reformulation Episodes. Three of the four dyads employed fewer number of turns with reduction in SP turn length. Effective strategies derived during the information transfer tasks were identified. Results are discussed with regard to intrapersonal and social influences on interactive behaviors, and clinical implications in using role-taking for training facilitators and AAC users in deriving effective interactional strategies.

INTRODUCTION

Current research in the field of Augmentative and Alternative Communication (AAC) indicates that Speaking Partners (SPs) have a particularly perplexing task attempting to meet the interactive needs of Nonspeaking Partners (NSPs) utilizing augmentative modes of communication (Buzolich & Wiemann, 1988; Calculator & Dollaghan, 1982; Calculator & Jorgensen, 1991; Farrier, Yorkston, Marriner & Beukelman, 1985; Light, Collier & Parnes, 1985; Mirenda & Iacono, 1990). The speaking partner in such dyads is often unfamiliar with the NSP's forms of augmentation and the ways in which these forms affect the interactional process. Hence, despite the provision of an augmentative aid, NSPs and SPs continue to evidence difficulty in managing communicative interactions. Furthermore, the suggestion has been made to incorporate SPs into training of appropriate and effective interactional management strategies.

Continued emphasis on integrating nonspeaking children in "least restrictive environments" and/or regular education classrooms increases the number of teachers and related service personnel who must interact with nonspeaking children. Since teachers are often unfamiliar with the strategies and devices that may be used to overcome the NSP's communicative limitations, this results in the NSP being less able or unable to participate in and

benefit from their educational experiences (ASHA, 1988; Calculator & Jorgensen, 1991; Nagi, 1977). Often, appropriate classroom support for nonspeaking students necessitates the expertise of a variety of related school personnel, primarily the knowledge and skill of trained Speech-Language Pathologists (SLPs). However, an overwhelming majority of SLPs have not had the training or experience with augmentative/alternative devices to provide even minimal support to the teacher and nonspeaking student. Indeed, in a three year survey by the American Speech-Language-Hearing Association Committee on Personnel and Service Need in Communication Disorders (1988), the need for professional training in the development and use of Augmentative and Alternative Systems headed the list of professional preparation needs identified by the committee. Clearly, then, the need to determine how to best work with NSPs and the necessity to train teachers and Speech-Language Pathologists in using these strategies is recognized.

The primary purpose of this investigation was to describe the interactive strategies created by speaking individuals as a result of using a VOCA in information transfer tasks. This study extends the current knowledge base in the augmentative communication literature by targeting an understudied population, using an indirect instructional method, and employing measurements that are

sensitive to changes in dyad interactions. The hypothesized derivation of communicative strategies is based upon theories of linguistic variation that attempt to explain the speaker's accommodation to a listener. The secondary purpose was to assess differences in strategies derived in interactions with able-bodied speakers as opposed to motorically disabled speakers. This focus is included because of the current practice in AAC research of employing able-bodied subjects despite the potential intrapersonal factors in influencing interactive strategies.

Method for Interactional Skill Training

Researchers and practitioners have come to recognize the importance and benefit of augmentative intervention programs that incorporate interaction skills training of NSPs and their communicative SPs (Angelo & Goldstein, 1990; Beukelman & Yorkston, 1982; Blackstone, 1991, Calculator & Delaney, 1986; Calculator & D'Altilio-Luchko, 1983; Glennon & Calculator, 1985). In light of this recognition, however, a majority of the studies on NSP-SP interaction have not employed units of analysis that are sensitive to the interactional process in which NSPs and SPs are engaged. Further, many of the existing studies contain methodological problems or inadequate control of confounding variables (Higginbotham, 1985, 1989; Light, 1988; Rauck, 1991). Little research on interactive

partner training in NSP-SP dyads substantiates the efficacy of NSP-SP training with subjects capable of generating their own utterances on voice output systems and on tasks other than conversation. In particular, little attention has been directed to addressing the interactional strategies needed for language expression used in the classroom, that is, language and interactive strategies used for effective transfer of information involving specificity and detail. Finally, a majority of the current investigations exploring interactional management strategies have employed methods of training that rely on direct instruction of learners through the imparting of information and modeling of strategies through live presentation or videotape, while focusing on targets chosen by professionals. Essentially, professionals are placed in the position of convincing the learners that changes are needed and providing expert opinions on the direction towards change. In contrast to the methodologies employed, other investigators have advocated the use of methods employing learner directed targets and more active learner participation (Armstrong & Firth, 1984; Blackstone, 1991; Johnson & Harrison, 1991). For example, Johnson and Harrison (1991), and Armstrong and Firth (1984) advocate the use of facilitator self-rating as inducing self-change in learners, in which specific behaviors to be targeted and the direction for change is determined by the individual,

rather than a professional. As elucidated by these authors, self-rating increases motivation and accountability for the interactive changes that occur, since the participants actively decide which particular interactive strategies to utilize, and have the sole responsibility in using these strategies. Additionally, studies with nonnative English speakers employing a role-taking method, such as placing more proficient nonnative English speakers in an information transfer task as receivers of information, resulted in more effective strategies when the speakers were subsequently placed in the role as sender of information (Anderson, Yule, & Brown, 1984; Yule, 1991, 1992). As with self-rating, role-taking resulted in strategies that were derived spontaneously by the learners and enhanced participants' awareness of the interactive needs of their partners. To date, methods which allow for strategies that are internally derived by the participants, rather than externally imposed by facilitators have not been investigated in NSP-SP dyads. As documented by prior research, such methods increase motivation and responsibility towards change, incorporate active learner participation, and account for the preexisting or internal motivations, attitudes, and perceptions of the interactants.

Linguistic Variation: Current Theory and Research

A majority of the studies in the field of AAC document individual variation in the style and strategies of NSP-SP interactants (Blackstone & Cassatt-James, 1988; Blau, 1986; Buzolich & Wiemann, 1988; Calculator & Delaney, 1986; Farrier, et al., 1985; Harris, 1982; Higginbotham, 1985; Higginbotham, Mathy-Laikko and Yoder, 1988; Light, 1988; Light, et al., 1985; Rauck, 1991; Wexler, Blau, Leslie & Dore, 1983). Investigators have suggested that these variations exist due to the particular interactive partners (Beukelman & Yorkston, 1980), purposes for the communication and task (Farrier, et al., 1985), and the types of augmentative systems employed (Buzolich & Weimann, 1988; Higginbotham, 1985, 1989).

Theories regarding linguistic variation have suggested that communication varies as a result of the interactants' designing their talk to meet the interactive needs of their listeners (Bell, 1984; Clark & Wilkes-Gibbs, 1986; Giles, Taylor & Bourhis, 1973; Krauss & Glucksberg, 1977). In addition to investigations that explain variation in accordance with variable rules (Labov, 1972), or rules of conversational turntaking (Sacks, Schegloff & Jefferson, 1974), Bell (1984) explained stylistic variation as resulting from the speakers' awareness of his or her addressee (or hearer). Bell's proposed framework, entitled "audience design" assumes that persons respond

predominantly to other persons and that speakers take their audience into account when designing their talk. Specifically, speakers assess the personal characteristics of their addressees, and their general style, when they design their talk.

Additional evidence from research in the field of cognitive psychology suggests variations in style as a result of attributes of an audience. An investigation by Krauss and Glucksberg (1977) described how speakers tailor what they say to fit what they think the speaker knows about a given referent. That is, a speaker varies his or her directions along a given route from "a" to "b" depending upon the knowledge and perspective of the listener. Hence, "referent" here is not "semantic" referent, but rather, the reference of the "hearer" or "listener" (p. 101). As discussed by Krauss and Glucksberg, children are capable of taking their listener's needs into account by age eight, at which time child "egocentrism" (i.e., the inability to detach oneself from one's own point of view) is no longer pervasive in their behavior.

In a related discussion, Clark and Wilkes-Gibb (1986) justified a model of speaker-hearer reference, guided by what they entitle the principal of mutual responsibility. Specifically, this principal states:

> "The participants in a conversation try to establish, roughly by the initiation of each new contribution,

> the mutual belief that the listener has understood what the speaker meant in the last utterance to a criterion sufficient for current purposes" (p. 33).

Clark and Wilkes-Gibb described this collaborative process between speaker and hearer as follows. The speaker initiates by using a standard noun phrase (e.g., "you see the spout?") which may be elaborated upon to assure that the hearer has sufficient information to identify the referent (e.g., "you know, the one that looks like the end of an oil can"). At other times, the speaker might bring the hearer into the referential process by using dummy phrases (e.g., "you know, whatchamacallit") or trial phrases (e.g., "remember the blue cap we talked about before?"). Once the speaker has made the presentation, the hearer must accept it and both speaker and hearer must recognize that acceptance. The hearer can "presuppose" acceptance by being silent and allowing the speaker to continue, or can "assert" acceptance by saying "ok," "I see" and so forth. Both speaker and hearer may repair, expand, or replace the noun phrase until they arrive at a version they can mutually accept. Often it is necessary for the speaker to set up some sort of common, overall perspective before identifying specific referents. For example, the participants may have to establish which directions correspond to "south" and "north." Throughout the process, speakers and hearers try to abide by what the authors refer to as the principal of least collaborative

effort. In other words, the participants try to say the most in the least number of words or turns. As elucidated by the authors, in conversation speakers have limited time for planning and revising while listeners must simultaneously attend to and attempt to understand the speaker's reference. Hence, a minimal presentation involving the least amount of effort may not be demonstrated due to "time pressure, complexity of the referent and/or ignorance on the part of the speaker about what the hearer needs" (p. 27). Finally, the authors make the point that in this collaborative process the participants are not trying to assure absolute understanding of each utterance, but rather, understanding to a "criterion sufficient for current purposes" (p. 34). Purposes in conversation may change so that participants tolerate more or less uncertainty about the listener's understanding of the speaker's reference. The authors explain that time factors, attitudes, and personalities of the participants may place more or less pressure on the listener to accept or reject the presentation and may have more or less tolerance for uncertainty.

This process of collaborative establishment of reference as proposed by Clark and Wilkes-Gibb has particular usefulness to a variety of tasks involving the transference of information from a speaker to a listener. Likewise, the principal of least collaborative effort has

significant relevance to disabled populations who generally require more time and energy in establishing a frame of reference. Even so, consideration of what the hearer's knowledge base entails does not take into account all of the decisions a speaker may make in reference to his or her listener. For example, empirical evidence indicates that a speaker may vary linguistic style in accordance to the listener's pronunciation (Giles, 1973), speech rate (Webb, 1970), pause, and utterance length (Jaffe & Feldstein, 1970), vocal intensity (Natale, 1975), and intimacy of topic (McAllister & Keisler, 1975). Traditionally, these aforementioned speech shifts may be viewed as rule governed, however, investigation by Giles, Taylor and Bourhis (1973) suggests that the catalyst is the speaker's intent or effort in "converging" in a style which is more like that of the listener.

A plethora of studies documenting convergent behaviors of a speaker to approximate that of the listener have led to the development of the Speech Accommodation Theory, (SAT) (Giles, 1973). The central notion of SAT is that during interaction, individuals adjust or accommodate their speech styles as a strategy for increasing intelligibility, predictability and/or efficiency between interactants. Underlying motivations include the speaker's gain in listener's social approval and/or maintaining a positive social identity. Convergence is not a matter of all or

none, but rather a matter of degree, depending on the speaker's need for social approval, albeit some people are more "person centered" or "receiver focused" (Giles, Mulac, Bradac & Johnson, 1987). On the other hand, "divergence" (i.e., the drive towards different speech styles) accentuates differences between interactants possibly to maintain a speaker's intergroup social identity from that of the listener or a difference in status. Divergence may also be used as a means of bringing another person's speech to a more acceptable level that meets both interactants' perceptions, motivations, and communication goals. Further, as Giles (1980) argues, interactants may simultaneously converge and diverge in an effort to complement each other towards a socially preferred balance. In contrast to Clark and Wilkes-Gibb's collaborative theory for reference, SAT incorporates a broader range of hearer based sociolinguistic phenomena. In addition to descriptions of interactive behavior, SAT attempts to offer explanations or the underlying motivations for the variations in linguistic behavior based on socio-psychological constructs such as feelings, motivations, and moods.

The abilities to establish reference with and accommodate a hearer are based upon a cognitive scheme for the listener's cognitive and linguistic needs. Construction of such a scheme requires speakers to have

experiences that indicate how speech can be similar or dissimilar. Speakers converge to the extent that they know and identify with the style of their listeners. Convergence depends on the speaker's ability to recognize differences and conceptualize the needs of their interactants.

Use of Able-Bodied NSPs in AAC Research

Researchers in the field of AAC have suggested the use of able-bodied individuals in AAC interactive research as a means of controlling for the heterogeneous nature of the population and resolve ethical problems in changing user augmentative systems (Doss & Reichle, 1992; Higginbotham, 1985, 1989). Higginbotham provides evidence that the point-verbalization pattern found with able-bodied NSPs using AAC systems is similar to that of disabled NSPs and their SPs. Although such research may illuminate the interactive behaviors that are specific to the AAC system, the use of able-bodied individuals does not take into account apparent interactional differences based on motoric limitations of the disabled partners, as well as the underlying motivations, perceptions, and attitudes of the participants. Such factors may result in marked differences in the interactions of disabled NSPs and able-bodied NSPs. To date, no empirical evidence is available which directly compares the interactive performances of

able-bodied and disabled NSP dyads and the potential differences that exist.

The Current Investigation

Empirical investigations of training methods that allow for spontaneously derived strategies and enhance the identification of a partner's interactive needs are in short supply. This study investigated one proposed method, in which SPs experience using an electronic voice output communication aid (VOCA) in interaction. It was hypothesized that this experience will alter the strategies used by NSP-SP participants to prevent miscommunication and facilitate message transmission. Furthermore, it was hypothesized that the SP's experience in using a VOCA will enhance realization of the dyads' communication needs, allow for spontaneous derivation of strategies, and result in more effective interactive strategies on the part of both members of the dyad. If so, this technique may be employed as a training method for teachers, speech-language pathologists, and other facilitators in utilizing effective interactional management strategies with school-aged individuals using AAC systems. Unlike prior investigations, subjects selected for this investigation were capable of generating utterances, utilized voice output systems, and derived strategies during information transfer tasks. Further, the measurement techniques employed accounted for the co-constructive nature of NSP-SP

interaction. Additionally, differences in the strategy use by handicapped versus able-bodied subjects in AAC interactive research was investigated. General questions posed for analysis were:

1) Does providing the SPs with experience in interacting with a VOCA result in different interactional management strategies on the part of the interactional dyad? If so, what types of interactional management strategies are facilitative in terms of accurate and efficient transfer of information?
2) Is there a noted difference in the interaction of dyads including normal, able-bodied persons on AAC systems compared to disabled, essentially nonvocal individuals?

RATIONALE AND LITERATURE REVIEW

This chapter focuses on several issues of interest to this investigation. Each issue will be discussed relevant to current investigations, and include: 1) the interactional patterns employed in NSP-SP dyads and units of analysis sensitive to this interactional process; 2) current descriptive studies on NSP-SP interaction and critique; 3) current studies investigating strategies for interactional management in NSP-SP dyads and methods of training; 4) a proposed method of training, role-taking, that has enhanced facilitative strategies; and 5) current research/discussion regarding the use of able-bodied individuals in AAC research.

Interactions Between Speaking and Nonspeaking Persons

Interaction between essentially nonspeaking, augmentative system users and normal speakers presents atypical and problematic characteristics. Some of the difficulty is due to the inherent characteristics of the nonspeaking individual who often exhibits physical and neurological impairments limiting intelligibility of vocalizations, gestures, and facial expressions (1). Additional interactional difficulties are due to the augmentative communication device itself (Brandenburg & Vanderheiden, 1988; Buzolich & Wiemann, 1988; Farrier, et al., 1985; Higginbotham, 1989; Vanderheiden, 1988), that typically provide access to limited vocabulary at

intrinsically slow rate of message transmission (2). These difficulties may cause the SP to make significant adaptations in turn exchange and the ways that message transmission is achieved. Furthermore, some of the interactional difficulties are more a function of the SP's interactional patterns and how NSPs are treated in everyday contexts (Calculator, 1988; Light, et al., 1985). Empirical evidence supporting a facilitative rather than a directive interactional style on the part of the SP has been documented in studies examining the effects of adult verbal behavior on the spontaneous language output of handicapped children (Halle, Baer & Spradlin, 1981; Norris & Hoffman, 1990; Mirenda & Donnellan, 1986).

To adapt to the constraints imposed, the NSP and SP must embrace unique interactive patterns. Initial investigations offered descriptions of these patterns as investigators observed interaction in conversational, institutional, play or classroom contexts. (Beukelman & Yorkston, 1980; Calculator & Dollaghan, 1982; Calculator & Luchko, 1983; Culp, 1982; Farrier, et al., 1985; Morningstar, 1981; Harris, 1982; Light, et al., 1985; Wexler, et al., 1983; Yoder & Kraat, 1983). General trends derived from these investigations include passive responding by NSPs who rarely initiate turns or topics, reduced range of communicative functions, reduced length of responses, and reliance on SPs to participate in message

construction. In contrast, SPs have been observed to dominate conversations with NSPs by disproportionate turntaking and topic initiation while they structure their conversation to elicit one or two-word responses from their handicapped partners. Some investigators have viewed the active participation of SPs as interruptive and problematic to the linguistic and conversational development of the AAC user (Harris, 1982; Light, et al., 1985; Morningstar, 1981). More recently, investigators have examined the structural and functional aspects of NSP-SP dyads with a keener eye and have embraced the notion that the interactive patterns observed may be necessary for efficient and effective transfer of information (Blau, 1986; Buzolich & Wiemann, 1988; Higginbotham, 1985, 1989; Rauck, 1991; Wexler, et al., 1983). Results of these studies suggest a more intricate interactional structure than observed in earlier investigations with the NSP's completed message depicted as a transactional and negotiated sequence of pointing, eye gaze, and point shift behaviors. This newly emerged description of NSP-SP interaction will be presented in the next section and a critique of current research with NSP-SP dyads will follow.

Characteristics of NSP-SP Message Formulation

Investigations by Blau (1986), Higginbotham (1985), and Wexler and colleagues (1983) note a common turntaking pattern during device-mediated interactions. As the NSP

points to letters or words on a nonelectronic, alphabet communication board, the SP confirms by repeating each item, responds by guessing the word, or by querying for a repetition. An example of a NSP-SP interchange is found in Figure 1 (Blau, 1986: 2). As noted in this example, the transmission of the NSP's initiations and subsequent responses by the SP involve intensive co-construction by both participants. Once the message is delivered, the SP repeats or reformulates the entire message that is

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1. NSP: /ai/ (points to self)
2. SP: /ai/ (I)
3. NSP: <p-r-e-f-e-r>
4. SP: prefer
5. NSP: (head nod) <c-o-m-m-u-n>
6. SP: communication board
7. NSP: mmm, <a-s>
8. SP: as
9. NSP: <t-o>
10. SP: to
11. NSP: <m-a-c-h-i>
12. SP: a machine?
13. NSP: (head nod)
14. SP: You prefer a communication board as to a machine?
15. NSP: (head nod)

Figure 1
Example of Turntaking and Message Formulation in NSP-SP Interactions with an Alphabet Board.

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confirmed or repeated by the NSP. If, at any point during the message formulation, a misunderstanding occurs, the NSP or SP may initiate a repetition or reformulation of the message sequence.

Higginbotham (1989) provided documentation that a similar NSP-SP turntaking pattern is characteristic of electronic device-mediated interactions in which an electronic output display attached provides a semipermanent record of the utterance (3). Although turn length and number of turns may be modified with electronic systems, Higginbotham provides justification that the length of turns and number of turns per message formulation are dependent on the conversational style of the communicative partners. That is, the participants in his investigation utilized either a telegraphic or a more complete grammatical style in their interactions. Higginbotham speculated that the "mode of output, taken by itself, does not consistently affect turn and message formulation structure" (p. 54). An example of an electronic device mediated NSP-SP pattern is taken from a pilot investigation by Damico (1992) (See Figure 2). In this investigation, the NSP utilized an electronic voice output communication aid that speaks each item as it is selected. The co-construction of the message between participants is evident in this example as the SP utilizes "meta-talk" in repeating and/or reformulating the NSP's messages, that are subsequently confirmed by the NSP.

Turntaking in NSP-SP Dyads

Some investigators have compared this message formulation process to the turntaking behaviors of vocal

1. NSP- <make r-e-s> (each letter spoken as it is activated)
2. SP- reservations?
3. NSP- "mm-mm" (yes)
4. SP- OK
5. NSP- <for a f-l-i-g-h-t>
6. SP- for a flight?
7. NSP- "uh-huh" (yes) <clear> <to the b-a-h>
8. SP- oh, the Bahamas.
9. NSP- "uh-huh" (yes) <clear>

Figure 2
Example of Turntaking and Message Formulation in a NSP-SP Dyad with Electronic Device Voice Output.

participants (Blau, 1986; Buzolich & Wiemann, 1988; Higginbotham, 1985; Higginbotham, et al., 1988; Wexler, et al., 1983). Wexler and colleagues reported that while the SP typically produces one or more speech acts per turn, the NSP takes several turns to produce a single speech act. Sacks, Schegloff, and Jefferson (1974) found that conversationalists generally speak one at a time and maintain an orderliness of conversation. In general, as the NSP indicates items via an alphabet board, the SP is silent. In contrast, as the SP talks the NSP is pointing to a word board. This overlap in pointing and talking may be desirable in as much as it speeds up conversational rate (Higginbotham, 1985).

Buzolich and Wiemann (1988) provide substantial data on how turns are regulated in NSP-SP dyads and how these patterns correspond to the turntaking model between adult speaking partners as proposed by Duncan and Fiske (1977).

Results of their study indicate that, in general, turn exchange in augmented interactions is similar to conversations between nondisabled speakers. Cues comprising turn system signals, such as eye gaze, body movements, and intonation, varied according to the range of verbal and nonverbal behaviors available to the motorically impaired interactants. Unlike the Duncan and Fiske model, however, the turn cues displayed by augmented communicators were not marked by intonation (i.e., pitch and loudness), but primarily through head turns, movement away and towards the communication aid, head nods and shakes, and flexed or tensed hand position. When both participants displayed turntaking behaviors, the augmented partner relinquished turn attempts; not a surprising finding since the authors reported an overall lack of conversational control with the augmented communicators. This lack of control was particularly evident when the augmented communicators were using a voice output communication aid (VOCA) as opposed to a nonelectronic alphabet board. The investigators reported that the SPs attempted to "fill" the observed long gaps of silence as the NSP was encoding the message on the communication device and "deprived, albeit unwittingly, the NSP partner the opportunity to complete his turn" (p. 13). Even so, the SPs were sensitive to the cues of the NSP and adapted

their style to interact successfully with the disabled subjects.

Conversational Sequences

Note that the first eight utterances in Figure 2 are similar in structure and function; that is, the NSP indicates items on the VOCA and the SP repeats the item or expands on it. This interactive behavior continues until the entire message is formulated, at that time the SP restates the message which is subsequently agreed upon by the NSP. This sequence represents a predictable pattern of conversational exchange between nonspeaking and speaking partners.

Researchers in the area of discourse structure identify sequences of at least two turns in the conversation of vocal participants as "utterance pairs" (Brown & Yule, 1983; Schegloff & Sacks, 1973). Utterance pairs are commonplace in such instances as question-answer, greeting-greeting, request-comply, and information-receipt. Also referred to as "adjacency pairs," Schegloff and Sacks (1973) identify utterance pairs as having the following features: they are two utterances long; the utterances are produced successively by different speakers; the utterances are ordered- the first must belong to the class of first pair parts, the second to the class of second pair parts; and, the utterances are related because the first pair part predicts the occurrence of the second.

Similarly, Goldberg (1975) identified with vocal partners an instruction/receipt pair that operates as a minimal conversational unit (p. 276) for the passage of instructions, such as the transfer of telephone numbers, driving directions, recipe cooking directions, and orders at a restaurant. Goldberg explained that the receipt is not found absent of its instruct, and therefore there is a "sequential contiguity" between the instruct/receipt pair (p. 276).

An analog to the conversational structural unit of utterance pair in the interactions of NSP-SP is identified by Higginbotham (1985; 1989) as the Message Formulation Episode (MFE). An MFE is defined by Higgenbotham as:

> "a) a statement delivered by the NSP that possesses a phrase or sentence-level status or b) a response, other than yes/no, by the NSP to a question posed by the SP. SP talk produced within the context of the NSP's statement or answer is also included as part of the MFE" (1989: 332).

Examples of MFEs can be found in Figures 2 and 3. As explained by Higginbotham, the composition of the MFE is of two parts. The first part consists of the actual production of the message (Figure 2: turns 1-8 and Figure 3: turns 1-8) while the second part consists of the confirmation of the message (Figure 2: turn 9 and Figure 3: turn 9) with focus on the content of the message itself. The pairs of utterances used in these examples serve the function of instruct/receipt. That is, the NSP provides

1. SP- What do we do there?
2. NSP- <clear> <h-a-m-b-u-r-g-e-r f-i-r> (gaze at paper"uh-huh" (no) <delete i-r> <r-i-e-s> (gaze at paper, then device) <a-n-d m-i-l-k-s>
3. SP- milkshake?
4. NSP- "uh-huh" (yes) <speak> <hamburger fries and milkshake> (gaze at SP)
5. SP- mmmmmmmm, ok. (writing)
6. NSP- (gaze at paper)
7. SP- Hamburger fries and milkshake.
8. Is that all we do there? (gaze at NSP)
9. NSP- "uh-huh" (yes)

Figure 3
Example of a Message Formulation Episode in NSP-SP Interactions.

new instructions or information and the message is repeated by the SP, followed by an acknowledgement by the NSP. As explained by Higginbotham (1985), the process of message formulation is "cooperative, patterned, and predictable to allow for successful production and understanding of the message," (p. 36), as well as sensitive to the turn-taking process in NSP-SP dyads.

The structures described so far have been linear, one pair followed by another. There are also cases of embedding in which one pair occurs inside another. Schegloff and Sacks (1973) called these embedded pairs Insertion Sequences that "intervene between the pair parts of the original utterance pair and bears a relationship with both pair parts" (p. 704). Thus, the sequence is inserted between the first pair part that has occurred and the second pair part that is anticipated. Turns 2 and 3 (query

for confirmation-reply) and turns 8 and 9 (query for information-reply) of Figure 3 constitute utterance pairs identified as Insertion Sequences. The SP often initiates an Insertion Sequence in an attempt to guess at the first pair part, or, to indicate that she doesn't understand or does not want to commit herself until she knows more. Thus, she produces another first pair part to which the NSP must reply before the second part of the original pair can be completed. As with utterance pairs, the Insertion Sequence serves as a way of dealing with misunderstandings and can be characterized as an efficient way for locating and remediating the source of communication breakdowns.

One type of Insertion Sequence identified by Higginbotham (1985) as the Message Reformulation Episode (MRE) is the result of communication difficulty, yet essentially serves the function of identifying sources of misunderstanding. An example of a Message Reformulation Episode is found in Turns 6-13 in Figure 4. In line 6, the SP initiates the MRE by querying for information as a result of not hearing or understanding the critical piece of information needed (i.e., the word "to") given by the NSP in line 3. It appears that the SP in line 4 was more concerned with spelling the previous word than listening to the most current item given by the NSP. The NSP appears to not understand the SP's confusion as evidenced by the puzzled look in line 7. After the SP identifies the

1. NSP- <make an a-p-p-o-i-n-t to have>
2. SP- appointment?
3. NSP- <to>
4. SP- ok, let's see if I can spell appointment.
5. NSP- <have your c-a-r-p-e-t c-l-e-a-n-e-d>
6. SP- Wait, am I having my carpet cleaned? (gaze at NSP)
7. NSP- (gaze at SP and looks puzzled)
8. SP- Am I making an appointment or am I having my carpet cleaned?
9. NSP- (gaze at device) <a-p-p>
10. SP- appointment?
11. NSP- "uh-huh" (yes) <to have>
12. SP- make an appointment to have your carpet cleaned?
13. NSP- "uh-huh" (yes)

Figure 4
Example of a Message Reformulation Episode in a NSP-SP Dyad.

Source: Damico, S. Pilot Investigation. (1992)

source of confusion (in line 8) the NSP provides the necessary information, however, in so doing provides a near complete reformulation of the utterance.

Although MFEs generally serve to facilitate the transmission of information between NSPs and their SPs, they are not immune to breakdowns in interactive exchanges and may, in fact, contribute to difficulties in the interaction (Higginbotham, 1985). For example, Insertion Sequences in the form of multiple word and message level guesses on the part of the SP may prove to be premature and/or incorrect, and delay the NSP's provision of the intended message. Further, multiple insertions may affect the SP's understanding and/or remembrance of previous pair parts, resulting in reformulation of utterances or delays.

Summary

As evident in recent interactional research utilizing analysis of NSP-SP interaction, the conversation exchanged between augmented communicators and their speaking partners involves a co-constructive process of message formulation and transactional turn exchange. This interchange is similar to the patterns employed by vocal participants. However, differences exist between vocal and augmented dyads in the reliance on, and nature of, nonverbal behaviors in the identification of turn signals, and as a result of the slow rate of message transmission inherent in augmentative communication aids. Higginbotham (1985) has derived an interactional organization structure, the Message Formulation Episode (MFE) that captures the co-construction process and is sensitive to turn exchanges in NSP-SP dyads. Along with turn construction, this level of analysis reveals similarities in structure and function of the interactional devices used between verbal participants. Additionally, MFEs and the embedded Insertion Sequences represent valid and effective units in analyzing NSP-SP interaction for clinical application and purposes of research. However, only a few of the studies of NSP-SP interaction utilize data analysis that reflects the co-constructive process. A review and critique of the current research which focuses on describing the structure of NSP-SP interaction is presented in the next section.

Review and Critique of Prior Research on Augmented Interaction

For approximately fifteen years, investigators have been documenting the interactional aspects of AAC (Beukelman & Yorkston, 1980; Blau, 1986; Buzolich & Wiemann, 1988; Calculator & Dollaghan, 1982; Culp, 1982; Colquhoun, 1982; Farrier, et al., 1985; Harris, 1982; Higginbotham, 1985; 1989; Light, et al., 1985; Morningstar, 1981; Rauck, 1991; Wexler, et al., 1983). A critique of the prior research on interaction in the area of Augmentative and Alternative Communication (AAC) reveals two predominant issues relevant to the current investigation. First, a majority of the studies prior to 1985 utilized data analysis techniques at a completed message level that were not sensitive to the co-constructive process described in the previous section (Blau, 1986; Higginbotham, 1985, 1989; Rauck, 1991). For example, the initial studies in interaction often provided counts of the number of initiations versus responses of NSPs and SPs, provided tallies of the number and type of communication modes utilized (i.e., gesture, facial expression, and use of communication board), and the number and type of communicative functions (e.g., number of requests, answers, acknowledgements, and question forms). Although results of these investigations provided informative initial impressions that were appropriate for the data analyses utilized, the data pool does not

represent the transactional co-constructive process. Often, nonverbal phenomena, such as eye gaze, body movements, and visual orientation, that have now been determined as critical in describing exchange of turns were not transcribed or noted. As described by Blau (1986) in her investigation of the back-channel feedback mechanism in NSP-SP dyads, the NSP sometimes demonstrated conversational control by "cueing" or soliciting the SP to restate the item or utterance through pauses, eye gaze, facial expression, and gestures. Additionally, investigations by Farrier and colleagues (1985) and Buzolich and Wiemann (1988), portray the NSP as a participant who volitionally relinquishes control of the conversation to the SP in an effort to maintain more rapid transmission of messages and, therefore, maintain conversational efficiency. Buzolich and Wiemann described such behavior utilizing a microanalysis of nonverbal as well as verbal behavior on the part of both participants. Eye gaze, body movements, and point shifts represent an important foci for selection of data collection measures in studying augmented interactions. Investigations not analyzing these behaviors in conjunction with the SP's speech from the perspective of a collaborative effort among communication partners, fall short of considering the relationships between the participant's behaviors and the conversational events (Blau, 1986; Higginbotham, 1985). Additionally, focusing

on the communication of SPs and NSPs on a completed message level does not take into account the active participation of both interactants during the message co-construction process. The data analyses employed, then, do not provide a valid representation of the issue of conversational control and dominance, leading to inappropriate suggestions for intervention (Higginbotham, 1985).

Second, a majority of these investigations are descriptive, as opposed to experimental, and lack methodological rigor (Light, 1988; Higginbotham, et al., 1988). Possible confounding variables such as the presence of observers, topic specification, and social status of the participants were not considered or described. As Colquhoun (1982) has noted, findings may be influenced by the unequal or equal status relationships within the dyad. Additionally, Blau (1986) presented evidence of a more didactic interaction style between uneven social roles of NSPs and their SPs.

These methodological issues, along with the few attempts to analyze the sequential and dynamic aspects of NSP-SP interaction bring to question the validity and relevance of the AAC interactional research. With the recent paucity of interactional research published in the AAC area the last few years, our understanding of the interactional process remains fragmented and incomplete (Light, 1988). While it has been proposed and documented

that the strategies used by SPs may both interfere with or contribute to the effectiveness of interaction, there has been little research regarding the effectiveness of facilitator as well as NSP training as a means to more proficient interaction (Light, 1988; Rauck, 1991). Variables and issues pertinent to interactional intervention will be reviewed next.

Interaction Management Strategy (IMS) Training

Kraat (1990) reviewed the use of AAC modes and stated:

> "As the field of AAC has evolved, it has become apparent that the mere provision or acquisition of signs and symbols does not necessarily lead to the pragmatic use of these alternate language forms in social interactions" (p. 327).

This finding has been replicated by other investigators who have identified the need to examine trained interactional management strategies (IMSs) in NSP-SP interactions (Beukelman & Yorkston, 1980; Calculator & Luchko, 1983; Higginbotham, 1989; Rauck, 1991). Despite operational competency of the prescribed technology, NSPs and SPs continue to evidence miscommunications due to several factors. These factors include: 1) misunderstanding of NSP's vocalizations, gestures, and synthetic speech; 2) limitations in vocabulary of the NSP; 3) unfamiliarity with gestures of the NSP and with the NSP's augmentative system; and 4) difficulty in timing and delivery of utterances (Buzolich & Wiemann, 1988; Harris,

1982; Light, Collier, & Parnes, 1985). Hence, there is a need for effective training of both interactive partners.

Intervention in interaction management often involves two general procedures. First, changing or adapting the augmentative communication aid is necessary so that vocabulary and signals helpful for managing interaction is accessible to the NSP. For example, programming an attention getting phrase such as "I need help" or assembling a call button to aid the NSP in gaining the attention of others may be in order. Likewise, including vocabulary or programmed items such as "Wait, I'm not finished" or "This may take a little while" can help the NSP manage interactions and maintain the conversational floor.

Second, training in appropriate and effective interactional strategies is often viable and, in fact, necessary. Over the past ten years, therapeutic programs with an emphasis on interactional management strategy training have emerged. Blackstone and Cassatt-James (1988) derived strategies for training various interactional skills. Techniques described included those for teaching partners to become facilitating agents, enhancing maximum speech and efficiency (e.g., use of telegraphic utterances, and use of pre-programmed utterances), facilitating conversational repairs (e.g., including symbol repair strategies on the board), developing conversational turn

taking (e.g., providing the NSP more time to communicate), initiating and establishing conversation (e.g., using vocalizations and gestures to obtain attention), and expanding the variety of speech acts employed by NSPs (e.g., structuring the environment to elicit particular speech acts). Culp and Carlisle (1988) have designed and assembled a resource guide for interaction facilitation training for children using AAC entitled "Partners in Augmentative Communication Training" (PACT). This resource provides a number of interactive strategies utilized effectively in clinical contexts along with specific assessment procedures, and individual and group activities that focus on incorporating these strategies into everyday routines and conversation. Specific strategies are delineated according to whether they are "child" behaviors (e.g., offers information, requests for assistance, establishes effective mode selection, secures partner's attention) or "partner" behaviors (e.g., positions self appropriately, provides pause time, confirms child messages). Considering the increasing concern for interactional management strategy training, however, the paucity of empirical data are remarkable. A handful of studies have provided support for such programs and will be reviewed and critiqued in the next section.

The Efficacy of Interactional Management Strategy Training: Review of Investigations

The investigations reviewed here represent those utilizing children or adults who are diagnosed with severe-profound disabilities and/or are essentially nonverbal. A majority of these studies trained strategies to facilitate the use of AAC systems, although a few of the researchers set out to observe any potential increase in nonverbal signals or gestures without signs or communication aids. Some investigators trained only AAC users in selected strategies, some trained only facilitators and some trained both AAC users and facilitators. Two of the references cited (Culp & Carlisle, 1988; McNaughton & Light, 1989) represent case studies that lack sufficient experimental controls to conclude that observed changes were the result of the instructional program, yet, are well-known references and often cited in the literature. The investigations will be grouped according to those utilizing children or adults, and will be reviewed briefly in terms of the following variables: 1) the subjects employed; 2) type of AAC systems used; 3) who was trained (AAC user vs. facilitator or both); 4) the general skills or strategies trained; 5) methods used for training; and 6) general results.

A majority of the earlier studies investigating training of AAC interactive strategies involved training children in functional, pragmatic use of sign or

communication boards (Angelo & Goldstein, 1990; Culp & Carlisle, 1988; Glennon & Calculator, 1985; Reichle & Ward, 1985; Reichle & Yoder, 1985). AAC users were generally developmentally delayed and ranged in age from three to six years. Three of these studies focused on training subjects to use communication boards for particular functions (e.g., labeling, requesting) and whether use of the board generalized to untrained partners or contexts (Angelo & Goldstein, 1990; Glennon & Calculator, 1985; Reichle & Yoder, 1985). Training procedures were structured and didactic in nature and incorporated time delays, prompts, and environmental cues. In all studies, subjects performed with increased levels on trained functions, however, in two studies, generalization to untrained functions was limited or nonexistent. Nearly all of these aforementioned investigations used nonelectronic manual communication boards with pictures.

In another study, Reichle and Ward (1985) investigated whether a 13 year old developmentally delayed male could be taught to discriminate the use of sign language or an electronic memowriter (with print output) with listeners who were or were not familiar with sign. The training method used involved role-playing and verbal prompts from the experimenter. The results indicated that the 13 year old subject evidenced an ability to use the

electronic communication aid and sign discriminately, even in novel contexts and with novel communicative partners.

One additional study, Fox and Westling (1991), provided empirical data in support of training the parents (facilitators) of severe-profound preschool children in the use of facilitative strategies. Parents were trained using instruction, videotapes, and positive reinforcement after using facilitative strategies during play with their children. Results of this investigation supported training parents to use more facilitative strategies and reported that parents had maintained the use of trained strategies over a period of two months. Two out of three parents generalized the trained strategies to untrained contexts. The investigators also reported an increase in social behavior on the part of some of the children as a result of parents utilizing the more supportive strategies. Interestingly, this study found that the strategies chosen for training were already present in the parents' interactive repertoires, and that training encouraged the parents to use these behaviors on a more frequent basis.

Two investigations evaluated the effects of school-age peer facilitators on the communicative interaction skills of children who use AAC systems (Cassatt, 1989; Hunt, Alwell & Goetz, 1991). Cassatt focused only on training of peers, whereas Hunt and colleagues taught strategies to both AAC users and peers. Both studies employed AAC users

on nonelectronic systems (i.e., communication booklets and boards). One study used developmentally delayed subjects, and the other study investigated subjects with cerebral palsy with near normal intelligence. In both investigations, peers were taught to pause for the AAC user to respond, as well as, to prompt or reinforce the AAC user in turntaking. Cassatt individualized target behaviors within individual dyads in addition to providing target behaviors for all dyads. Additionally, she was the only investigator who taught peers to model the use of the augmentative system for the disabled individual. Peers were trained via instruction, modeling, and role playing with the experimenter, although Cassatt also utilized experimenter coaching during live interactions as a training method. Results reported by both investigations indicate an increase in the frequency of communication utterances of AAC users using the AAC systems. Additionally, Cassatt reported that trained peers employed the trained strategies with other children using AAC systems and could instruct untrained, unfamiliar peers on the use of these strategies as well.

Investigations employing adult subjects reported positive effects of training interactive management strategies as well (Calculator & Luchko, 1983; Dattilo & Camarata, 1991; Light, Dattilo, English, Gutierrez, & Hartz, 1992; McNaughton & Light, 1989; Rauck, 1991). Three

of these investigations studied subjects with normal IQs; one study utilized normal, able-bodied individuals on an electronic augmentative communication system. The McNaughton and Light study was a nonexperimental case study, investigating facilitator training with a low-level adult female who expressed herself via eye gaze and body movements. Interestingly, the study was the only one that reported participation of the facilitators in the actual selection of target behaviors to be trained. All other investigations employed goals or target behaviors that were selected by the experimenter(s). Light and colleagues (1992), and Dattilo and Camarata (1991) investigated the use of trained strategies with AAC users utilizing voice output systems. Facilitators in all of these adult investigations were trained via inservice and explanation of strategies by the experimenter. Two of the studies (Light, et al., 1992; McNaughton & Light, 1991) incorporated experimenter modeling, role playing, and experimenter coaching during dyad interaction; whereas, one study (Rauck, 1991) trained predominantly through explanation of strategies and with examples via video tapes. Additionally, Rauck (1991) was the only study providing data on interactional management strategies utilized during an information transfer task. Strategies were selected by the experimenters and included the following: 1) mark word boundaries (i.e., the NSP signaled

word boundaries between spelled words); 2) cue a long or complex word (i.e., before spelling out long or complex words the NSP cued the SP to repeat each letter as it was spelled); 3) cue a respelled word (i.e., before respelling a word the NSP cued the SP to repeat each letter as the word was respelled); 4) cue a comprehension problem (i.e., the SP gave the NSP specific feedback as to why SP was having difficulties); 5) cue SP mistake (i.e., the NSP indicated to the SP that SP guesses were incorrect). Marking word boundaries appeared to contribute to a decrease in the number of message reformulations for two dyads, and thus, facilitated successful message transmission. The other strategies selected were minimally used by the dyads in the post intervention stage of the study and, therefore, did not consistently affect reformulation length or frequency.

In summary, a growing corpus of investigations have provided empirical data to support the success of incorporating interaction strategies into an intervention program with children and adult NSPs. The results of these studies substantiate claims in support of training interaction management strategies involving adaptation(s) to the NSPs augmentative device and/or training to one or both communicative partners.

The Efficacy of Interactional Management Strategy Training: Critique of Investigations

While research in the training of NSP-SP interactive partners has provided a better perspective and insight into training of these dyads, the results can only be generalized to a certain portion of the AAC population due to four concerns within the reviewed studies. First, a majority of the subjects in these studies were cognitively delayed and incapable of generating utterances. Consequently, the studies often utilized picture boards with a limited set of vocabulary items. The inclusion of subjects with the cognitive and linguistic capability of generating their own utterances, along with AAC systems that allow for the generation of an unlimited number and type of utterance, has been restricted to only a few of these studies (Light, et al., 1992; Rauck, 1991).

Second, only limited attention has been given to the unique characteristics of electronic voice output communication systems and how these characteristics influence distinct interactive patterns on the part of the participants (Higginbotham, 1989). Prior research indicates differences in the interactive patterns of NSPs and their SPs based on various augmentative communication system output modes. Buzolich and Wiemann (1988), in examining the turntaking system of NSP-SP dyads, reported that NSPs demonstrated a greater number of attempts in taking a turn when utilizing an electronic output system.

In comparison to nonelectronic alphabet boards, the NSPs were at a greater risk of losing the conversational floor with the electronic devices due to periods during message encoding. In contrast, use of the nonelectronic board required active and consistent feedback on the part of the SP while co-constructing messages. Moreover, Higginbotham (1989) systematically investigated the effects of different augmentative communication device output modes on the interactions between NSPs and their SPs. Subject interaction was observed while utilizing a communication board with and without an electronic output display. Results of the study indicated that there were no significant differences in turn length, message formulation length, and communication units (a measure of propositional content) due to the various interactional styles of the subjects. However, the number of message reformulations that occurred was significantly reduced when an electronic output display was added to the board. Prior evidence suggests, then, that the interaction patterns of dyads utilizing electronic systems vary from interaction with nonelectronic systems. Yet, to date, interactional management strategy research with electronic voice output systems is nearly nonexistent.

Third, with only one exception (Rauck, 1991), all of the studies have concentrated on training in conversation with minimal effective strategies identified for

information transfer tasks. Prior research indicates that interaction patterns vary depending on the demands and expectations of different tasks (Light, 1988). For example, Farrier and colleagues (1985), in their study of normal subjects using AAC systems, found turntaking and interactional control patterns varied between a decision making task and a direction giving task. During the direction giving task, the NSP was afforded more control as a result of giving the SPs directions for reproducing a design. While studies that investigate interaction management strategies in conversation are beneficial, they don't enable the augmented user to participate fully in the interactions. During conversational tasks, the more competent communicators (i.e., the speaking partners) monopolize the conversational interaction and the less proficient communicators (the AAC user) participate at a minimal level. Consequently, the full range of the augmented user's abilities or the spectrum of strategies that the augmented users might employ may be underestimated.

This potential problem may be overcome by using "transactional tasks" (Brown, Anderson, Shillcock, & Yule, 1984). In these tasks, each participant has information that is unknown to fellow participants but is required by them in order to execute a task. For example, the NSP may transfer information to the SP for successful reproduction

of a geometric design or a route on a map. Such interactions are representative of situations in which information, such as telephone numbers or directions are given from one interactant to another. To be successful, these interactions typically require two-way exchanges of information and participation of both individuals in reaching a final solution. These information transfer tasks, then, allow for more opportunity for equal participation on the part of both interlocutors (Farrier, et al., 1985; Pica & Doughty, 1988).

Finally, as noted by Light (1988) few studies investigating augmented interactions have attempted to analyze these interactions and/or select targets from the perspectives of the actual participants. Rather, analysis has been made only by the investigator's "third party" perspective, that may be more objective in nature, yet, "necessitates that the outside observer infer the intent of the participants (including attitudes and motivations) from observable behaviors" (p. 70).

In summary, there continues to be a critical need to provide evidence concerning the efficacy of NSP-SP training in general. This need is particularly acute for subjects capable of generating their own utterances on voice output systems, and on tasks other than conversation. Of particular interest to this investigation is the need to incorporate research on a frequent type of interaction in

classroom; the information transfer task, and on training methods that take into account the perspectives of the learners. The issue regarding training methods will be discussed in the following section.

Training Methods

Training Methods Employed in Prior Research

A majority of the investigations training interactional management strategies have focused primarily on what strategies to train rather than on how to train them. Yet it seems logical to assume that the way that we teach facilitators may also affect their effectiveness and strategy use. The methods employed in these investigations for training NSPs and/or SPs ranged from explanation, discussion, and modelling of the various strategies by the experimenter, review of videotapes, experimenter coaching of the NSP-SP in interaction, and any combination of the above. More recently, Johnson and Harrison (1991) advocated using facilitator self-rating to reduce the directive styles of interaction between mothers and their vocal, language impaired children. As discussed by the investigators, self-rating "induces" self change, in that the specific behaviors to be targeted and the direction for change is determined by the individual, rather than the professional. Johnson and Harrison noted significant differences in the directive behaviors of mothers as a

result of the mother's continual self-rating of her own interactive behaviors over several videotaped sessions.

A common characteristic of the majority of the aforementioned teaching methods is that they call for active participation of the trainee in utilizing the targeted facilitative strategies while interacting with the AAC user. Thus, these methods required less inferencing and "projecting" on the part of the interactants. In spite of these developments, however, only two investigations used training methods that involved the trainee in the decision making process of selecting which particular behaviors to target and the direction of change. The apparent advantage of incorporating the learner in the choice of selected targets is that it better assures learner responsibility for change and that any change in behavior reflects the attitudes and perceptions of the participant. Moreover, an increase in motivation for change and accountability on the part of the trainee can be assumed with greater certainty. As expressed by Blackstone (1991) in regard to training of interactive speaking partners:

> "our goal in interaction training is not only to impart information, but to change behaviors and attitudes" (p. 3).

Blackstone advocates the use of "learner oriented" activities and active participation of speaking partners in the learning process, as opposed to merely imparting information. Additionally, she reports that the most

effective learning programs are those in which "adults respond to particular events (e.g., training program) on the basis of meanings they construct, both for the event and for themselves in relation to the event" (p. 3). The expectation of participant's deriving effective targets for training, however, necessitates an increase in awareness of the needs of their interactive partners. Thus, techniques that also facilitate the learner's awareness of the needs of both participants in the interaction are essential if effective training is to be implemented.

Role-Taking Effect

One interactive training strategy that has been empirically investigated with positive effects on communicative behavior is that of placing interactants in the particular interactive role of their interlocutors. Much of the research regarding this role-taking effect has been in the area of second language acquisition. In a study by Yule (1991), nonnative speakers with relatively high English language proficiency (H group) were placed in an interactive transfer task with lower proficient nonnative speakers (L group). The task required one participant, the sender, to describe a route on a map to the other participant (the receiver) so that the receiver could draw the route on his map. The task presented a number of referential conflicts in that both speakers, H and L, were presented with slightly dissimilar maps

requiring the interlocutors to negotiate the problems encountered when their maps were incompatible. In one group of subjects, the H speaker was continually placed in the role of the sender with three different L speaker receivers. In the second group, the H student was initially placed in sender role, then placed in the receiver role (with the L speaker sending the information), and subsequently in the sender role once again. Results of this investigation demonstrated that after the H proficient speakers acted as receivers of information, their performance as senders on the subsequent task included more successful negotiations of referential conflicts as compared to those H speakers with practice in the sender role alone. As explained by Yule, the obtained experience of depending on the less proficient partner for crucial information resulted in the more competent speaker's use of strategies for obtaining and monitoring the other's world of reference on subsequent interactive tasks. An earlier study by Anderson, Yule and Brown (1984) demonstrated this same role-taking effect in utilizing a variety of information transfer tasks with adolescents.

In the aforementioned studies the more dominant participant served the role as listener or hearer. In contrast, the present study advocated placing the SP in the role of interactively using a device. This role-taking model in which a speaking partner models use of the device

has been advocated by practitioners with clinical evidence that such models enhance the functional use of the device by the AAC user. However, the minimal empirical evidence that exists regarding device modeling with children utilizing AAC devices and their mothers, indicates that in most instances facilitators do not model use of the device (Culp, 1982; Bruno & Bryen, 1986). Reasons for this have not been more than vaguely discussed, although one can speculate that perhaps modeling on the device was too unfamiliar to the mothers or represented too much effort. Perhaps documentation of more facilitative interactional strategies as a result of modeling will result in a shift in behaviors towards greater modeling and use of the device by able-bodied persons.

Conclusions. Although empirical investigation of role-taking as a training technique is still in its initial stages, results of these investigations demonstrated role-taking to be advantageous in sensitizing more speakers to the needs of their partners, resulting in more accurate and effective strategies for communication. An added benefit accrues from allowing the participants in the interaction the freedom to derive their own strategies for managing the interaction based on their own experiences and perceptions. It is hypothesized that a greater or more enhanced identification with the other partner's interactive needs will result in more effective interactional management

strategies once the SP has had experience in interactive use with a VOCA. Additionally, use of the device ensures the active participation of both partners in this learning process and allows them to construct their own interpretations of effective interaction for both themselves and their partner.

Normal Individuals as Subjects in AAC Research

One final issue, that of incorporating normal, able-bodied individuals in AAC research is of importance to the present investigation. These studies previously cited, Farrier, and colleagues (1985), Higginbotham (1985), and Rauck (1991), utilized normal, able-bodied individuals on electronic devices. Higginbotham (1985) provided evidence that the point-verbalization interactive pattern found in dyads with one handicapped speaker existed in dyads utilizing two able-bodied persons, one using an augmentative system. Therefore, Higginbotham and others (Doss & Reichle, 1992; Farrier, et al., 1985), advocate the use of able-bodied persons in AAC research in order to gain a perspective on what interactive patterns are a result of the specific characteristics of the augmentative system itself (i.e., output mode and slow rate of message transmission). Granted, the incorporation of normal individuals using AAC devices provides insight as to the effects on interaction that are specific to the augmentative system. Moreover, it is argued that the

generalization of empirical results is often limited regardless of the population selected (Doss & Reichle, 1992), and particularly with subjects as heterogeneous as those using AAC systems. However, the use of able-bodied persons in AAC research does not take into the account the interactional patterns that may exist as a result of the physical limitations of the AAC user (i.e., inability to use conventional gestures, facial expressions, and rapid transmission of messages) or the psycho-social factors (e.g., attitudes and perceptions) of both participants which, as previously discussed, may have a great deal of impact on the interaction. Hence, further investigation is necessary in delineating the variables pertinent to the use of normal, able-bodied versus disabled and the specific differences that exist so that we may be forearmed with information about what generalizations may or may not apply. To date, no empirical data exist that make direct comparisons between these two populations and the nature of the apparent differences in interaction.

Conclusions

It is the intent of the author to provide additional empirical data regarding the effect of interaction management strategies on NSP-SP dyads utilizing voice output systems and the types of interactional strategies that work effectively in information transfer tasks. Furthermore, the units of analysis discussed in this

section (i.e., Message Formulation Episodes and Insertion Sequences), as devised and previously verified by Higginbotham (1985, 1989), provide an effective context in which to study the effects of the independent variable, and to indicate effects of treatment.

In contrast to the earlier investigations, however, it is the intent of this investigation to provide data regarding a training strategy (i.e., SP's experience with a VOCA) not previously investigated and its effects on NSP-SP interaction. Intuitively, such an approach enhances the SP's and NSP's awareness of their partner's interactive needs, and may facilitate the SP's and NSP's ability to accommodate the other and facilitate the establishment of a common reference. It is projected that results of this study will be beneficial in providing practitioners and those serving the nonspeaking population information regarding an effective training strategy that yields improvement in interactions between NSPs and their teachers, speech-language pathologists, families and other significant SPs. Moreover, of importance to continued AAC research incorporating able-bodied persons, is the delineation of interactive variables that systematically differ as the result of using nonhandicapped subjects and handicapped subjects. It is anticipated that this investigation will present initial data relevant to this topic.

Footnotes For Chapter II

1. Nonspeaking persons are impaired due to a variety of etiologies including cerebral palsy, autism, hearing impairment, mental retardation, apraxia of speech, aphasia, spinal chord injury and traumatic brain injury. Latest statistics by Matas, Mathy-Laikko, Beukelman and Legresley, (1985) estimate that up to six percent of the special education population in the schools are nonspeaking. According to Yoder (1980) there are an estimated 1,255,000 children in the United States classified as nonspeaking.

2. Vanderheiden (1988) reports that typical information transmission rates for individuals using augmentative communication devices range from 2 to 25 words per minute (wpm), depending on physical ability and type of device employed. These rates are approximately 5 to 90 times slower than the communication rates for normally speaking persons (i.e., 120-180 wpm).

3. Different types of communication devices employ various types of output modes. Nonelectronic boards require the SP to constantly attend to the NSP's vocabulary selections and retain each selection in memory. Current electronic devices may employ synthetic speech, print, liquid crystal displays or light emitting diode displays in transmitting messages. These means of output allow the SP to wait and receive the message after it is complete and do not have to consistently attend to the display. Alterations in the structure of NSP-SP interactions may occur as a result of the output mode.

METHODOLOGY, PILOT INVESTIGATION AND SPECIFIC RESEARCH QUESTIONS

Effects of the SP's experience with a voice output communication aid were assessed using a single subject experimental design as described in the next section. Measurements included the types and amounts of Insertion Sequences that promoted efficiency, along with the number of turns, turn length, and length of Message Formulation Episodes as measured by number of turns per MFE. Additionally, the number, length, and type of Message Reformulation Episodes were compared in pretreatment and posttreatment conditions. The types of strategies used by each dyad in promoting an optimal balance of accuracy and efficiency during the information transfer task and in resolving referential conflicts was described. These strategies accounted for the role relationships and underlying communicative goals, motivations and perceptions of the participants.

In observing potential differences with able-bodied and disabled NSP dyads (research question #2), differences in the amount of eye gaze, the SP's use of the device, the dyads' use of Insertion Sequences, and other apparent differences were measured and described throughout all experimental trials.

Design

A single subject ABA experimental design was replicated across 4 interactional dyads. In this design, the A1 represents pretreatment baseline measures, B represents the treatment phase, and A2 represents the posttreatment phase. Single subject designs are particularly well suited to evaluating experimental effects with populations that are heterogeneous, such as the AAC population and allow for more scrutinized observation of behaviors for better application to clinical situations (Barlow & Herson, 1988). The experimental variable (SP interactive experience with a VOCA) was applied in all four dyads. The effects of the independent variable were examined via intra-subject comparisons made across pre-treatment and post-treatment conditions. Results of initial pilot data indicated that a predictable interactive pattern between participants was evident after the first trial (map task) during the initial baseline. This indicated familiarity with the task and that the interactive partners had negotiated an agreeable "pattern" for transfer of information given the task and constraints imposed. Additionally, data analysis indicated that the dyads' behavior patterns stabilized after the second trial (or second map task) and continued to remain relatively stable through the eighth trial (or eighth map task) of the baseline condition. Therefore, a control dyad (engaging

only in repeated practice) was not implemented. However, the baseline condition (Condition A1) was extended for Dyads 1 and 2 to observe the trend of behaviors with repeated practice.

Each dyad participated in four experimental phases: 1) a device training phase (including four structured practice tasks), 2) a pre-treatment phase (six trials for Dyad 1; five trials for Dyad 2; four trials for Dyads 3 and 4); 3) an experimental phase (three trials); and a post-treatment phase (three trials).

All pre-experimental device training tasks were presented on the first day. Both the NSP and SP participated in the pre-experimental structured training trials so that any change from pretreatment to posttreatment conditions could be attributed to the SP's interactive use of the device. All dyads participated in two to three experimental trials (two maps) per day for approximately 1 1/2 to two hour sessions, resulting in six days of data collection over a period of one and one-half weeks. The data collection took place at the same time each day. Each partner using a device participated in one structured practice task at the beginning of each session to re-familiarize him/her with the device prior to experimental trials.

For the pretreatment, experimental, and posttreatment phases, a different map was used for each trial. These

twelve maps were prepared, randomized, and then selected for the trials. All subjects utilized the same map ordering. During the pretreatment phase (Condition A1) the SP was speaking and the NSP was interacting with a VOCA. In the treatment phase (Condition B) both the SP and NSP were interacting with a VOCA. The posttreatment phase (Condition A2) was identical to Condition A1.

Specific procedures for each phase and condition follow and are presented in Table 1.

Table 1
Single Subject ABA Experimental Design Replicated Across Four Dyads.

Dyads 1 and 3	Handicapped school-aged male (sender) and female college student (receiver)
Dyads 2 and 4	Nonhandicapped school-aged male (sender) and female college student (receiver)

Pre-exp	Condition A1	Pre-tx	Condition B	Condition A2
training of NSP & SP on device	NSP on device; SP speaking	Review training of SP on device	Both NSP & SP on device	NSP on device SP speaking

Pre-Baseline Device Training Phase

Prior to the Baseline Condition A1, both the NSP and SP participated in a device training phase to familiarize them with the VOCA, the speech output, the programmed vocabulary, and locations of vocabulary on the device. Vocabulary items consisted of the English alphabet, the

numbers 0-9, and 80 most frequently occurring words utilized by AAC users in conversation, according to Beukelman and colleagues (1984) word-sample frequency list. The vocabulary items pre-programmed into the device are provided with a sample display of the device in Appendix D.

Initially, a graduate student clinician familiarized the NSP and the SP with the necessary features of the device, such as on/off, volume control, and the function keys, <Speak>, <Clear> and <Delete>. The NSP and SP demonstrated how to perform each of these functions with 100% accuracy upon request by the graduate student before moving on to the four structured tasks.

In the first structured task, the graduate student presented a stack of cards with each vocabulary item (letter, number, or word) written on a separate card in random order. As the subject turned over each letter, number or word, he/she found that item on the device and activated the item so that it would be spoken. This procedure continued for a minimum of two trials per letter and/or until the NSP and SP had located all vocabulary items with 100% accuracy.

The second structured task was identical to the first, except that half of the words presented were not located on the device and had to be spelled out. These words were also selected from Beukelman and colleagues (1984) list of most frequently used vocabulary. If the word was not

located on the device the subject independently spelled out the word and then selected <Speak> so that the word would be spoken in its entirety. Again, this procedure continued for a minimum of two trials per item and/or until the subject had located and spelled all vocabulary items without prompting with 100% accuracy.

The third structured task allowed the subjects to copy 20 written sentences, so that he/she would have practice in generating longer utterance lengths and use of the <Space>, <Speak> and <Delete> keys. The fourth structured task allowed the subjects to copy partial sentences and fill in the blank (e.g., My name is _____). The subjects were instructed to type the entire sentence using <Delete> keys when necessary and <Speak> the sentence when it was completed. Subjects were also instructed to <Clear> the generated sentence from the memory and electronic visual display prior to generating the next sentence. This training task ended once the subject had demonstrated accurate selection of items and accurate use of the functions of the device with at least 95% accuracy. The subjects were allowed breaks between tasks if necessary. All training tasks were administered on one day.

The experimenter was not present in the room during practice and experimental trials. The intrusive effect of the videotape recording equipment on subject performance

was diminished by having the dyads practice in front of the video equipment prior to experimental trials.

Baseline--Condition A

During the baseline condition the dyads participated in an information transfer task in which the NSP led the SP along a particular route on a map, giving an activity to be performed at each of 10 stops. Written instructions were given to each subject and were read aloud by a second graduate student. The instructions were as follows:

> You will each be given a map. The maps are similar but differences exist, since one map is older than the other. _____ (the NSP) will give _____ (the SP) directions for drawing the same route that is on his map. Each map has a total of 10 stops. At each stop, _____ (the NSP) will give _____ (the SP) an activity at each stop and _____ (the SP) is to write that activity on a sheet of paper next to the number corresponding with each stop. You will each be paid an additional $1.00 for each map pair that has the same locations and routes.
>
> You may not show your partner your map or activity sheet. You and your partner may interact in any way you like to perform the task, except the NSP is to use the device for all expressions except for Yes/No. This task has no time limit. Do you have any questions?

The subjects were videotaped and baseline data were collected. Baseline continued for six trials (one map per trial) for Dyad 1, five trails for Dyad 2 and four trials for Dyads 3 and 4 to view for potential changes in behaviors given repeated practice.

Treatment Phase--Condition B

During Condition B both the NSP and SP were using a VOCA while interacting on the map task. The SP in these dyads received a review of the training on the device that was a shorter version of that during the pre-experimental training phase. The same criterion for training applied.

Instructions to the dyad for this experimental condition were modified as follows:

> _____(the SP partner) may interact in any way, except you may not speak or use any gestures except for "yes" and "no."

Post-treatment Phase--Condition A2

Condition A2 was identical to Condition A1, with the NSP interacting with the device and the SP speaking once again. At the conclusion of this phase, each dyad was debriefed as to the purpose of the study.

Instrumentation

Voice Output Communication Aid (VOCA)

The "TouchTalker" electronic voice output communication aid with Dectalk synthesized speech was employed. This VOCA was selected based on its frequent use and high quality speech intelligibility (Mirenda & Beukelman, 1990). The Touchtalker had attached a communication overlay consisting of 128 half-inch squares, each square covering 128 cells that were activated via finger pointing. As the user selected each item on the device the item was spoken out. All of the 128 vocabulary

items (listed in Appendix D) were pre-programmed, however, the device did allow the user to generate complete words and sentences which may subsequently be spoken in their entirety and were visible to the user via the liquid crystal display.

Behavior Recording Equipment

During the experiment, the dyads performance was recorded using a color video camera positioned approximately 5 feet away and facing the dyad. Vocal behavior of the participants was recorded onto the videotape via a microphone placed approximately 1 foot behind and to the right of the dyad.

Task

The task employed in this study was similar to a map task utilized by Yule (1991; 1992) in prior research with nonnative English speakers (1). Each person in the dyad was given a similar, but slightly different map and the NSP (the sender) was instructed to guide the SP (the receiver) along a particular route on the map. The SP traced the route on her map with a red marker. The maps were placed on either side of a barrier so as not to be seen by the other speaking partner. Each route had 10 stops. In addition to the map, the NSP was given a list of 10 activities (e.g., "drop off the mail," "pick up a carton of milk"), and one activity was associated with each stop. After the SP drew the route on the map, she wrote the

activity associated with that stop on a separate sheet of paper. For each trial the dyad was given a separate map and separate sheet of activities.

Each map was large enough in size for the partners to adequately read. Each map contained 18 referents (or places)--15 structures (buildings, homes), and 3 man-made or natural landmarks or facilities, such as lakes, golf-courses, parks, and so forth. To control for some referents being more predictable than others, the number of referents containing the same first letter (e.g., bank and books), was constant for maps used in Condition A1 and A2, that is, if Map #2 in Condition A1 had 2 stops beginning with the same letter, so did Map #9 in Condition A2. No referents had the same initial two letters (e.g., magazine and market) and all referents were typical stores, places and/or landmarks found in most communities along with typical activities performed at those places.

Of the ten stops on each map, four of these stops presented ambiguity or conflicting information requiring the partners to negotiate the differences in maps. The differences in maps were described as any or all of the following:

1. In the sender's map, there is a building in one location with the label "Circle K" which, in exactly the same location in the receiver's map has the label "7-11."
2. In the sender's map there is a building in one location marked "Hardware" and in the receiver's map there is one building marked "Hardware" but in a different location.

3. The sender's map has a single "Clothing" store marked in an area where the receiver's map has that "Clothing" store, plus two other similar "Clothing" stores.
4. In the sender's map only one road leads to a particular location and the receiver's map has two roads leading to that location.

For a sample map and associated activities refer to Appendix E.

Measurement Techniques

The definitions and procedures used for transcript segmentation and data analysis are found in Appendix B. Units of analysis included mean frequency of NSP and SP turns, NSP and SP mean turn length (based on number of words per turn) and mean MFE length. In addition, nine types of Insertion Sequences employed during message formulation for interaction management and repair purposes (e.g., Repetitions, Guesses, Confirmation Queries, Message Reformulation Episodes) were identified, along with frequency counts and percentage of total turns. These units of analysis represented the salient interactive behaviors noted in the pilot data and were characteristic of interaction management and repair in NSP-SP dyads utilizing alphabet and word systems (Higginbotham, 1989). Given that referential conflicts were encountered via the particular map task employed, one type of Insertion Sequence (i.e., Resolution of Referential Conflict Episodes) represented a majority of the strategies initially described by Yule (1991; 1992) while

investigating the behaviors of nonnative speakers utilizing a similar task. These strategies have been slightly modified to best describe what may occur in NSP-SP dyads when referential conflicts are encountered. Operational definitions for these units are provided in Appendix B.

This protocol was designed to capture the cooperative behaviors of both participants in the dyad and reflects facilitative behaviors, as well as communication problems of the dyad. The hypothesized differences as a result of the independent variable in pretreatment and posttreatment conditions were measured quantitatively as follows:

1. Increase in rate enhancement behaviors employed by the dyad was documented by any or all of the following:

    a. Increase in frequency and percentage of Insertion Sequences which promote efficiency such as Word Guesses, Word Confirmation Query Guesses, solicited guesses and/or Yes/No Confirmations.

    b. Increase in number and percentage of abbreviated words or utterances.

    c. Differences in frequency of turns and/or turn length between pretreatment and posttreatment conditions as a result of increased use of rate enhancement.

2. Overall reduction in frequency and/or length of Message Reformulation Episodes due to more effective interactional management strategies on the part of the interactional dyad.

Descriptive observations accompanied these quantitative measures along with a description of additional strategies not mentioned.

Upon completion of the experimental conditions, open-ended question interviews were conducted with all subjects to obtain subjective judgements about their experiences during the experimental conditions. A portion of the interview consisted of the participant viewing selected videotapes with the experimenter and reflecting about or explaining the observed behaviors. The intent of the interviews was to determine the meaningfulness and usefulness of the treatment employed as well as to obtain information about specific attitudes regarding disabled individuals in general and augmentative communication aids in general.

Transcription and Coding

Each trial (or map task) was transcribed in its entirety. Using the procedures described in Appendix B, each transcript was segmented into MFEs, then communication turns. Subsequently, turn number, turn length, and MRE length were calculated and Insertion Sequences were identified and coded.

Interobserver Reliability

To obtain measures of interobserver reliability the experimenter trained a graduate student in coding of transcription and an associate from the Department of Communication Disorders on coding of MFE's, turns, and Insertion Sequences. Training consisted of 2-3 hours of training for each inter-reliability observer and each coder

was supplied with the definitions in Appendix B. Reliability percentages were calculated on the transcriptions of 2-3 map trials from pretreatment and posttreatment conditions for each dyad, representing 20-25% of the complete data set. These data are presented before the actual results to assist in clarity of organizational format.

Point to point agreement between two judges for transcription was 95% for verbal data (vocalizations, verbalizations, and device) with a range of 85% to 96%. Total percentage of agreement in transcription of nonverbal data (gaze, movements, and gestures) was 85.5% with a range of 80% to 88%.

Interobserver reliability for number of turns, turn length, and MFE status is presented in Table 2. Agreement was also calculated for each of 24 Insertion Sequences along with the percentage agreement for all Insertion Sequences. These data are presented in Table 3.

Table 2
Frequency and Percentage of Interobserver Agreement Scores for MFE Status and Turns.

Data	# Correct	Total	% Correct
Number of Turns	1122	1133	99.02
Turn Length	1052	1133	92.85
MFE Status	155	164	95.0

Table 3
Frequency and Percentage of Interobserver Agreement Scores for Insertion Sequences.

Insertion Sequences	# Correct	Total	% Correct
WLR	7	7	100
MLR	30	31	97
PMLR	18	18	100
WLG-NON	35	36	97
WLG-SOL	13	13	100
MLG-NON	18	19	95
PMLG	21	21	100
WCQ-R	3	5	60
MCQ-R	14	14	100
WCQ-G NON	6	6	100
WCQ-G SOL	1	1	100
MCQ-G NON	4	4	100
CLAR-NSP	52	59	88
CLAR-SP	28	31	90
CONF	162	164	99
IND CONF	18	22	81
Y/N CONF	56	59	95
OT-S	7	7	100
IQ-SP	71	82	87
OI-ME	3	4	75
OI-MM	5	6	83
RRCE-NP	0	1	0
RRCE-ARB	13	14	93
RRCE-OWS	9	10	90
Total Insertion Sequences	515	561	91.8

Note. Abbreviations for Insertion Sequences are specified in Appendix B.

Percentage of interobserver agreement was 85% and above for a majority of the Insertion Sequences. Percentage of agreement for WCQ-R, IND CONF, OI-ME and I-MM were below 85%. However, with the exception of Indirect Confirmations (IND CONF) each of these Insertion Sequences represented a low occurrence of interactive

behavior with disagreement on only one or two occurrences. Some of the Indirect Confirmations (IND CONF) were inadvertently missed by the coder, resulting in a lower percentage of agreement of 81%. However, these data were not particularly relevant for the interpretations made and were predominant in only one dyad. The Insertion Sequences with less than 95% agreement on this initial data, were reviewed by the experimenter and observer, negotiated, and agreed upon to 100% agreement.

Pilot Investigation

In order to guide this inquiry further and to aid in the formulation of specific hypotheses, a pilot investigation was undertaken. The methodology previously described was utilized except that the training phases during the pilot investigation were stretched out over a period of six weeks. Also, the pilot investigation utilized maps which were not consistent across all trials (in terms of differences and number of different referents), and a single dyad consisting of a motorically impaired 9 year old male, B.L. and his mother participated.

B.L. acquired a significant neurological impairment at the age of seven years, with concomitant inability to speak with the exception of a few single syllable or bi-syllabic vocalic utterances, such as "uh-uh" for "no" and "uh-huh" for "yes." Cognitive, linguistic and perceptual abilities had remained essentially intact, and B.L. was functioning

on grade level, according to school records. Prior to the study, B.L. had been using a "Touchtalker" portable voice output communication aid for approximately six months and had been receiving speech-language services, primarily aimed towards gaining operational competence of the device and training on use of the device in natural, communicative contexts. The "Touchtalker," used in the pilot investigation contained an updated speech synthesizer compared to the one inherent in B.L.'s "Touchtalker." The vocabulary used included the alphabet, numbers 0-9, and 80 of the most frequently occurring words used by AAC system users (Beukelman, Yorkston, Poblete, & Naranjo, 1984). This vocabulary set was different from the picture-based vocabulary system that B.L. was currently using.

Descriptive comparisons in the interactive behaviors of the dyad in each trial were made between pretreatment and posttreatment conditions. Behavior differences that may have been attributed to the treatment variable were substantiated by observing, coding, and quantifying the interactions during the treatment Condition B.

Results

A salient difference in the interactive behaviors of B.L. and his mother between pretreatment and posttreatment was in the increased use of rate enhancement strategies in posttreatment, particularly in terms of word and message level guesses or guesses in the form of confirmation

queries. That is, instead of waiting for the entire word or message to be formulated by the NSP, the SP would make frequent attempts to guess the word or message to save time in message transmission. Table 4 presents frequency counts of all Insertion Sequences for both partners on two trials in Condition A1 (trials 2 and 8) and the two trials (trials 12 and 13) in Condition A2. Note that the frequency counts for Repetitions and Guessing Insertion Sequences for both Conditions A1 and A2 indicate an increase in the number of Word Level and Message Level Guesses (WLG and MLG) in Condition A2, while the number of Word and Message Level Repetitions (WLR and MLR) remains about the same for all trials. Additionally, the number of Word and Message Level Confirmation Queries-Guessing (WCQ-G and MCQ-G) increased in Condition A2, whereas the number of Word and

Table 4
Frequency Counts for Turns and Message Formulation Episodes in Pilot Data.

Trial	Frequency of MFE turns NSP turns	SP turns	Total # MFEs
CONDITION A1			
2	77	99	21
8	76	89	19
TOTAL # turns	153	188	
CONDITION A2			
12	79	79	21
13	94	102	21
TOTAL # turns	173	181	

Message Level Confirmation Queries-Repetitions (WCQ-R and MCQ-R) decreased in number particularly in trial number 12. Although the low frequency counts do not warrant statistical comparison, observation of the data do indicate an upward trend in the number of guesses as opposed to repetitions. Also of note is the increase in number of guesses solicited by the NSP in Condition A2, particularly for Word and Message Level Guessing (WLG and MLG). That is, upon giving the SP a partial word or message, the NSP would pause, gaze at the SP and often vocalize in an effort to solicit a guess by the SP. In nearly all instances, these SP's guesses were accurate and resulted in more efficient message transmission on the part of the interactional dyad. Another rate enhancement strategy employed by the SP that occurred more often in Condition A2 was that of Yes/No Confirmation sequences. This strategy consists of the SP rephrasing her utterances in an effort to elicit "yes" or "no" responses by the NSP, rather than requiring the NSP to produce the utterance via the "Touchtalker." The Yes/No Confirmation strategy was primarily utilized by the SP during episodes in resolving referential map conflicts.

The increased use of guessing by the SP and solicited guesses by the NSP, coupled with the use of Yes/No Confirmation sequences are evident when observing the frequency of NSP and SP turns and turn length in Conditions

A1 and A2. It was predicted that with the inclusion of more guesses, turn length would decrease along with an increase in the number of turns per Message Formulation Episode. Table 5 presents the frequency of NSP and SP Message Formulation Episode turns for each trial, as well as the total number of Message Formulation Episodes for each trial. An increase in turn frequency for the NSP was observed in Condition A2, however, a slight decrease in number of turns was evident for the SP. This slight decrease in number of turns appeared to be predominantly due to a decrease in the number of off-task/interruptive turns taken by the SP in Condition A2 (will be explained later). Nevertheless, the difference in number of turns between pretreatment and posttreatment conditions indicates a general upward trend for the interactional dyad.

Table 5
Mean Turn Length per Trial and Weighted Mean and Standard Deviation for Each Condition in Pilot Data.

	Mean Turn Length	
Trial	NSP	SP
CONDITION A1		
2	1.64	4.94
8	1.69	4.68
MEAN	1.66	4.77
	(sd 1.59)	(sd 4.24)
CONDITION A2		
12	1.22	2.60
13	1.62	3.42
MEAN	1.46	3.05
	(sd 1.43)	(sd 3.29)

The turn length measure was based on the number of words produced during each NSP or SP turn. Table 5 presents the mean length of turns during all trials and overall weighted means and standard deviations for each condition. The overall weighted mean for turn length for Condition A1 was 1.66 and 1.46 for Condition A2. This did not appear to be significant. However, for the SP the overall weighted means for Conditions A1 and A2 were 4.77 and 3.05 respectively. A t-test for independent samples indicated that for the speaking partner, the A2 Condition consisted of significantly shorter turn lengths (number of words per turn) compared to the A1 Condition ($t=4.31$, $p< .001$). However, these statistical results regarding turn length must be interpreted with caution. In all trials, the SP's turn length increased predominantly as a result of longer turns in resolving referential conflicts. In trial 12, however, only one Resolution of Referential Conflict Episode (RRCE) occurred (compared to two RRCEs in the other 3 trials), resulting in a reduced mean turn length for trial 12. Even so, a general trend in reduction of SP turn length was indicated.

This increase in rate enhancement strategies on the part of both partners in Condition A2 can be explained by an increase in the awareness of and adaptation to the significant amount of time required in the formulation of utterances by both partners during the Treatment B

Condition. During Condition B, with both interactive partners on devices, the increased number of solicited guesses and overlap in talk as the SP attempted to guess the word during NSP formulation of utterances was particularly salient. Additionally, the SP's message level utterances in Condition B were significantly shortened to represent only the key words necessary for transmission of meaning. For example, rather than typing out the complete utterance, "Where do we go from there?" the SP would type, "Where next?" The use of these shortened forms extended into Condition A2 and was partially responsible for the decrease in SP turn length.

In addition to the increased use of rate enhancement strategies, a difference observed in the interactive behavior of the SP between pretreatment and posttreatment conditions was the decrease in Off-task/Interruptive turns which appeared to interfere with or delay the NSP's formulation of utterances. These Off-task turns were nearly nonexistent in Condition A2, after the SP's experience in interacting with the VOCA (see Appendix C) and were observed only once in the Treatment Condition B. Apparently, during Condition B, producing any utterance other than what was necessary for adequate message meaning was deemed to be not worth the time and effort. There can be several reasons for the decrease in off-task/ interruptive behavior in Condition A2. Perhaps the SP was

not particularly interested in saying more than necessary that day, or she was tired of the task, or she identified with the NSP's need to concentrate on message formulation as a result of interactively using a VOCA in Condition B. Given that the SP persisted in this behavior throughout the course of eight map trials in Condition A1, the latter explanation seems plausible.

Two other Insertion Sequences not previously discussed are Information Queries and Message Reformulation Episodes (MRE). The number of Information Queries did not change significantly between the pretreatment and posttreatment conditions. This is not surprising, given that this SP generally requested information from the NSP to assure accurate responses, particularly while resolving differences in the maps. The number of MRE's, however, did decrease, with no MRE's observed in Condition A2. The primary reason for this appeared to be the overall reduction in turn length, accompanied by an increase of Yes/No Confirmation sequences on the part of the SP during instances of resolving referential conflicts. In Condition A1, the SP generally initiated these referential problems with a rather lengthy explanation of the apparent differences in the maps. These explanations often involved arbitrary decisions about the NSP's world of reference rather than asking the NSP specifics about his map, as shown below in Figure 5. As evident in this example,

NSP may have had difficulty processing and/or retaining the amount of information initially presented by the SP,

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NSP: "c-h-i-l-d-c-a-r-e"
SP: "Childcare. Ok, I have one, two...I have two of them. One of them is across the street from the electric store and next to the Walmart and the other one is kinda across the street from the library, and around the corner."
NSP: (gaze at SP) "uh?"
SP: "What, you want me to repeat it?"
NSP: "uh" (gaze at map)
SP: "Ok, do you have two childcares?"
NSP: "uh"
SP: "Ok, is it the one next to the Walmart or near the library?"
NSP: "W-a-"
SP: "Next to the Walmart?"
NSP "uh-huh"
SP "Ok"

Figure 5
Example of NSP-SP Interaction Sequence in Condition A1 of Pilot Data.

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resulting in an NSP initiated Message Reformulation Episode. Subsequently, the SP proceeded to ask short answer or Yes/No questions in an effort to resolve the

---

NSP: "c-l-o- " (gaze at SP)
SP: "OK, I have two of them. One is on the same block as the dry cleaners?"
NSP: "uh-uh" (no)
SP: "and the other one is up at the top of the map next to the clothing store"
NSP: "uh-huh" (yes)
SP: "That one? OK"

Figure 6
Example of NSP-SP Interaction Using Yes/No Confirmations in Condition A2 in Pilot Data.

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referential problem. In Condition A2, however, the SP initiated these sequences with Yes-No Confirmations rather than a lengthy arbitrary solution as evident in Figure 6.

Based on these observations, then, the SP's use of Yes/No Confirmations resulted in a reduction of Message Reformulation Episodes, and served as a form of rate enhancement. It appears, then, that the Yes/No Confirmation strategy may prove to be an effective one for accurate and efficient transmission of information in NSP-SP dyads. Interestingly, the use of Yes/No Confirmations was not repeatedly used by this dyad until the SP's experience in using the VOCA during Condition B, during which a reduction in the length of SP turns was evident.

The type of strategy used by this dyad for successful negotiation of referential conflicts was often that of arbitrary solutions. On a few occasions, the mother initiated an arbitrary solution, which subsequently resulted in a series of Yes/No questions, some of which would hint at taking the NSP's world of reference into account. In all but one instance, the SP initiated the particular strategy utilized and was primarily responsible for the resolution of the referential problem. Oddly enough, despite the arbitrariness of the decision, the arbitrary solutions were correct in all instances. This was due, at least in part, to the fact that the particular maps employed contained referents which were easy to

identify with only one or two referential problems per map. Of interest too, was the observation that particular referential problems resulted in particular strategies or solutions. For example, when more than one road leading to a referent was a possibility, the SP would initiate an Other World's Solution (OWS) (i.e., "Do you have two roads that enter from the other side?"). More than two buildings with the same name resulted in the SP initiating an Arbitrary Solution (i.e., "Ok, I have two, is it the one that is .....). However, if any confusion arose about the name of a particular building (i.e., same building--two different names) the dyad would elect to Abandon (ABAN) any attempt at resolving the conflict. Often, this latter strategy would involve increased time and effort in that the identification of various referents on the map in relation to the intended referent was necessary.

One can speculate that the reason for the various choices in resolution strategy had to do with characteristics inherent to this particular dyad. However, this issue of increased time and effort is a particularly relevant one for NSP-SP dyads. If the amount of perceived effort for accurate transfer of information is too great, then the dyad may choose to resort to non-negotiated strategies, such as Abandonment, or in one of the interactive partners initiating arbitrary decisions agreed upon by the other partner. Of interest for further

investigation, are the types of conflicts which pose particular difficulty for the NSP-SP dyad, and what interactive strategies result in successful negotiation of these conflicts based on Other's World Solutions.

Certain methodological problems inherent in this pilot investigation need to be mentioned. First, the amount of time that elapsed between experimental conditions may have introduced unidentified confounding variables, and may have resulted in a diminished effect of the treatment variable. Second, the number and type of referential problems inherent in each map trial were not systematically controlled resulting in an inability to make comparisons in turn length, number of turns, and in the number and type of Insertion Sequences across all trials. Further investigation controlled for these variables so that any effect of treatment could be demonstrated with greater confidence and accurate comparisons could be made across all trials. Finally, although the pilot investigation demonstrated trends in the data regarding a role-taking effect, it was hypothesized that a more enhanced or greater role-taking effect would be demonstrated by nonfamiliar partners who were also nonfamiliar to the field of AAC and individuals who utilized augmentative systems.

The Current Investigation

Forearmed with results of the pilot investigation, the current study employed college-level female students

majoring in Communication Disorders as SPs with no prior training and clinical experience in the field of AAC. These students were matched with three school-aged male adolescents (and one adult, age 20), two of which were disabled, and two, able-bodied males posing as nonspeaking persons. This section will provide specifics regarding these subjects, and the specific research questions posed for further research.

Subjects

Speaking partners. Four nonhandicapped adult females, with minimal or no prior experience interacting with AAC users, minimal or no Speech-Language Pathology clinical practice or experience and no coursework in AAC were selected as speaking partners. They volunteered to participate from a pool of undergraduates at the Junior level majoring in Communication Disorders at LSU. The speaking partners were not familiar with their nonspeaking partners, and were selected based on the following criteria:

1) Females, 20-23 years of age.
2) No history of communicative or neurological impairment or learning disability.
3) Normal vision (corrected or uncorrected).
4) Normal hearing based on audiological screening.
5) Native English speakers.
6) Minimal or no prior experience in interacting with an individual using an augmentative communication system.
7) No clinical experience with speech-language disorders.
8) 95-100% accuracy on identifying letters, numbers, and words spoken by the device.

9) Passed all pre-treatment training tasks on the device and vocabulary items.

Handicapped, school-aged partners. Two motorically handicapped, school aged males who were diagnosed with cerebral palsy volunteered as subjects for this investigation. These handicapped individuals had limited, if any, experience in interacting with a voice output communication aid. The participants were selected based on the following criteria:

1. Males, school age (14-21 years).
2. No history of developmental delay or learning disability based on medical and school records and parent interview.
3. Normal vision (corrected or non-corrected) or history of visual processing deficits.
4. Normal hearing (corrected or non-corrected) or history of auditory processing deficits.
5. Native English speakers.
6. Performance on or near grade level in school subjects according to school records, parent and teacher report.
7. Utilizes complete and complex sentences in interacting using current mode of expression.
9. Can adequately use finger point for accessing VOCA and performs with 95-100% accuracy on pre-experimental device training tasks.

Subject 1, T.B., was 16 years old and was a sophomore in high school. He was diagnosed with mild-moderate athetoid cerebral palsy. T.B. was ambulatory, yet required a walking cane for assistance. His vision was aided by glasses and hearing acuity was within normal limits.

T.B. expressed himself primarily through vocalizations, gestures, and facial expressions. He was often unintelligible to those not familiar with him,

however, quite intelligible to familiar listeners. He had a strong command of language, used and understood a wide repertoire of words, and was capable of conversing on a range of subjects. T.B. demonstrated appropriate use of pragmatic communication strategies for initiating, maintaining, and terminating conversation.

T.B. was familiar with voice output electronic devices and had hands-on experience with a few devices, yet had not had long term exposure nor had one been prescribed for his use. T.B. had been prescribed a laptop computer with rate enhancement software (i.e., "Keywhiz" by Words + Inc.) as a written language system, since his writing was essentially unintelligible. T.B. had been using this written system for approximately 2 years.

According to the Basic Reading Inventory, T.B. was reading independently at the eighth grade level in terms of reading comprehension and sight word recognition. According to teacher and parent report and school records T.B. was an exceptional student and functioning on grade level in all school subjects.

P. W. , Subject 3, was 20 years of age and had been diagnosed with mild-moderate athetoid cerebral palsy. Visual and hearing acuity were within normal limits. P.W. had received a diploma from high school and had taken a few college credit courses at LSU yet was not working towards a major. P.W. was ambulatory although needed manual

assistance in going up and down stairs, climbing in vehicles and so forth. P.W. primarily communicated via vocalizations, gestures, and facial expressions. He was intelligible to familiar persons, but generally not those who were unfamiliar with his speech patterns. P.W. had used an alphabet board at one time, however, said that he preferred to "speak on his own." P.W. was familiar with electronic voice output aids but had not used any for communicative purposes. P.W. also had a strong mastery of language and could talk on a range of topics. His ability to initiate, maintain, and terminate conversation was normal. According to the Basic Reading Inventory, P.W.'s independent reading ability was at the ninth grade level.

Nonhandicapped, school-aged partners. Two nonhandicapped school-age males ages 16 and 20 years, with no prior experience in interacting with an individual on an AAC system, were selected from a list of possible subjects from local or surrounding area school systems. The school-aged students served as the nonspeaking partner's for Dyads 2 and 4 throughout the course of the study. The reasons for the inclusion of nonhandicapped subjects in this study was to present empirical evidence as to whether nonhandicapped subjects and their speaking partners interacted in a similar fashion as disabled nonspeaking partners and their speaking partners.

The participants were selected based on the following criteria:

1. Males, 14-21 years of age.
2. No history of communicative or neurological impairment or learning disability.
3. Normal vision (corrected or non-corrected).
4. Normal hearing based on audiological screening.
5. Native English speakers.
6. Performance at grade level in all school subjects.
7. No prior experience in interacting with an individual who utilizes an AAC system for communication.
8. 95-100% accuracy on pre-experimental device training tasks.

Each subject was paid $5.00 per hour for his/her participation in the study. Table 6 provides descriptive information for each subject.

Table 6
Subject Description.

Dyad	Member	Initials	Age	Gender	Dis/Nondis	Education
1	NSP	T.B.	16	M	Disabled	Soph/ HS
	SP	P.P.	21	F	Nondis	Jr/ College
2	NSP	D.O.	16	M	Nondis	Soph/ HS
	SP	K.W.	20	F	Nondis	Jr/ College
3	NSP	P.W.	20	M	Disabled	Equiv/ College
	SP	H.B.	23	F	Nondis	Jr/ College
4	NSP	J.J.	20	M	Nondis	Jr/ College
	SP	J.C.	23	F	Nondis	Jr/ College

Specific Research Questions

Based on results of the pilot investigation and earlier studies the research questions posed were as follows:

1. Does providing SPs with experience in interacting with a VOCA, coupled with the NSP listening to a VOCA, result in different and more effective interactional management strategies in terms of accuracy and efficiency. Specifically, does the dyad employ:
   A. An increase in rate enhancement techniques as measured by change in the amount and type of Insertion Sequences and/or change in number of turns, turn length, and MFE length.
   B. A decrease in the frequency and/or length of Message Reformulation Episodes.
   C. What types of interactional management strategies are facilitative during information transfer tasks and while resolving referential conflicts?
2. Is there a difference in the interaction of dyads utilizing disabled, nonspeaking individuals with a VOCA versus dyads utilizing able-bodied individuals with a VOCA who are posing as nonspeaking persons?

Footnotes for Chapter III

1. Yule (1992) utilized a similar map task in his studies of nonnative speakers, although his communicative outcomes were described under the following definitions: No Problem, Unacknowledged Problem, Abandon Responsibility, Arbitrary Solution, Sender's and Receiver's World Solution. The names and definitions of these communication outcomes were modified for the purpose of this investigation with NSP-SP dyads and with the NSP as the speaker during the task.

RESULTS

The primary question under investigation was whether experience with a communication device would induce the development and use of more effective interactional management strategies. Within the information transfer task used in this study, efficacy is defined with respect to whether the agreed upon referents and routes were accurate and whether this accuracy was achieved in an efficient manner requiring least amount of effort (Clark & Wilkes-Gibb, 1986). Accurate completion of the task in the most efficient manner possible is typically considered ideal. However, these dimensions sometimes work against one another in as much as accuracy involves specificity and detail while efficiency involves decreased detail, fewer words, and generally fewer turns. Interactions were examined for an increased use of Insertion Sequences that promoted accuracy and efficiency. Efficacy was also considered to include the roles assumed by each participant based on their underlying communicative goals, motivations, and perceptions (i.e., their internal dispositions). Based on postexperimental interviews and observations of subject behaviors during experimental sessions, an attempt was made to define the internal dispositions of each subject that affected interactive behaviors.

A second focus of efficacy of the training method was its effect upon communication failures. Communication

failures were operationalized in terms of Message Reformulation Episodes (MREs). A discussion of the participants' attempts to repair communicative breakdowns is presented, along with quantitative changes in the number and length of MREs.

Third, the specific types of interactional management strategies that appeared to result in efficacy for each dyad will be described. These strategies were identified as those which promoted accurate and efficient transfer of information, while taking into consideration the underlying roles of the participants based on their communicative goals, motivations, and perceptions. Additionally, specific descriptions of the strategies resulting in successful solutions to resolving referential conflicts or differences in the maps are presented.

Fourth, the differences noted between dyads incorporating disabled NSPs and able-bodies NSPs are presented. Quantitative analysis of these differences in terms of eye gaze, use of Insertion Sequences, and the SP's use of the VOCA during treatment is provided, along with a qualitative analysis of the various roles assumed by the participants in disabled NSP and able-bodied NSP dyads. The following sections will discuss accuracy of the transfer of information, efficiency of information

transfer, and the participants' interactive roles based on their communicative goals and motivations.

Accuracy

Accuracy in the map task was measured relative to the establishment of appropriate stops, routes, and activities. Table 7 presents the mean frequency of correct agreement on these for each dyad, task, and condition. A mean of 10.0 represented total agreement between partners for all trials in the condition. Stops and routes were counted as in agreement if the receiver's understanding of the stops and the routes was identical to that intended by the sender. Activities were considered in agreement if there were no omissions of words or changes in wording with the exception of omission of [-s] in marking plurals and minimal spelling errors.

As illustrated in Table 7, overall agreement was high for all dyads, ranging from 9.0 to 10.0. As expected, all dyads performed best on transferring the activities, since this task was not complicated by differences in sender-receiver maps. Furthermore, all dyads evidenced slightly better agreement on stops than routes. Overall performance varied slightly between map tasks for all dyads across all conditions. Changes across conditions revealed slight increases in agreement for the posttreatment condition for all dyads, and in particular for Dyads 3 and 4. These slight changes, however, did not appear to be significant

warranting statistical comparisons and were attributed to more familiarity with the task and the interactive partner.

Table 7
Mean Frequency and Overall Mean Frequency of Correct Agreement for All Map Tasks for Each Dyad and Condition.

	Condition			
Map Tasks	A1	B	A2	Overall Mean
		Dyad 1		
Stops	9.60	9.60	9.30	9.45
Routes	9.20	9.60	9.00	9.20
Activity	9.50	9.70	10.00	9.73
Overall Mean	9.40	9.62	9.42	9.46
		Dyad 2		
Stops	10.00	10.00	10.00	10.00
Routes	9.60	10.00	10.00	9.88
Activity	10.00	10.00	9.66	9.88
Overall Mean	9.85	10.00	9.87	9.92
		Dyad 3		
Stops	10.00	10.00	10.00	10.00
Routes	9.30	10.00	10.00	9.77
Activity	9.30	10.00	10.00	9.77
Overall Mean	9.73	10.00	10.00	9.85
		Dyad 4		
Stops	9.50	10.00	10.00	9.85
Routes	9.50	10.00	10.00	9.84
Activity	9.80	10.00	10.00	9.94
Overall Mean	9.57	10.00	10.00	9.87

Note. A mean of 10.0 represents total agreement between partners on the task.

In summary, accurate transfer of information characterized the performance of all of the dyads across

conditions. Thus, all dyads appeared to be operating under the principle that the transfer of information was an important aspect of this task.

Efficiency

Effect of device use upon efficiency of information transfer was evaluated with respect to measures of the number of communicative turns necessary to complete the map tasks, the length of communicative turns in words, and the length of MFEs (defined by number of turns in each MFE).

Number of Turns

More efficient transfer of information is generally characterized by fewer turns with relative stability in turn length, or an increase in number of turns with significant decrease in turn length. Table 8 displays the number of turns taken by the SP and NSP during three map tasks in each condition. In general, each dyad decreased the number of turns taken from the pretreatment baseline to the treatment condition when both members were using communication devices. This decrease in turns occurred for both members of the dyad, not just the SP. The SP in three of the dyads, Dyad 2, Dyad 3, and Dyad 4, maintained a generally lower number of turns during the posttreatment phase, while the SP in Dyad 1 returned to baseline levels. Thus, experience in device use did induce rate enhancement strategies that resulted in fewer turns. However, a decrease in number of Clarifications and Information

Queries as the dyads became more adept in predicting conflicts in the maps was also partially responsible for the decrease in number of turns.

Table 8
Number of Communicative Turns Taken by the Nonspeaking Partner (NSP) and Speaking Partner (SP) in each Dyad in Three Maps During Pretreatment, Treatment, and Posttreatment Phases.

	Pretreatment			Treatment			Posttreatment		
Dyad 1									
NSP	105	136	171	79	72	67	135	131	136
SP	104	122	151	68	58	50	123	120	117
Dyad 2									
NSP	73	45	49	43	45	32	52	31	50
SP	60	46	48	36	39	22	42	28	49
Dyad 3									
NSP	110	95	75	70	61	45	89	77	62
SP	114	81	80	53	52	44	68	64	63
Dyad 4									
NSP	76	51	44	29	51	35	29	40	33
SP	66	45	42	7	28	8	20	29	27

Length of Turns

Efficiency was also expected to be represented by a decrease in the number of words per utterance by the participants. Table 9 shows the mean number of words per turn for both participants under all three conditions. The SPs in all four dyads decreased their turn length to about one half of their previous turn lengths. The NSP's number of words per turn remained relatively the same as baseline measures. Even though the NSPs in two dyads increased in the number of word abbreviations during and after

treatment, this was not evident in the turn length measure since partial words, or abbreviations were included in the whole word count. During the posttreatment phase, the SP in Dyad 1 returned to pretreatment levels, while the SPs in Dyad 2, Dyad 3, and Dyad 4 all showed decreased length of utterance. This decrease in turn length for three of the SPs was attributed to the use of Yes/No Confirmations as a form of rate enhancement on the part of the SPs in Dyads 2 and 3. The SP in Dyad 4 offered minimal participation on map tasks during the treatment and posttreatment phases which accounted for the decrease in number and length of turns. Hence, the decrease in number of turns and turn length resulted in greater efficiency in three of the four dyads.

Table 9
Mean Length of Turns Taken by the Nonspeaking Partner (NSP) and Speaking Partner (SP) in each Dyad in Three Maps During Pretreatment, Treatment, and Posttreatment Phases.

	Pretreatment			Treatment			Posttreatment		
Dyad 1									
NSP	2.0	1.6	1.5	2.6	2.9	2.4	2.3	1.8	1.6
SP	2.9	3.6	3.9	1.5	1.7	1.3	4.5	3.7	4.3
Dyad 2									
NSP	2.9	3.6	3.0	4.1	4.2	5.6	1.6	3.8	3.0
SP	6.9	7.8	4.3	1.3	1.5	1.6	6.7	3.9	3.6
Dyad 3									
NSP	3.1	2.9	3.2	3.3	3.9	4.9	2.5	2.8	2.6
SP	8.1	7.4	7.7	2.4	1.6	2.6	6.2	5.6	5.3
Dyad 4									
NSP	3.6	5.0	3.9	6.4	5.1	5.4	5.2	4.7	4.7
SP	3.9	2.4	5.1	1.3	3.0	2.6	1.6	5.5	2.9

Message Formulation Episodes

One additional measure documenting efficiency quantitatively is the number of turns per MFE across trials and conditions. Table 10 presents these data for each dyad for the pretreatment and posttreatment conditions. Study of the data changes in mean frequency of turns per MFE across trials and conditions reveal that all dyads achieved greater efficiency in the posttreatment condition as compared to the pretreatment condition.

Table 10
Mean Frequency of Turns per Message Formulation Episode (MFE) for Pretreatment and Posttreatment Conditions.

	Trials								
Dyad	Pre Treatment					Post Treatment			
	A1-1	A1-2	A1-3	A1-4	X A1	A2-1	A2-2	A2-3	X A2
1	18.8	10.7	12.8	15.9	14.55	12.5	12.0	11.7	12.0
2	7.7	5.8	4.0	5.4	5.06	4.7	3.2	4.0	3.96
3	8.1	11.3	8.4	7.8	9.17	7.9	6.8	6.4	7.03
4	5.4	7.0	4.7	4.5	5.40	2.3	3.2	3.2	2.90

Note. Performance for A1 Condition represents the last 4 trials in Condition A1 for Dyads 1 and 2.

There was not a linear or successive decrease in the number of mean MFE turns per trial. However, each dyad performed most efficiently on one of the last two map trials, with the exception of Dyad 1, whose performance in trial 3 (A1-2) represented the smallest number of turns per MFE.

Accuracy and Efficiency: Insertion Sequences

The type and frequency of Insertion Sequences promoting accuracy and efficiency were used as a critical quantitative and qualitative measures in documenting changes in the strategies used by the participants. In addressing research question #1 further, this section will offer the frequency and type of Insertion Sequences for each dyad, along with descriptive comparisons across experimental conditions.

Insertion Sequences Promoting Accuracy

A small set of Insertion Sequences (IS) appeared to be primarily responsible for, or facilitative towards, accurate transfer of information across all dyads. Although the greater burden for accurate transmission of information fell with the SPs (receiver) since they were better able to assess comprehension, the NSP's (sender's) delivery of specific and accurate information was deemed necessary as well. Typical Insertion Sequences, and patterns of behaviors for both interactive partners are presented in Table 11.

A general pattern of Insertion Sequences emerged. The task often began with the NSP providing a standard verb phrase (e.g., "Go to g-r-o-c-e-r-y"). Frequently, however, the NSP may have then provided additional information, especially if it was perceived that

identification of the referent was premature or insufficient. The additional information typically consisted of either providing specifics (CLAR-NSP) regarding the route or basic location (e.g., "Go s-o-u-t-h to i-n-t-e-r-s-e-c-t-i-o-n then n-o-r-t-h"), or the NSP

Table 11
Insertion Sequences (IS) Primarily Responsible for Accurate Transfer of Information.

Nonspeaking Partner (Sender)	Speaking Partner (Receiver)
1. Information Queries (IQ-NSP)	1. Word and Message Level Repetitions (WLR and MLR)
2. Clarifications (CLAR-NSP)	2. Word and Message Level Confirmation Queries-Repetition (WCQ-R and MCQ-R)
	3. Direct and Indirect Confirmations (CONF and IND CONF)
	4. Information Queries (IQ-SP)
	5. Clarifications (CLAR-SP)

Note. Definitions and examples of these IS's are found in Appendix B.

would ask a general question or query the SP as to where the location was on her map (IQ-NSP) (e.g., "Where is g-r-o-c-e-r-y?" or "Where are you?") prior to the presentation of stops or routes.

In turn, the SP (receiver) would confirm acceptance directly (CONF), or indirectly (IND CONF) by remaining silent and allowing the NSP to continue. However, if the initial phrase was judged by the SP to be insufficient, she

might initiate a repair (e.g., "Where?"), expand on or query for additional information (IQ) (e.g., "You mean the hospital next to the park?") and/or provide the NSP with information regarding her map (CLAR-SP). This process of clarification, acceptance, and query by both partners continued until a mutually accepted form of interaction was reached. At this point, the SP (receiver) might repeat the entire word or phrase as a means of confirming that the information is correct (WLR, MLR, WCQ-R, MCQ-R).

Each dyad and partner varied as to the number and types of Insertion Sequences used throughout this process of establishing shared routes and referents. Patterns of interaction for accurate transmission of information will be described for each dyad, followed by performance comparisons across all dyads and a summary of results relevant to the accuracy parameter.

Dyad 1 (T.B. - P.P). Throughout the pretreatment condition (trials 1-6) the SP (receiver) demonstrated a greater number of ISs relating to accuracy than the NSP (sender). On most occasions, the NSP partner presented a general verb phrase (e.g, "Go to f-l-o-r-i-s-t) and the SP generally asked for specifics (e.g., "Ok, next to the hospital?"). Thus, there was a large number of Information Queries (IQ-SP) throughout condition A1, as depicted in Table 12. Upon recognizing conflicts between the maps, the SP generally flagged the NSP by describing her map (e.g.,

"OK, I have two of those, one next to the church and the other by the park") resulting in a range of 3-12 Clarifications (CLAR-SP) made by the SP throughout this condition. Also of note, is the large number of repetitions, particularly Message Level Repetitions,

Table 12
Total Frequency of Insertion Sequences That Promote Accuracy Across All Conditions for Dyad 1.

Insertion Sequences	Trials											
	1	2	3	4	5	6	7	8	9	10	11	12
WLR	7	5	5	3	6	5	0	0	0	5	2	2
MLR	20	24	24	8	7	19	0	0	0	16	7	9
PMLR	0	3	2	0	0	0	0	0	0	0	0	0
WCQ-R	2	9	12	1	5	1	0	0	0	3	2	2
MCQ-R	14	6	7	5	6	3	0	0	0	5	7	1
PMCQ-R	0	0	0	0	0	0	0	0	0	0	0	0
CONF	24	14	14	16	9	3	8	11	17	15	7	11
IND CONF	3	1	1	2	1	0	11	7	4	1	3	2
IQ-SP	23	23	22	9	12	10	7	4	1	26	10	14
IQ-NSP	1	0	0	5	0	0	0	0	2	2	3	7
CLAR-NSP	5	7	0	1	0	0	4	3	3	1	0	0
CLAR-SP	7	12	3	5	4	5	2	1	2	1	5	1

Note. All of the codes for Insertion Sequences listed are defined in Appendix B.

as the SP double-checked for accuracy by repeating the entire utterance produced by the NSP. Along with these repetitions, she readily and directly confirmed (CONF) each NSP contribution. The use of repetitions as a confirmation strategy varied, however, with a marked decrease in number of repetitions in trials 4 and 5. It was noted that the SP appeared to become more content with

confirmation alone. However, the NSP did ask her to repeat at times and made the comment during the final interview that he preferred her to repeat the utterances as a way of assuring accuracy of the information transferred.

During the treatment condition (trials 7-9) the SP rarely used the Touchtalker to communicate so there was a marked decrease in the number of SP Information Queries (IQ) and Repetitions (MLR). The SP directly confirmed with head nods and "uh-huhs", although a marked increase in Indirect Confirmations (IND CONF) was noted. There was a slight increase in the number of Clarifications used by the NSP (CLAR-NSP), but these were not acknowledged. Thus, during this condition more disagreement occurred in that the NSP didn't always provide specifics and the SP rarely asked for them except when conflicts occurred.

In the posttreatment condition (trials 10-12) there was a marked increase in Message Repetitions, Information Queries, and Confirmations; although the frequency of these did not reach pretreatment levels. Throughout all conditions, the NSP provided the SP with an identifying number of each current location and activity. This facilitated accuracy and reduced possible occurrences of message reformulations. As a general rule, however, this dyad was the least meticulous about accurate information, as evident in their slightly lower frequency of agreement across all map trials. This was certainly true in terms of

map routes. These routes were never mentioned or confirmed. Instead, attention was focused on the next location. Additionally, the names of locations took precedence over routes when confusions between the two arose. One final observation is that the NSP in this dyad often utilized analogous referents in referring to locations along the map. For example, he would begin with "We b-u-y U-S-A" in reference to "Walmart," or "rab" in referring to the "minister," as a means of making the task a "communication game" and "livening up" the situation. Although possibly adding interest to the task, these analogies required greater effort and specificity on the part of the SP, resulted in more turns, and increased the chances that the SP would misunderstand the referent.

Dyad 2 (D.O. - K.W.). On the first few map trials, Dyad 2 was extremely careful about attending to detail. This was primarily due to the NSP (sender). The dyad established agreement of the cardinal directions (i.e., which directions represented north, south, east, and west) as well as left and right. The NSP also provided specifics for routes "on" and "off" the map (e.g., "s-t-a-r-t o-n t-h-e l-e-f-t s-i-d-e o-f t-h-e m-a-p n-e-a-r h-a-t-s"), and double checked routes and activities upon map completion. Note the high level of Clarifications by the NSP (CLAR-NSP) on trials 1 and 2 in Table 13, most particularly for trial 2. Additionally, the SP (receiver) directly confirmed each

contribution and asked for specifics if necessary (IQ), particularly during conflicts between the maps. The number of Message Level Repetitions (MLR) increased markedly in trials 2 and 3 as the NSP requested that the SP repeat each activity once it was delivered. At the beginning

Table 13
Total Frequency of Insertion Sequences That Promote Accuracy Across All Conditions for Dyad 2.

Insertion Sequences	Trials										
	1	2	3	4	5	6	7	8	9	10	11
WLR	0	0	1	1	0	0	0	0	0	0	0
MLR	0	10	15	0	6	0	0	0	1	4	2
PMLR	0	5	6	0	2	0	0	0	0	1	1
WCQ-R	0	1	0	0	1	0	0	0	0	1	0
MCQ-R	0	5	3	2	5	0	0	0	2	1	1
PMCQ-R	0	3	0	0	0	0	0	0	0	0	0
CONF	22	29	12	20	20	21	18	17	19	14	20
IND CONF	5	0	0	1	0	4	4	4	0	3	2
IQ-SP	7	16	26	17	7	7	10	1	18	10	8
IQ-NSP	2	0	0	0	0	1	2	0	0	0	0
CLAR-NSP	14	42	3	9	8	10	11	12	4	0	1
CLAR-SP	4	5	4	8	9	1	0	0	1	1	2

Note. All of the codes listed are defined in Appendix B.

of trial 3, however, this pattern changed as the NSP became less meticulous about providing details in his initial presentations (decrease in CLAR-NSP) and allowed the SP to ask for specifics if needed (increase in IQ). This pattern was consistent for the remainder of the pretreatment condition. By map trial 3, the NSP was more astute regarding the routes and locations that would

probably require more specification and detail. Hence, a pattern emerged (particularly in trials 4 and 5) in which the NSP would provide specifics on long or detailed routes and would allow the SP to clarify on easier routes if needed. This pattern was responsible for the near equal number of CLAR-NSP and CLAR-SP in trials 4 and 5. These partners frequently established shared referents based on the mutual acceptance of prior referents and the elimination of non-probable referents.

During the treatment condition (trials 6-8) the NSP once again provided more initial detail, and thus, the increase in CLAR-NSP as compared to CLAR-SP. The SP's contributions to accuracy during this condition were almost entirely in the form of Direct Confirmations (CONF), although she did not hesitate to use the device for querying (IQ) about information when conflicts arose. This, in combination with the NSP's specificity in the initial presentation, allowed the partners to maintain accuracy despite the SP's lessened contributions during this condition. It was observed that there was an increase in eye gaze as a means of confirming or showing confusion between both partners during the condition.

Upon initiation of the posttreatment condition (trials 9-11) the pattern changed once again with the NSP providing a standard verb phrase (i.e., "Go to ___") and the SP asking for information (IQ) on most of the routes and

locations. Although repetitions of utterances were again provided, they were few in number. Throughout all conditions, the NSP required the SP to confirm and asked for confirmation if it was not given.

Dyad 3 (P.W. - H.B). On map trial 1 in the pretreatment condition (trials 1-4), note the typically high number of SP (receiver) Clarifications (CLAR-SP) and Information Queries (IQ) in Table 14. In this trial the

Table 14
Total Frequency of Insertion Sequences That Promote Accuracy Across All Conditions for Dyad 3.

Insertion Sequences	Trials									
	1	2	3	4	5	6	7	8	9	10
WLR	0	0	1	0	0	0	0	0	0	0
MLR	0	9	4	0	1	0	0	4	4	5
PMLR	0	0	0	0	0	0	0	0	0	0
WCQ-R	0	0	0	0	0	0	0	0	0	0
MCQ-R	0	4	4	0	0	0	0	3	0	0
PMCQ-R	0	3	0	0	0	0	0	0	0	0
CONF IND	23	32	30	26	30	31	24	26	24	24
CONF	0	0	0	0	0	0	0	0	0	0
IQ-SP	24	38	25	31	7	3	4	5	12	2
IQ-NSP	1	6	1	9	6	1	4	3	4	3
CLAR-NSP	6	22	17	18	14	26	15	23	11	6
CLAR-SP	15	22	6	16	8	4	4	7	8	4

Note. All of the codes listed are defined in Appendix B.

speaking partner was primarily responsible for specificity and clarification on locations and routes. Once familiar with the task and the information needed by the SP, the NSP responded with more specific instructions and directions.

Beginning with trial 2, both partners contributed equally to Clarifications (CLAR-NSP and CLAR-SP) and informing the other regarding specifics about their maps, although the SP Clarifications reduced to 6 in map trial 3. Of interest is the NSP's use of Information Queries in asking the SP about her map before presenting the initial noun phrase (IQ-NSP), particularly in map trials 2 and 4. This is illustrated in the following example:

NSP: < <clear> what is b-e-s-i-d-e//>
SP: // "What is beside what?"
NSP: <r-e-a-l //>
SP: "Real estate. Ok, across the street is a loan building and further south is a grocery store and across the street from it is a park."
NSP: <go s-o-u-t-h to g-r-o-c-e-r-y <speak> go south to grocery>
SP: "Ok, I'm at the grocery now."
NSP: < <clear> t-u-r-n r-i-g-h-t <speak> turn right>
SP: "Ok, so I'm heading in a east direction"
NSP: (nods) <where are you> (gaze at SP)
SP: "When I take a right, on the left side is a church and behind the church is a park."

[Map trial 2; MFE 3]

This strategy of using information queries proved to be beneficial in learning about the SP's map and determining when specifics were needed. In subsequent trials, however, the SP tended to provide the NSP with unsolicited details regarding her map and this reduced the number of NSP information queries. Message Repetitions were occasionally requested by the NSP to assure agreement on tasks, particularly during trial 2.

During the treatment condition, the number of clarifications on the part of the NSP significantly increased with a corresponding decrease in SP Clarifications. However, the SP continued to actively confirm the NSP's contributions and did not hesitate using the device for Information Queries and Clarifications when needed.

A different pattern emerged in the posttreatment condition that was related to the SP's dramatic increase in Yes/No Confirmations, creating a marked increase in speed and efficiency. This strategy will be discussed in the next section. In general, the use of Yes/No Confirmations was responsible for the decrease in SP Clarifications and Information Queries (in relation to the pretreatment condition). The NSP's frequency and use of clarifications was reduced, yet similar to that prior to treatment. In addition, the NSP occasionally requested SP Message Repetitions after treatment, as a means to satisfy his sensitivity for accuracy and detail.

Dyad 4 (J.J. J.C.). The NSP in Dyad 4 consistently provided specific directions (e.g., up/down, east/west, left/right) from the beginning. Hence, the high level of NSP Clarifications (CLAR-NSP) across all conditions noted in Table 15. The SP typically responded with Direct Confirmations or Information Queries, particularly in the pretreatment condition. The NSP's Clarifications, along

with the SP's queries resulted in accurate agreement between the maps. On the initial trials, the NSP readily learned from the SP's queries about the type and amount of specificity needed for mutual understanding and became adept at presenting the amount of appropriate detail in the initial presentation. Often, he would present only one

Table 15
Total Frequency of Insertion Sequences That Promote Accuracy Across All Conditions for Dyad 4.

Insertion Sequences	Trials									
	1	2	3	4	5	6	7	8	9	10
WLR	0	0	1	0	0	0	0	0	0	0
MLR	0	2	0	0	0	0	0	0	2	0
PMLR	0	0	0	0	0	0	0	0	0	0
WCQ-R	0	2	0	0	0	0	0	0	2	0
MCQ-R	2	0	0	1	0	0	0	0	1	0
PMCQ-R	0	0	0	0	0	0	0	0	0	0
CONF	25	33	30	22	7	18	2	10	12	19
IND CONF	1	3	3	0	20	18	19	10	10	7
IQ-SP	9	13	6	13	1	4	0	2	5	5
IQ-NSP	2	1	1	1	1	1	0	0	0	0
CLAR-NSP	18	20	20	13	9	23	11	13	15	16
CLAR-SP	6	2	1	2	0	1	1	0	3	1

Note. All of the codes listed are defined in Appendix B.

instruction at a time. That is, rather than spelling out "g-o r-i-g-h-t to i-n-t-e-r-s-e-c-n, then up and t-a-k-e a l-e-f-t," he presented each of these directions individually "g-o r-i-g-h-t to i-n-t-e-r-s-e-c-n," (pause) "go up" (pause) "t-a-k-e a l-e-f-t." This appeared to

facilitate the SP's comprehension of the route and of the device.

During the treatment condition (trials 5-7) the SP participated even less, with minimal Information Queries and Clarifications. Most of her contributions to the process were Direct and Indirect Confirmations, which suggested primarily passive acceptance (e.g., sitting up and putting her pen down). Both partners were comfortable with her limited participation. She would flag conflicts to the NSP with her device, yet often appeared to figure them out on her own based on the information given by the NSP. Accuracy and agreement, then, was achieved by the NSP through the use of detail and specificity in his initial presentations. Consequently, the SP had little need to ask for further information, particularly after the NSP became familiar with differences in the two maps.

Summary of insertion sequences promoting accuracy.

Overall, each dyad was effective in the transmission of accurate information on each map task and throughout experimental conditions. Their ability to reach a common agreement with the inclusion of specificity and detail improved, as noted by the slight increase in agreement for the posttreatment condition. This increase was attributed to task familiarity, familiarity with the types of map differences or conflicts, and familiarity with the interactive partner. Despite the general trend of less SP

participation while using a communication device, accuracy was not adversely affected. Participants shared the responsibility accordingly by collaboratively adjusting their contributions in accordance with the constraints imposed upon them and the contributions of their communicative partner.

Throughout all trials and conditions, it was apparent that the strategies used represented a negotiation of meaning between the two partners and mutual problem solving. When the NSP did not provide specifics initially, the SP cooperated with the NSP in carrying the burden of information transfer and guessed, provided clarifications or asked for specifics when needed. When the SP did not ask for or provide specifics, particularly during the treatment condition, the NSP provided more detail in his initial presentation or gave more clarification. Hence, each partner influenced the other in terms of choice of strategy as both partners' strived for accuracy.

Throughout baseline, general trends in the interactive behaviors of the participants emerged. The data indicated a predictable interactive pattern between participants in terms of frequency and type of Insertion Sequences by the third map trial. This indicated familiarity with the task and that the interactive partners had negotiated an agreeable pattern for transfer of information. As predicted, data analysis indicated that behaviors

relatively stabilized after the second trial and continued to remain relatively stable through the baseline condition. This was particularly true for the types of Insertion Sequences used by the participants. The amount or frequency of Insertion Sequences generally varied between 2 and 10 data points throughout map trials and experimental conditions. This variance in the interactive patterns can be attributed to the amount of responsibility assumed by each partner in defining and describing specifics. An additional reason for this variance in interaction was that the senders and receivers attempted to minimize collaborative effort. The reduction of effort accounted for changes in the Insertion Sequences that promote efficiency and will be discussed next.

Insertion Sequences Promoting Efficiency

It has been hypothesized that the SP's interactive use of a device will result in effective interactional management strategies primarily by triggering rate enhancement techniques on the part of the NSP-SP dyad. The increased use of rate enhancement strategies in the posttreatment condition has already been documented in terms of number of turns, turn length, and MFE length in three of the four dyads. In order to examine this possible effect further, the interactive patterns of each dyad will be examined in terms of the types and frequency of Insertion Sequences found to promote more efficient

interaction, and in the number of abbreviated words or messages utilized in pretreatment and posttreatment conditions. These Insertion Sequences are listed in Table 16.

This set of Insertion Sequences is not meant to include all interactive behaviors that were responsible for efficiency. For example, in two dyads, the NSPs' continual use of Clarifications (CLAR-NSP) served as a rate enhancement strategy by avoiding additional turns. Where a particular type of Insertion Sequence results in accuracy and efficiency, (i.e., when an Insertion Sequence primarily responsible for accuracy also results in efficiency), the particular behaviors of the dyad will be described. Off-task turns (OT-T) and Sequences (OT-S) initiated by either partner were tallied as well,

Table 16
Insertion Sequences Primarily Responsible for Efficient Transfer of Information.

Nonspeaking Partner	Speaking Partner
1. Word and Message Level Guess-Solicited (WLG-SOL, MLG-SOL).	1. Word and Message Level Guess-Nonsolicited (WLG-NON, MLG-NON)
2. Word and Message Level Confirmation Queries Guess- Solicited (WCQ-G-SOL, MCQ-G-SOL)	2. Word and Message Level Confirmation Queries-Nonsolicited (WCQ-G-NON, MCQ-G-NON)
	3. Yes/No Confirmations (Y/N)

Note. Definitions and examples of these Insertion Sequences is found in Appendix B.

since these often impede the rate enhancement process and task completion.

Dyad 1 (T.B.-P.P). In map trial 1, the SP immediately guessed locations and activities. This resulted in the high level of Nonsolicited Guesses (see Table 17). These nonsolicited Word and Message Level Guesses by the SP continued throughout the pretreatment condition (trials 1-6).

Table 17.
Total Frequency of Insertion Sequences That Promote Efficiency and the Number of Word Abbreviations (ABREV) per Trial for Dyad 1.

Insertion Sequences	Trials											
	1	2	3	4	5	6	7	8	9	10	11	12
WLG-NON	10	6	6	5	4	7	6	4	6	1	7	2
WLG-SOL	3	7	4	6	6	5	2	2	6	2	14	12
MLG-NON	1	2	6	3	3	1	3	3	1	2	0	3
MLG-SOL	0	1	3	0	1	11	2	0	1	3	4	5
WCQ-G-NON	13	20	16	13	22	25	0	0	0	11	9	8
WCQ-G SOL	2	8	15	5	19	25	3	1	0	15	11	9
MCQ-G-NON	12	12	13	0	5	3	0	0	0	3	4	3
MCQ-G SOL	5	6	11	0	6	8	0	0	0	4	10	7
Y/N	0	2	0	0	2	8	2	0	0	0	2	5
ABREV	0	0	0	0	0	0	0	0	0	0	0	0

Note. All of the codes listed are defined in Appendix B.

Solicited guesses generally increased as well, as the NSP utilized mime, hand gestures, and facial expressions to promote and initiate guessing by the SP. On map trials 3, 5, and 6 the NSP elicited multiple guesses from the SP

(WCQ-G SOL), often without providing confirmation or information about her guesses. The SP would flag her level of confidence regarding her ability to guess by occasionally requesting that the NSP use the device, as illustrated below by the SP saying "just go on from there":

NSP: <<clear> m-e-e-t your r-e//>
SP: "meet your real estate agent?"
NSP: (nods) (gestures her to continue to guess)
SP: "meet your real estate agent, just go on from there [in using the device]" (looks down at paper)
NSP: <w-h-o>
SP: "who?"
NSP: <will h-e-l//>
SP: "help?" (gaze at NSP)
NSP: (nods) (motion to continue to guess)
SP: "who will help you"
NSP: (motions to continue)
SP: "buy"
NSP: (motions to continue)
SP: "Is that right, buy?"
NSP: (motions to continue)
SP: "a house"
NSP: (nods)

[Map 2; MFE 2]

Guessing was the only form of rate enhancement used by this dyad throughout all conditions, with the exception of a series of Yes/No Confirmations in trial 6 and again in trial 12. The NSP in this dyad initiated several Off-Task sequences and turns ranging from 2 to 4 occurrences per map trial in the pretreatment condition, 3-10 in the treatment condition and 3-5 in the posttreatment condition. The off-task behaviors interfered with the natural flow of the interaction, in as much as the dyad had to re-establish topic and reference.

In the treatment condition (trials 7-9), the number of guesses (i.e., in the form of Word Confirmation Query-Guess) significantly decreased due to SP's limited use of the Touchtalker. During this condition, the NSP attempted to solicit guesses to no avail, and finally discontinued these solicitations by the end of map trial 7. Occasionally, the SP would indicate to the NSP (through hand motions and head nods) that she understood prior to his completion of the word or utterance. However, this occurred no more than six times per trial during the treatment condition.

Guessing increased once again during the posttreatment condition (trials 10-12) and in particular, solicited guessing. The NSP appeared relieved that the SP would once again attempt to guess, even to the extent of being unrealistic about what may constitute sufficient shared knowledge. The number of posttreatment guesses did not significantly increase in comparison to the pretreatment condition, however, because the SP would reject solicited guesses particularly when multiple solicited guesses. In fact, guessing decreased in Condition A2.

Based on these data, device practice by the SP did not appear to facilitate an increase in rate enhancement techniques. Dyad 1 maintained the same pattern of interactive behaviors and nearly the same number and type of Insertion Sequences as in the pretreatment condition.

In fact, fewer rate enhancement techniques were noted after the treatment condition. In the postexperimental interview, the SP mentioned that she felt that multiple guessing was impeding task completion, since she was not able to guess correctly based on the lack of sufficient information given by the NSP, resulting in an increase in turns, and MFE length, and rejection of repeated solicited guesses by the SP.

Dyad 2 (D.O.-K.W.). Few rate enhancement strategies were utilized by Dyad 2 in the pretreatment condition. The number of word abbreviations used by the NSP began to increase in trial A1. However, these remained minimal (see Table 18). During the postexperimental interview the SP

Table 18
Total Frequency of Insertion Sequences That Promote Efficiency and the Number of Word Abbreviations (ABREV) per Trial for Dyad 2.

Insertion Sequences	Trials										
	1	2	3	4	5	6	7	8	9	10	11
WLG-NON	0	2	0	0	1	0	0	1	2	2	1
WLG-SOL	0	0	0	0	0	0	0	1	1	0	0
MLG-NON	0	0	0	0	0	0	0	0	0	1	0
MLG-SOL	0	0	0	0	0	1	0	0	0	0	0
WCQ-G-NON	0	0	1	0	0	0	0	0	0	1	0
WCQ-G SOL	0	0	0	0	0	0	0	0	0	0	0
MCQ-G-NON	0	1	1	0	0	0	0	0	0	0	0
MCQ-G SOL	0	0	0	0	0	0	0	0	0	0	0
Y/N	0	0	3	0	0	0	0	0	7	3	15
ABREV	0	1	3	2	4	15	10	22	26	20	16

Note. All of the codes listed are defined in Appendix B.

stated that she felt it was "impolite to interrupt" while the NSP was typing out the utterance. Thus, only a few instances of guesses were noted throughout all trials.

During the treatment condition, there was a marked increase in the number of word abbreviations made by the NSP. These abbreviations often represented locations and specific directions for routes as evident in the following example:

NSP: <<clear> g-o t-o h-a-r-d-w-a-r-e <speak> go to hardware>
SP: (on device) <how>
NSP: <<clear> w-t-n-t-i-e <speak> w-t-n-t-i-e> (gaze at speaking partner)
SP: (pause > 2 sec)
NSP: w- (gaze at speaking partner)
SP: (nods) "w-e-s-t" (gaze at nonspeaking partner)
NSP: (nods) < I i-s i-n-t-e-r-s-e-c-t-i-o-n>
SP: (nods)
NSP: <<clear> t i-s t-h-e-n>
SP: (nods) <Then n is n-o-r-t-h?">
NSP: (nods) <w-i-n-i-e h-a-r-d-w-a-r-e <speak> w-i-n-i-e hardware (gaze at SP)
SP: (nods) "uh-huh"

[Map trial 6; MFE 11]

The use of word abbreviations by the NSP continued to increase in the posttreatment condition, particularly on referents already established. Additionally, there was a marked increase in the number of Yes/No Confirmations by the SP immediately following the treatment condition that continued throughout the posttreatment condition. This dramatic increase in Yes/No Confirmations was indicative of an increased awareness by the SP regarding the laborious

process of typing out all utterances on the device. As stated by the SP in the interview: "I now understand how long it takes to type out something."

Dyad 3 (P.W.-H.B.). The Insertion Sequences responsible for rate enhancement in Dyad 3 can be observed in Table 19. Note that in Condition 1 (trials 1-4) few forms of rate enhancement were utilized. The SP continued to guess, despite the discouragement of the NSP's continuing to type out all utterances. Additionally, a few occurrences of Yes/No Confirmations were evident in pretreatment trials. Immediately following treatment, there was a marked increase in the SP's use of Yes/No Confirmations. Often, she would predict what the

Table 19
Total Frequency of Insertion Sequences That Promote Efficiency and the Number of Word Abbreviations (ABREV) per Trial for Dyad 3.

Insertion Sequences	Trials									
	1	2	3	4	5	6	7	8	9	10
WLG-NON	0	0	0	0	0	0	0	0	0	0
WLG-SOL	0	2	0	0	0	0	1	0	0	0
MLG-NON	0	2	3	1	0	0	0	1	0	0
MLG-SOL	0	0	0	0	2	0	0	0	1	0
WCQ-G-NON	2	5	2	0	0	0	0	1	0	1
WCQ-G SOL	0	1	0	0	0	0	0	0	0	0
MCQ-G-NON	0	1	6	2	0	0	0	0	1	1
MCQ-G SOL	0	0	0	0	0	0	0	0	0	0
Y/N	2	0	2	3	0	0	0	18	17	31
ABREV	0	0	0	0	0	0	0	0	0	0

Note. All of the codes listed are defined in Appendix B.

NSP was going to present and ask him Yes/No questions prior to the presentation as illustrated below:

NSP: <go on up to>
SP: "The first horizontal?"
NSP: (nods)
SP: "Then I go south when I get the vertical?"
NSP: (nods)
SP: "Then I go to McDonalds?"
NSP: (nods) <where is it>
SP: "It's on the second vertical road across the street from the frozen yogurt."
NSP: (nods)

As stated by the SP in her postexperimental interview, "the use of questions was the only way he would let me guess." Additionally, the SP expressed her frustration with the slow rate of interaction during the treatment condition. Hence, this form of rate enhancement was determined to be a result of the SP's interactive use of the Touchtalker. One other notable observation is that the NSP consistently used the word vocabulary programmed in the device. The use of entire words served as a form of rate enhancement as well since all words did not have to be spelled. This particular NSP had a good memory for the items programmed in the device, probably since he had similar experiences throughout his life.

Dyad 4 (J.J.-J.C.). In Table 20, note that Dyad 4 evidenced few rate enhancement Insertion Sequences. The SP guessed on words and messages, although her occurrences of doing so are minimal. In the treatment condition only, rate enhancement was not used with the exception of word

level abbreviations by the NSP for frequent terms used such as "intersection" (abbreviated as "i-n-t-e-r-s-e-c-n") and "right" (r-i-t-e). Although the use of this form of rate enhancement began and peaked during the treatment condition, the number of abbreviations used were limited

Table 20
Total Frequency of Insertion Sequences That Promote Efficiency and the Number of Word Abbreviations (ABREV) per Trial for Dyad 4.

Insertion Sequences	Trials									
	1	2	3	4	5	6	7	8	9	10
WLG-NON	1	1	0	0	0	1	1	1	1	0
WLG-SOL	0	0	0	0	0	0	0	0	0	0
MLG-NON	1	4	0	0	0	0	0	1	0	0
MLG-SOL	0	0	0	0	0	0	0	0	0	0
WCQ-G-NON	0	6	2	5	0	0	0	0	0	0
WCQ-G SOL	0	0	0	0	0	0	0	0	0	0
MCQ-G-NON	1	2	1	0	0	0	0	1	0	0
MCQ-G SOL	0	0	0	0	0	0	0	0	0	0
Y/N	0	0	0	0	0	0	0	0	0	0
ABREV	0	0	1	0	1	6	7	5	5	5

Note. All of the codes listed are defined in Appendix B.

to only a handful of words. The NSP did not solicit guesses, nor did the SP attempt to "interrupt" by guessing, due to her feelings expressed during the postexperimental interview regarding politeness. Additionally, the NSP in Dyad 4 made good use of the whole word vocabulary and did not type out each word and utterance. There were no Yes/No

confirmations observed throughout all experimental conditions.

Summary of insertion sequences promoting efficiency.

The SPs' experiences in interaction with a voice output communication aid resulted in an increase in rate enhancement techniques for three of the dyads. This effect was demonstrated by the initiation of rate enhancement behaviors either during or immediately following the treatment condition, and reinforced via postexperimental interviews with the subjects. As examined previously, three of the dyads (Dyads 2, 3, & 4) evidenced an overall decrease in number of turns with a reduction in SP turn length. The rate enhancement strategies partially accounted for this, but also there was a decrease in the number of Clarifications or Information Queries as the partners were better able to predict conflicts in the maps. In comparing the mean frequency of turns per MFE, all dyads achieved greater efficiency in the posttreatment condition as compared to pretreatment data. Hence, throughout the process of establishing shared referents, participants collaboratively minimized the amount of physical, temporal, and linguistic effort. The speakers developed and apportioned their strategies in the interest of achieving a balance between the two competing motivations of accuracy and efficiency.

The particular types of strategies that promoted efficiency varied across dyads. The two able-bodied NSP dyads used abbreviations, primarily as a way of achieving efficiency. The two disabled NSP dyads, used primarily gesture or Yes/No Confirmations. One overwhelming reason for this was the difference in interactive roles assumed by the participants. This dimension of interactive role relationship within each dyad will be described next.

The Interactive Role Relationship

The interactive behaviors of the participants have thus far been analyzed and described in accordance with the dimensions of accuracy and efficiency. One additional dimension that affected strategies was that of the interactive role that each partner assumed, and how these roles defined the interactive process. Interactive role in this context relates to the amount of control assumed by the sender (NSP), as well as the amount of participation assumed and given to the receiver (SP). Given the task constraints imposed, the sender (NSP) was afforded a large degree of control in that the receiver (SP) was unable to carry out the map task without information from the sender. Complete control by the sender, however, posed a risk to accuracy or disagreement, given the map conflicts. Thus, the receiver felt the need to participate to assure greater accuracy. The amount of receiver participation, however, was ultimately a function of the sender's own goals,

motivations, and perceptions. That is, the sender could limit the amount of receiver participation by, for example, being more specific in his initial presentations or by refusing her attempts to guess. On the other hand, the sender may invite participation by the receiver in the way that he fashions his initial presentation, by asking her about her map, and/or by soliciting guessing. The receiver had the option of accepting this invitation to participate by the sender. She may do so freely, may feel there is no need to participate other than to confirm, or may reject the invitation altogether. The roles assumed by each participant, then, were based to a great extent on internal disposition in terms of interactive goal or purpose, temperament, motivations, and sensitivities regarding their own needs and the perceived needs of their interactive partner.

In this investigation, internal disposition of the participants was often based on the interactant's sensitivity towards greater accuracy and/or efficiency. However, on occasion the desire towards greater accuracy or efficiency was offset by additional internal intraspeaker motivations, as well as the motivations of the interactive partner. What emerged were unique variations in interactive behavior within dyads based on their assumed roles. The following section will define these roles

given and assumed by each participant and the resulting interactive behaviors of the dyad.

Dyad 1 (T.B.-P.P.)

The first few trials in Condition A1 consisted primarily of the NSP presenting an initial verb phrase in the form of <go to_____>, the SP, in turn, asking for information or clarification, and the NSP confirming the clarification, and/or providing the details. The SP's repetition of the complete form would generally end the negotiated episode. Occasionally the SP would make attempts to guess during the first few trials. By map trial 3, the NSP was soliciting several word and message level guesses from the SP in the form of mime, gestures, and humming syllables, as illustrated in the following example:

SP: "Check out the school for your...."
(gaze at NSP)
NSP: <c-h-i//>
SP: "Child?"
NSP: (shakes head no) (hand motions and hums two syllables)
SP: "Children?"
NSP: (nods)
SP: "Ok, where next?"
NSP: <<clear> q-u-e-e-n <speak> queen>
(gaze at SP) (hand motions and hums two syllables)
SP: "Queen?"
NSP: "uh-huh" (nods) <<clear> d-a-i-r-y <speak> dairy (gaze at SP) (hum two syllables)
SP: "Dairy Queen?"
NSP: (nods)

[Map 3; MFE 5]

Note that the NSP often extended the invitation to the SP to participate in the interaction. In fact, as mentioned in the posttreatment interview, this NSP preferred the SP to guess. He stated that the task was "too dull otherwise." He also stated that he didn't like interacting with the device because it "didn't allow him to show his personality." As expressed by the NSP:

> "This thing [device] has no personality. You can't tell a joke with it. I like using gestures because they come natural to me."
>
> [T.B.; Post Experimental Interview]

By map 3, the NSP was playing a game of "Can You Guess?" with a fairly high number of solicitations and analogous presentations. For example, instead of <Go to Walmart>, the NSP presented <We b-u-y U-S-A>; for <library> he generated the initial utterance as <My m-o-s-t f-a-v-o-r-i-t-e p-l-a-c-e>; and in conveying the word <hire>, he raised his arm and pointed up, meaning "higher." The SP would go along with the NSP and play this communication game for the majority of Condition A1, despite the increase in number of turns and risk of communication repair.

At the initiation of the treatment condition, with both partners on the device, the NSP continued with his solicitation of guesses. This time, however, the SP rejected his invitations to guess by turning her back towards him, ignoring his solicitations, and avoiding eye

contact. This resulted in the NSP encouraging her participation by generating the requests, <T-a-l-k i-t> and <Q-u-i-t l-o-o-k-i-n-g a-w-a-y>, particularly when she would not directly confirm his contributions. At this point, the SP would reluctantly assent to his solicitations and guess a few single words, yet only to pacify his request. Midway through the first map trial in Condition B, the NSP accepted the fact that the SP was not going to participate actively. Out of politeness towards her feelings he typed out the utterance, <I-t i-s e-a-s-i-e-r for m-e t-o t-y-p-e>, eliciting a smile from the SP. Furthermore, there was an increase in the number of off-task behaviors initiated by the NSP during this condition as he struggled to elicit more participation on the part of the SP. Specifically, the number of off-task turns and sequences initiated by the NSP over six trials during Condition A1 was 18. The number of off-task turns and sequences during three map trials in Condition B was 22. These off-tasks behaviors subsided in Condition A2 (with the SP talking once again) to 12.

At the initiation of the posttreatment phase, the NSP solicited guesses once again, however, during the first map he used the device more than during the pretreatment condition. By the second map trial, however, he was once again soliciting multiple guesses from the SP. Some of these solicitations, however, were made with little if any

shared knowledge or cues. The SP responded on a few occasions with "How am I supposed to read your sign language?" and "It's faster if you use the device."

Hence, the amount of sender control and receiver participation varied across map trials and experimental conditions depending on the motivations and perceptions of the partners. The NSP in this dyad actively invited receiver participation and was motivated by his desire to make the task a guessing game and express his personality, even at the cost of accuracy and efficiency. The SP, however, reacted to this with divergence from guessing and interaction, particularly if it required her to use the device. Her motivation was to complete the task as efficiently as possible and she did not perceive her use of the device and multiple guesses as efficient, even though she was a faster typist than he.

Dyad 2 (D.O.-K.W.)

During the first few trials in Condition A1, the NSP assumed control by giving specifics about the locations and routes. The SP's behaviors confirmed these specifics along with asking for specifics and clarification when conflicts arose. Both partners at this point appeared to be more concerned with accurate transfer of information than efficiency as evident by few, if any rate enhancement Insertion Sequences. The NSP exerted his control by a few rather intimidating remarks such as:

SP: "South is at the bottom of the page, right, and north is at the top?"
NSP: (nods) <I s-a-i-d g-o s-o-u-t-h f-i-r-s-t>
SP: "Ok, when you go south..and then you//"
NSP: <//<speak> I said go south first>
SP: (gaze at NSP and sits back) "OK" (draws)

By map trial 3, however, the NSP appeared to become more concerned with efficiency, and merely offered standard noun phrases (e.g., <G-o t-o p-o-s-t o-f-f-i-c-e> rather than initial presentations with specific information. The SP, in turn, obliged the desires of the NSP by "filling in the gaps" with more clarifications and querying for information only if needed. This pattern of NSP offering standard noun phrases and inviting the SP to ask for specifics was continued throughout the remainder of the pretreatment condition and most of the posttreatment condition.

During Condition B, the NSP assumed more control, similar to his performance at the beginning of Condition A1. The SP predominantly confirmed once again and asked for specifics if needed. However, when the SP used the device for querying and clarification, the NSP apparently viewed her use of the device as inefficient to the interactive process. The NSP frequently interrupted her and, at times, quickly typed additional information if the SP merely placed her hand on her device indicating a need for additional information. The following example is illustrative:

NSP: <G-o t-o t-r-a-v-e-l> (gaze at SP)
SP: (hand on device) <W- //
NSP: // < S o-f r-o-o-f-i-n-g> <speak> S of roofing>
SP: (shakes head no) <I d-o//-n-t h-a-v-e>
NSP: // <r-o-o-f-i-n-g i-s d-i-r-e-c-t-l-y w-e-s-t o-f g-a-s <speak> roofing is directly west of gas> (gaze at SP)
SP: (gaze at paper) (hand on device) <w-h-i-c//-h g-a-s>
NSP: //<t-h-e o-n-e y-o-u w-e-r-e j-u-s-t a-t>

The NSP's continual interruptions of the SP on the device resulted in a few lengthy episodes of clarification and reformulation. Had the NSP waited to listen to the SP's contributions, the dyad probably would have fared better in terms of accuracy and efficiency. However, the NSP perceived the SP's slowness in typing as a threat to efficiency which was his primary motivation at the time. During the interview, it was apparent that the NSP did not realize he was interrupting her to the extent that he was. The SP was quick to point out that these interruptions annoyed her saying, "if he would have just let me finish we wouldn't have had to work so hard."

Dyad 3 (P.W.-H.B.)

During Condition A1 the NSP in Dyad 3 appeared more concerned with accuracy than with efficiency. He was meticulous about assuring that differences in the maps were resolved accurately. Additionally, it became apparent that this NSP was concerned as well about maintaining his control and invited SP participation on only a few occasions. Thus, he would often not respond to her

attempts to guess and rarely solicited guesses. Frequently he asked for clarifications regarding her map, particularly prior to presenting any new or novel information. To offset this concern for accuracy, the SP's motivations appeared to be more related to efficiency and completing the map with less effort. Thus, despite the NSP's nonresponsiveness towards guessing she continued to make attempts. She offered him nonsolicited specifics regarding her map, prior to him asking for them, in an attempt to speed the process along.

During Condition B, the NSP continued his "hold on the reign" by providing more specifics. The SP predominantly used the device in inquiring about specifics yet she also used it for confirming and clarifying about her map. This particular SP used the device more during the treatment condition than any other SP. As expressed in the post-experimental interview, she felt that her use of the device would relieve the NSP of some of the physical and cognitive effort involved in using his device, and would prevent him from being responsible for a large majority of the information. Also, she was aware that her typing on the device was much faster than his.

During the majority of Condition A2, the pattern reversed, in that now the SP exerted more control over the location and routes in the form of Yes/No Confirmations.

That is, she would ask the NSP about the routes and locations prior to his presentation, as follows:

NSP: <Go on up to the //>
SP: // "First horizontal?"
NSP: (nods)
SP: "Do I then go left?"
NSP: (nods)
SP: "Then I go south when I get to the vertical?"
NSP: (nods)
SP: "Do I go to McDonalds?"
NSP: (nods) <Where is it> (Gaze at SP).
SP: "It's on the second vertical road across the street from the frozen yogurt."
NSP: (nods)

Note too, however, that the NSP wished to maintain a power differential by asking her questions about her map so that he would be better informed about the specifics to present on the next location. He did, however, respond to her repeated yes/no confirmations perhaps due to his increasing need to conserve energy and motivation towards efficiency. At this point, he was less concerned about maintaining control, yet still attempted to keep a stronghold on new and novel information.

During the interview, the NSP expressed his desire to talk for himself which was apparently based on an underlying drive for autonomy and independence. The NSP realized that the SP was a faster typist, and that the SP could gain some control and "talk for" him. He attempted to offset this by repeatedly ignoring her attempts to guess and by "holding his reign" on new and novel information. The SP, on the other hand, was more concerned about

"getting things moving along" with the least amount of physical and temporal effort. The NSP went along with these efforts in the posttreatment condition, probably due to his increased desire for conserving energy and decreased desire for maintaining complete control.

Dyad 4 (J.J.-J.C.)

The roles assumed by the NSP and SP in this dyad varied the least of all dyads. Throughout all conditions, the NSP maintained control in providing most of the information and specifics. After one map trial, he was astute and sensitive to the SP's needs for information yet rarely solicited information from her nor invited participation. The SP initially played a greater participatory role in asking for specifics and clarification. She also played a greater role in informing the NSP regarding her map. Her participation diminished dramatically in Condition B with only confirmations, many of which were indirect in merely allowing the NSP to continue. She appeared to realize the competency of her partner in conveying accurate and specific information. So she assumed more, particularly during conflicts, without informing the NSP regarding these differences nor feeling the need to ask for more clarification. These feelings were expressed by her in the postexperimental interview. Thus, her participation was minimal after the pretreatment condition. Both partners appeared to remain comfortable

with their roles, despite changes or constraints imposed on them.

Summary and Inter-Dyad Comparisons

As demonstrated, the role assumed by the interactants based on their expectations, motivations, and goals influenced the interactive strategies utilized. These roles varied throughout trials and experimental conditions for all dyads, given changes in external forces (e.g., time pressures) and internal dispositions. Many of the interactive behaviors demonstrated by the participants supported an underlying motivation towards accuracy and efficiency on the part of one or both partners. For a majority of the dyads, the drive for accurate transfer of information took precedence in the beginning, followed by a competing motivation towards efficiency around the second or third map task. The interactive behaviors of one interactant wittingly or unwittingly influenced the behaviors of the other, resulting in a unique combination of strategies based on the combined motivations and perceptions of both participants.

To suggest that all communicative behaviors are generally the result of the two competing motivations of accuracy and efficiency, however, falls short of explaining the interaction of all participants, particularly those of the disabled partners. The NSP in Dyad 1, for example demonstrated a persistent desire to exert certain aspects

of his personality and to convert what he perceived to be a dull task into a guessing game. These desires, along with his ambition to use more natural forms, dominated his choice of mode through the use of pantomime and gesture, and dictated the interactive strategies used by the dyad. Additionally, this NSP demonstrated a desire to interact socially, either gesturally or through the device, resulting in a number of off-task turns and sequences. His attempts to engage his partner in a high level of interaction resulted in a greater number of turns than demonstrated by the other dyads.

Similarly, the disabled NSP in Dyad 3 wished to present himself in a way that maintained autonomy and independence. His desire to "speak for himself" was manifested in his withholding of new and necessary information from his communicative partner. Even when his motivation towards efficiency increased, he sought to maintain this power differential to a certain extent. His need to present himself as a competent interactant dictated a desire to remain an active contributor towards task completion. Hence, the overriding feature of strategy usage in the disabled NSP dyads was the ever present influence of their internal motivations to conform, as much as possible, to the cultural expectations and social norms as natural, competent communicators.

Message Reformulation Episodes

The first research question (Part B) hypothesized that the SP's use of the device would result in a decrease in the number of Message Reformulation Episodes (MREs) based on misunderstanding of message elements and/or message meaning. Hence, the SP's experience with a voice output aid was also examined in terms of its effect on the number and length of Message Reformulation Episodes (MRE). MREs were differentiated from Clarifications and Information Queries in that they consisted of multiple turns, as well as repetitions or reformulations of information presented previously by the NSP or SP. Furthermore, MREs resulted from comprehension conflicts not directly the result of differences in the maps. The frequencies of MREs for each dyad throughout all trials and conditions were tallied, as well as the percentage of reformulation turns in each trial and condition. Types of MREs (e.g., other-initiated message elements, other-initiated message meaning) were tallied as well. These data for the experimental conditions are presented for all dyads in Table 26. For Dyads 1 and 2, only the results of the last 4 trials in Condition A1 were considered in the data, since the A1 condition consisted of only 4 trials for Dyads 3 and 4. All of the dyads showed decreased occurrences of the number of MREs and turns from pretreatment to posttreatment

conditions. Three of the four dyads decreased MREs and turns from pretreatment to posttreatment.

Dyad 1 (T.B- P.P)

Note in Table 21 that the number and length of MREs decreased for Dyad 1 in the posttreatment condition. A

Table 21
Frequency of Reformulation Episodes, Turns and Type, and Percent of Total Turns per Condition for Each Dyad.

Dyad	Condition	# MREs	# Turns	% Tot. Turns	Type		
					OI-ME	OI-MM	OI-EM
1	A1	8	51	4	3	4	1
	B	2	15	2	0	2	0
	A2	3	35	4	1	2	0
2	A1	6	49	8	1	5	0
	B	1	6	3	0	1	0
	A2	2	11	4	1	1	0
3	A1	5	26	4	4	1	0
	B	1	10	3	0	1	0
	A2	1	3	1	1	0	0
4	A1	2	16	4	1	0	1
	B	0	0	0	0	0	0
	A2	2	8	4	1	1	0

Note. Types of MRE: OI-ME- Other Initiated Message Element; OI-MM- Other Initiated Message Meaning; OI-EM- Other Initiated Element Meaning.

majority of the MREs evidenced in Condition A1 were either a result of misunderstanding of the device, particularly on words such as "lure" and "inquire," or the result of the NSP calling referents by a different, but related name (e.g., "daycare" for "preschool"). On a few occasions the NSP had to repeat small words (e.g., "to," "at") that were

missed by the SP in recording activities. By the end of Condition A1, the SP appeared to understand the device better, and any additional message element confusions were the result of the NSP misspelling words. Additionally, in Condition A2, the SP was confused over the NSP's use of terms, such as "rab" for "minister" and "Tojo" for "Toyota." Otherwise, miscommunications were minimal throughout all conditions.

Dyad 2 (D.O.-K.W.)

As observed in Table 21, the number of MREs decreased with a marked change in MRE length in turns. The SP's difficulty with comprehension of the VOCA's voice was responsible for 2 MREs. In Condition A1, the NSP presented the wrong locations on 2 occasions resulting in lengthy reformulation of the numbers and routes, and thus, the high number of turns for MREs in Condition A1. In Condition A2, the speaking partner had difficulty understanding a few words (e.g., "emerald") and the NSP accidentally cleared his device, when he meant to speak the utterance, resulting in a repetition of the activity.

Dyad 3 (P.W.-H.B.)

The number and percentage of MREs for Dyad 3 decreased dramatically in the posttreatment condition, as well as the number or turns per MRE. Difficulty in understanding the synthetic speech on words such as "bled," "vertical" and "lure" was a reason for some of these MREs. Additionally,

in the beginning, the NSP demonstrated left-right confusion and confusion with vertical and horizontal. This was responsible for some of the miscommunications in terms of message meaning.

Dyad 4 (J.J.-J.C.)

The NSP and SP in this dyad demonstrated few MREs throughout all conditions. Once again, difficulties with the speech synthesizer created spelling repetitions in three of these episodes. Two MREs were created by the NSP accidently providing the SP with incorrect stops and/or routes.

Summary and Inter-Dyad Comparisons

Although all dyads demonstrated a reduced number of MREs, and a decrease in MRE length in the posttreatment condition, it appears that this reduction in MREs was the result of familiarity with the task and partner and not the direct result of SP's experience with the voice output aid. All of the NSPs and SPs in this investigation could readily understand the VOCA from the beginning with the exception of novel words which were difficult to understand. Several of the SPs had difficulty on the same words. Also, from the beginning of the experiment, a predominant number of the MREs were the result of incorrect information provided by the NSP or accidental activations of the device. More specifically, the MREs were not the result of inappropriate

interactive strategies that could have been reversed or improved upon by the training method employed.

Effective Interactional Management Strategies

We now take a closer look at the types of interactional management strategies described as effective for each dyad. As previously discussed, effective will denote those strategies that achieved an optimal balance between accurate and efficient transfer of information, yet also incorporated the role relationships of the dyad based on their dominating motivations and perceptions as observed and expressed in the postexperimental interviews. Hence, the definition of "effective" considers all three of these dimensions.

Given that each dyad was successful in achieving a high level of accuracy and agreement on the majority of trials in each condition, primary focus will be paid to those strategies which incorporated the primary roles of each participant and resulted in greater efficiency. Effective strategies used for information transfer, in general, will be presented first, followed by a discussion of specific strategies used for resolution of referential conflicts.

The types of Insertion Sequences used in promoting efficiency have already been described. Additionally, MFE length for each dyad has been presented, documenting that dyads achieved greater efficiency in the posttreatment

condition as compared to the pretreatment condition. These data, along with a descriptive analysis and examples from trial transcriptions will be used to pinpoint those strategies that were determined to be most effective.

Effective Strategies for Information Transfer

Dyad 1 (T.B.-P.P.). In keeping with the primary participant roles identified for the NSP and SP in Dyad 1, effective strategies were identified as those which allowed the NSP to utilize a combination of gesture and device modes, while at the same time satisfying the SP's overall desire towards efficiency and ease in the comprehension of referents. For the purpose of discussion we will begin with an example taken from map trial 12:

NSP: <p-a-r//>
SP: "park?"
NSP: "uh-huh"
SP: (draws)
NSP: (gaze at speaking partner) (hand motion to stop)
SP: "stop..."
NSP: (nods) (hand motion as if feeding)
SP: "stop...the people?"
NSP: (shakes head no) (hand motions as if feeding)
SP: "stop to feed the ducks?"
NSP: "uh-huh"
SP: "is that the whole thing?"
NSP: "uh-huh." <4. d-a h-o//>
SP: "the hospital?"
NSP: "uh-huh"
SP: "ok" (draws)
NSP: <<clear> g-o t-o d-a e-m-e//>
SP: "emergency room?"
NSP: (nods)
SP: (writes)
NSP: <<clear> to h-v-e your a-n-k//>
SP: "ankle?"
NSP: (nods) <c-h-e//>
SP: "checked?"

NSP: "uh-huh" <a-f-t-e//>
SP: "after?"
NSP: <you>
SP: "you"
NSP: <h-u-//>
SP: "hurt it?"
NSP: "yep" <b-u//>
SP: "hurt it buy"
NSP: <d-a p-o//>
SP: "the pond?"
NSP: "yep"
SP: "go to the emergency room to have your ankle checked after you hurt it by the pond"
NSP: "yep." <5. d-o-c//>
SP: "doctor?"
NSP: "uh-huh"
SP: "I have three. Um, there's one underneath the hospital (pause), there's one on the side of the police"
NSP: "uh-huh"
SP: "the one at the side of the police?"
NSP: (nods)
SP: "ok" (draws)
NSP: <<clear> m-a-k-e a-n a-p-p (gaze at speaking partner)(gesture to guess)
SP: "appointment"
NSP: "uh-huh" <w-i-t
SP: "with"
NSP: (nods) (hand motion to continue)
SP: "the doctor"
NSP: "yep" <for n-e-x-t w-e
SP: "for next weeks"
NSP: (nods) <v-i-> (hand motion to guess)
SP: "visit. Make an appointment with the doctor for next week's visit"
NSP: "yep"

[Map 12; MFE 5-11]

This example consists of a variety of strategies found to be facilitative for this dyad. First, the dyad demonstrates an effective balance between accuracy and efficiency in the way that the NSP uses a combination of gesture and device along with the SP's frequent guesses.

The NSP provided her with sufficient information to elicit accurate guesses, generally in the form of an initiation of each word. The SP readily guessed each word, followed by a confirmation or rejection by the NSP. On other occasions, the NSP continued to gesture for more guessing without confirming whether or not the SP's guess was accurate. The SP in turn, asked for a confirmation. Additionally, word level guessing proved to be more effective for this dyad than message level guessing. Often, if the SP waited until the entire message was presented before guessing or repeating, she confused word order or replaced function words (e.g., a, the), causing the NSP to go back and repair the differences. As a general rule, the NSP allowed the SP to guess, rather than soliciting guesses. Since the NSP often had difficulty in sufficiently gauging the amount of shared information needed for the SP to guess accurately, unsolicited guesses generally proved to be the more effective strategy. Part of the reason the NSP solicited multiple guesses was his effort to make the task a game. However, he often solicited guesses even if it would have been difficult to identify the referent based on the lack of information given. Providing the SP with the number of each location and activity was also a facilitative strategy. On occasions in which the NSP did not do this, miscommunication occurred regarding the location and activity.

Dyad 2 (D.O.-K.W.). The primary motivation of the NSP in Dyad 2 was that of promoting efficiency. He frequently invited the SP to provide him with specifics regarding locations and routes rather than spending the time to clarify them himself. The SP in this dyad was primarily concerned with accuracy and politeness in interaction. Guessing was not an option for her since it would result in interruptions of the NSP which she felt would pose an imposition.

The example used to demonstrate effective strategies on the part of this dyad is taken from map trial 11:

NSP: <g-o t-o i-> (gaze at speaking partner)
SP: "go to the intersection"
NSP: <g-o e- t-o s-c-h-o-o-l>
SP: "ok, the school is north of the Burger King?"
NSP: <n- o-f d-a-i-r-y q-u-e-e-n>
SP: "is the dairy queen across...to the east of the TV place?"
NSP: (nods)
SP: "ok, the Burger King is now the Dairy Queen"
NSP: (nods) <c-h-e-c-k o-u-t t-h-e s-c-h> (gaze at speaking partner)
SP: "check out the school"
NSP: <f-o-r y-o-u-r c-h-i-l-d-r-e-n <speak> for your children>
SP: "check out the school for your children"
NSP: <g-o b-a-c-k t-o d-q>
SP: "Ok"
NSP: <s-a-m-e r-o-u-t-e>
SP: "Ok"
NSP: <b- a b-u-r-g-e-r a-n-d f-r-i-e-s <speak> b- a burger and fries>
SP: "buy a burger and fries. Is that it?
NSP: (nods) <g-o n- t-o a-p-a-r-t <speak> go n- to apart>
SP: "Ok, all the way north?"
NSP: <t-e-l-l m-e>
SP: "from the dairy queen I go all the way north and then to the east to apartments"

NSP: (nods) <p-l-a-c-e a d-e-p-o-s-i-t d-o-w-n o-n y-o-u-r a-p <speak> place a deposit down on your a-p>
SP: "OK"
NSP: <g-o e-t-s-t-e (east then south then east) t-o h-o-t-e-l <speak> go e-t-s-t-e to hotel>
SP: "ok, I have two hotels, is it across from the cars?
NSP: (shakes head no)
SP: "north of the park?"
NSP: (nods)
SP: "ok"

[Map 11, MFE 14-20]

The example cited provides an illustration of the variety of strategies used by this dyad to achieve specificity and efficiency. The NSP provided most of the specifics regarding the routes to the SP in the form of abbreviations (e.g., "e-" for "east" and "i-" for "intersection"). However, on one occasion he asked the SP to tell him the route as a means of rate enhancement and checking for accuracy. Additionally, the NSP was selective about the type of words he abbreviates and limited them to abbreviations already used or abbreviations of locations that have already been identified (e.g., "d-q" for dairy queen). The SP generally repeated each utterance after it had been agreed upon as a means of confirmation. Additionally, during the episode representing conflicts between the maps, the SP utilized a Yes/No Confirmation strategy which facilitated speed in that it did not require the NSP to type out utterances.

It could be argued that the NSP's use of multiple abbreviations in one turn (e.g., e-t-s-t-n) was taxing for the SP and risked communication difficulties. However, in this dyad's performance, the use of abbreviations in this manner was an effective strategy and resulted in no reformulations. The SP stated in the postexperimental interview that during these abbreviation sequences she often had to repeat the abbreviations to herself and study the map prior to responding.

Dyad 3 (P.W.-H.B.). The NSP's motivations and needs in Dyad 3 centered on accuracy and the desire for control in speaking for himself. The SP's motivation was primary that of efficiency, perhaps to offset the NSP's dominating desire for specificity and to maintain a more natural interactional flow. She also expressed concern about the physical effort required of the NSP in using the device.

The following example from map trial 10 represents a set of strategies which satisfied the roles and motivations of both interactive partners:

NSP: <<clear> Go to the v-e-t-e-r//>
SP: "The veterinary hospital?"
NSP: (nods) <-i-n-a-r-y h-o-s-p-i-t-a-l <speak> Go to the veterinary hospital>
SP: "Ok" (draws)
NSP: <<clear> Take s-n-u-f-f-y your d-o-g to have h-i-s <speak> take snuffy your dog to have his>
SP: "Ok"
NSP: <l-e-g e-x-a-m-i-n-e-d <speak> leg examined>
SP: "Take snuffy your dog to have his leg examined"
NSP: (nods) <<clear> Go w-e-s-t t-e-l-l m-e <speak> Go west tell me>

SP: "Ok, I have an LSU Vet next to the Hospital, the University next to it. Pet store and lake underneath LSU Vet"
NSP: (nods) <l-s-u v-e-t <speak> l-s-u vet>
SP: "Ok" (draws)
NSP: <get a s-e-c-o-n-d o-p-i-n-i-o-n <speak> get a second opinion>
SP: "Ok" (writes)
NSP: <and to get m-e-d-i-c-a-t-i-o-n>
SP: "Ok" (writes)
NSP: <<clear> go to p-e-t <speak> go to pet>
SP: "Go to the pet store, ok"
NSP: <<clear> B-u-y a l-e-a-s-h and c-h-a-i-n for s-n-u-f-f-y <speak> Buy a leash and chain for snuffy>
SP: "Ok, do I keep going south?"
NSP: (nods)
SP: "To the gift shop?"
NSP: (shakes no)
SP: "Ok do I go all the way to the horizontal road?"
NSP: (shakes) <<clear> to l-a-k-e <speak> to lake>
SP: "Ok" (draws)
NSP: <<clear> Where is it>
SP: "Across the street from the pet shop, underneath the golf course and across the street from the gift shop"
NSP: (nods) <<clear> l-u-r-e s-n-u-f-f-y out of the w-a-t-e-r <speak> lure snuffy out of the water> (gaze at SP)
SP: "OK"
NSP: <a-f-t-e-r he r-a-n a-w-a-y <speak> after he ran away>
SP: "OK, next"
NSP: <<clear> go s-o-u-t-h>
SP: "Do I go all the way to the intersection?"
NSP: (shakes no)
SP: "Stop at the gift shop?"
NSP: (shakes no)
SP: "Stereo?"
NSP: (nods) <<clear> B-u-y n-e-w s-p-e-a-k-e-r-s for the s-t-e-r-e-o <speak> Buy new speakers for the stereo>
SP: "Buy new speakers for the stereo"
NSP: (nods) (pauses)
SP: "Uh, do I go east?"
NSP: (nods)
SP: "All the way to the intersection?"
NSP: (shakes no)
SP: "I stop at the gas station?"
NSP: (shakes no)

SP: "hardware?"
NSP: (nods) <<clear> m-a-k-e h-a-r-d-w-a-r-e h-o-m-e d-e-p-o <speak> make hardware home depo>
SP: "OK" (draws)

[Map 10; MFE 1-11]

The strategies utilized in this example, allowed the NSP control in providing some of the specifics and information regarding the maps. He also was allowed the flexibility to decide when to clarify in his initial presentations and when to allow the SP to take control in asking for Yes/No Confirmations. The Yes/No Confirmation strategy also allowed the NSP the ability to learn the SP's map, make comparisons, and provide specifics to prevent referential conflicts from occurring (as in changing "hardware" to "Home Depot"). The Yes/No Confirmation strategy satisfied the SP's desire for greater efficiency as well. Note too, that the NSP in this dyad frequently used the word vocabulary on the device rather than spelling out all the words, resulting in greater efficiency. Both partners expressed that they finally "felt good" with the strategies they used in Condition A2. The SP expressed that "the question asking made it go a lot faster." Although rate measures were not obtained due to the NSP's physical limitations, it was noted that Dyad 3 was completing a map trial in approximately 20 minutes in Condition A2, as compared to approximately 30-45 minutes in Condition A1. The NSP's presentation of lengthy

activities in installments was also an effective strategy. That is, he would speak part of the activity, facilitating comprehension and accuracy for the SP, with a completion of the activity in the next turn. At this point it is important to note a qualitative difference in the Yes/No Confirmations of this dyad from those of Dyad 2. The SP in Dyad 2 utilized Yes/No Confirmations as a means of clarifying referents already presented by the NSP (e.g., "Is it the one south of Home Depot?; "Is it north of the office?"). The SP in Dyad 3, however, utilized Yes/No Confirmations as a means of predicting the upcoming location and route (e.g., "Do I go to the park?"; "Do I go south?"). In this way, the SP assumed greater responsibility and control towards task completion. To differentiate the qualitative difference in these Yes/No Confirmations, the partner (SP/NSP) who assumed control during these confirmations was identified (i.e., Y/N Conf- SP control; Y/N Conf- NSP control).

Dyad 4 (J.J.-J.C.). The motivations and goals of both partners in Dyad 4 appeared to primarily be that of accuracy, although the SP in this dyad was also concerned about politeness and avoiding interruption of the NSP. Dyad 4 used few rate enhancement strategies with the exception of a few abbreviations of directions and already established referents. However, given that the NSP had a keen awareness of, and sensitivity about, the shared

knowledge of his partner, he often made initial presentations with sufficient specificity, resulting in fewer turns and prevention of communication breakdowns. Thus, as noted previously in Table 27, the number of MFEs per episode was less for this dyad than for any other dyad. The following example is taken from map trial 10:

NSP: <<clear> down and r-i-t-e to r-i-t-e e-n-t-r-a-n-c-e of l-a-k-e <speak> down and rite to rite entrance of lake>
SP: "Ok" (draws)
NSP: <<clear> l-u-r-e s-n-u-f-f-y o-u-t of the w-a-t-e-r a-f-t-e-r <speak> lure snuffy out of the water after>
SP: "lure?" (writing)
NSP: "yeah" (pause)
SP: "ok"
NSP: <h-e r-a-n a-w-a-y <speak> out of the water after he ran away>
SP: "ok" (pen down)
NSP: <<clear> go down to b-o-t-t-o-m and l-e-f-t to s-t-e-r-e-o <speak> go down to bottom and left to stereo>
SP: "before the intersection?"
NSP: "yeah"
SP: (draws) (pen down)
NSP: <<clear> b-u-y n-e-w- s-p-e-a-k-e-r-s for the s-t-e-r-e-o s-y-s-t-e-m <speak> buy new speakers for the stereo system>
SP: (writes) (pen down)
NSP: <<clear> n-o-w a-l-l the w-a-y to b-o-t-t-o-m <speak> now all the way to bottom>
SP: "OK"
NSP: <<clear> r-i-g-h-t to c-a-r-p-e-n-t-e-r <speak> right to carpenter>
SP: (draws) (pen down)
NSP: <<clear> s-e-e a-b-o-u-t g-e-t-t-i-n-g the b-a-c-k-y-a-r-d g-a-t-e f-i-x-e-d <speak> see about getting the backyard gate fixed>
SP: "OK" (writing) (pen down)
NSP: <<clear> r-i-t-e to m-i-d-d-l-e i-n-t <speak> rite to middle int
SP: "Ok"
NSP: <<clear> up and r-i-t-e to h-o-m-e d-e-p-o-t <speak> up and rite to home depot
SP: (writes) (pen down)

NSP: <<clear> b-u-y n-e-w p-a-r-t-s for the g-a-t-e <speak> buy new parts for the gate
SP: "OK" (writing) (pen down)
NSP: <<clear> down to b-o-t-t-o-m <speak> down to bottom>
SP: "OK"
NSP: <<clear> r-i-t-e to g-a-s <speak> rite to gas>
SP: "Do I turn right before the hardware store, I mean, the home depot?"
NSP: "yeah"

[Map 10; MFE 7-15]

Note in the example above how the NSP often provided specifics regarding the route in installments to facilitate comprehension on the part of the SP. The NSP also provided specifics regarding which direction to turn, which entrance to take, and where the location was in terms of previously established referents. All of these strategies were used in his initial presentations. There was little participation on the part of the SP, although she did occasionally ask for specifics. Yet, when there was a difference in the map (as with hardware store and Home Depot) she didn't flag this to the NSP, but rather made the necessary changes without his confirmation. Despite this, the dyad's accuracy did not suffer. Since the NSP was astute at evaluating her shared knowledge, the SP had confidence in his ability to provide her with the appropriate specifics. However, she was not as sensitive to asking for clarifications as the other SPs in this investigation. One additional facilitative strategy that this NSP utilized was to <clear> his device only after the

entire activity was confirmed. Since he did not <clear>, prior phrases were spoken along with the newly generated phrases, which allowed the SP to hear the prior phrases again and check for wording. However, the NSP did <clear> when giving instructions about locations and routes, since he was aware that a repetition of old information in these instances may have resulted in confusion.

Summary and inter-dyad comparisons. The effective strategies identified for each dyad in this investigation were those which allowed for an optimal or desired balance in accurate transfer of information with efficiency. Most importantly, however, these strategies were based on and derived from the preferred roles of the participants and their underlying motivations, expectations, and perceptions as expressed during the postexperimental interview and weighed against their observed behaviors during the experimental trials.

Undoubtedly, familiarity with the task, device, and the interactive partner contributed to the use of viable strategies. Furthermore, the relation between use of rate-enhancement strategies as prompted by, or the direct result of the SP's interactive use of the device has been demonstrated.

Strategies Used in Resolving Referential Conflicts

Resolution of Referential Conflict Episodes (RRCEs), although similar to Message Reformulation Episodes (MREs),

were differentiated in that they occurred as a result of a dyad's encounter with differences or conflicts in their maps. Generally, the referential conflict episodes began with the SP flagging confusion or informing the NSP about apparent map conflicts. However, particularly with two of the dyads, conflicts were not easily identified in the transcripts in that the SP did not flag these conflicts to the NSP or indicate confusion. Scrutiny of the data revealed that the SP in one dyad engaged in a process of elimination based on the specifics provided her by the NSP regarding locations and routes. In the other dyad, the NSP informed the SP on how to proceed, based on what he already knew about her map from prior information queries and SP clarifications. In either case, these instances were coded as Arbitrary Solutions or Other World Solutions depending upon whether or not, at some point, the participants negotiated a mutual understanding of each partner's referents and routes.

The three strategies of No Problem, Arbitrary Solutions, and Other World Solutions were the three general types of solutions used by the participants to the referential problems encountered in these map tasks. Each solution will be described and illustrated. One additional solution, identified prior to this experiment as a possible candidate was that of Abandonment in which none of the dyads demonstrated instances of this strategy. Additional

specification and illustration of all types of RRCEs may be found in Appendix B.

No problem (NP). In performing these tasks, the SP in Dyad 1 acted as if no referential problem existed at all. This occurred predominantly during Condition B when the location specified had two entrances or routes leading up to it. Apparently, this SP engaged in a process of eliminating the route which seemed the least plausible given the direction and locations of prior referents. Regardless of the fact that the majority of these solutions resulted in accurate identifications, this strategy will be regarded as ineffective due to the SP's lack of responsibility in communicating ambiguous or conflicting information.

Arbitrary solutions (ARB). In a majority of the dyads the SP would make arbitrary decisions about the location or route. The SP asked the NSP about specifics such as which direction to take or to identify other referents nearby. The key element that differentiated arbitrary decisions from Other World Solutions is that the partners did not mutually negotiate the location and route in an attempt to learn about the other's world of reference. The illustration below, taken from Dyad 1, was typical in a majority of these instances.

NSP: <<Clear> 7. M-a-//>
SP: //"Magazines?"
NSP: (nods)

SP: "There are three. Ok, I have one....it's the one...above the Circle K, one a little bit below the Circle K, or one way below the Circle K."
NSP: (hand motion up and to the left)
SP: "They're all to the left."
NSP: (hand motion and pointing up)
SP: "The one at the top?"
NSP: (nods)
SP: "OK"

[Map 4, MFE 13]

Rather than asking questions about specific locations and routes in an attempt to discover which location on the SP's map best represented the NSP's location, each partner in this example engaged in a discussion of the general direction of the location resulting in an arbitrary, perhaps inaccurate solution.

The next example, taken from Dyad 2, is also illustrative of a general type of arbitrary solution found by the participants:

NSP: <<clear> <G-o t-o m-a-g-a-z-i-n-e-s <speak> go to magazines>
SP: "Ok, which one. There's three on my map. One north....."
NSP: <<clear> N-o-r-t-h o-f t-h-e f-l-o-r-i-s-t <speak> north of the florist>
SP: "I don't have a florist on my map"
NSP: <<clear> A-c-r-o-s-s f-r-o-m K>
SP: "Ok, there's two across from K, there's one north and there's one south in that little circle."
NSP: <<clear> N-o-r-t-h o-f t-h-e e-x-e-r-c-i-s-e>
SP: "I don't have an exercise on my map either."
NSP: (gaze at paper)
SP: "Is it northeast of the library?"
NSP: "yes"
SP: "Ok"

[Map 4; MFE 11]

The use of "trial and error" on the part of both partners, rather than attempts to learn the other's map, results in an arbitrary decision by the SP based on the general location of the referent in relation to another nearby referent.

A majority of the arbitrary decisions made by the SP in Dyad 4 were qualitatively different from the others, in that often the SP would not notify the NSP of differences in the maps, but rather made individual decisions through a process of elimination. The specific directions given to her by the NSP, coupled with the limited complexity of the map, enabled her to successfully select the referent and route despite her lack of clarification. When she did flag the NSP about differences they were often in the form illustrated below:

NSP: <<clear> go up to gas>
SP: (pen down) (hand on device) <u-p a-n-d g-a-s o-n l-e-f-t o-r r-i-g-h-t>
NSP: <<clear> on r-i-t-e <speak> on rite>
SP: "uh-huh."

Although this illustration was taken from a map in which both partners were utilizing devices, the lack of specifics noted in the SP's utterance was typical of her verbal expressions as well. Both partners assumed that the other could easily identify a referent based on the general direction, without additional clarification or negotiation of the location of gas. In this instance, the SP had two locations marked gas within the general location on the

right, although the entrance to one was on a different route. The SP made no attempt to clarify this, resulting in an unsuccessful solution.

Other world solution (OWS). The most typical pattern with OWSs involved both participants asking about the other's map in an effort to negotiate a mutual understanding about map differences. This strategy was most typically used by partners in Dyad 3. Often, the NSP in this dyad would either query the SP about locations along a route or, upon initiation of a new map task, ask the SP a general information query such as, <Where are you>. Both of these strategies were used in an effort to learn the SP's map. The following example illustrates:

NSP: <<clear> go back>
SP: (nods)
NSP: <take a r-i-g-h-t>
SP: (gaze at NSP)
NSP: <<clear> where are you <speak> where are you> (gaze at SP)
SP: (on device) <at the i-n-t-e-r-s-e-c-t-i-o-n- with the p-r-e-s-c-h-o-o-l <speak> at the intersection with the preschool (gaze at NSP-gaze at device) m-o-v-i-e-s and g-u-l-f- s-t-a-t-e u-t-i-l-i-t-i-e-s <speak> and movies and gulf state utilities> (gaze at NSP)
NSP: (nods) <What is b-e-l-o-w the m-o-v-i-e-s <speak> what is below the movies> (gaze at SP)
SP: <p-r-e-s-c-h-o-o-l <speak> preschool>
NSP: (nods) <make it c-h-i-l-d-c-a-r-e i-n-s-t-e-a-d <speak> make it childcare instead>
SP: <you have c-h-i-l-d-c-a-r-e n-e-x-t to g-u-l-f s-t-a-t-e <speak> you have childcare next to gulf state>
NSP: (nods)
SP: (nods and draws)

[Map 5; MFE 11]

Note in the prior example that the NSP was making an unquestionable effort to learn the SP's map so that he could instruct her on how to proceed with the next referent. In this example, his sensitivity to learning the other's world of reference, prevented the conflict from occurring. In other instances, the dyad engaged in sharing information about their maps, along with querying the other for information as follows:

NSP: <Go to l-o-a-n-s>
SP: "Ok, my loans is right across the street from where real estate was"
NSP: (pause) (looks at map)
SP: (gaze at NSP) "Way at the top"
NSP: <My l-o-a-n-s r-i-g-h-t b-e-s-i-d-e <speak> my loans right beside <clear> the b-a-n-k
SP: "Mine aren't. I have a pizza right next to my bank and a school across the other street." (Both partners look at map) (>2 sec). "Do you want me to go to the building right next door to the bank or to the loan place which for me is right at the top?"
NSP: <<clear> the b-u-i-l-d-i-n-g r-i-g-h-t b-e-s-i-d-e the b-a-n-k <speak> the building right beside the bank> (Gaze at SP)
SP: "Ok, that's my pizza place. But I'll do that. Do you have a pizza place?"
NSP: (nods) <C-h-a-n-g-e p-i-z-z-a t-o l-o-a-n-s <speak> change pizza to loans>
SP: "Wait, your pizza changed to loans?"
NSP: (nods)
SP: "Ok, you still want me to go to my pizza place?"
NSP: (shakes)
SP: "No, you want me to go to loans?"
NSP: <<speak> change pizza to loans>
SP: "Ok, I got ya."

[Map 2; MFE 7]

Once again, the NSP in this example, negotiated a solution to the referential conflict, and was able to direct the SP to the appropriate location using expressions that fit the SP's world of reference. Additionally, the SP readily offered information about her map to the NSP and inquired about his map. The succession of communicative exchanges resulted in a successful solution and allowed each partner to learn more about the other's map to possibly prevent and repair further conflicts.

Having established these three typical solutions to referential problems, we can now attempt to determine which types of solutions result in successful outcomes, in an accurate, efficient manner. Given that all dyads were generally successful in achieving agreement and accuracy, we will once again attempt to determine the type of interactions that were most desirable in terms of efficiency. One measure which can be considered is that of the number of turns and the percentage of total turns allocated to RRCEs across conditions. Table 22 presents this data, along with frequency and type of RRCEs for all dyads. Data for Condition A1 were calculated on the last three map trials only.

In comparing these data across conditions, it was evident that the number of turns significantly decreased in Condition A2 for Dyads 3 and 4, remained essentially the same for Dyad 1, and increased for Dyad 2. The same trend

holds for percentage of total turns with the exception of Dyad 4, with a percentage of total turns near equal to that of Condition A1. Number and percentage of RRCE turns was lower in Condition B for all dyads due to the reduced

Table 22
Resolution of Referential Conflict Episodes (RRCE) Turns and Type, and Percent of Total Turns per Condition for Each Dyad.

Dyad	Condition	# of Turns	% Total Turns	Type			
				NP	ABAN	ARB	OWS
1	A1	100	.13	3	0	6	3
	B	56	.14	7	0	5	0
	A2	98	.13	4	0	7	1
2	A1	66	.22	0	0	11	1
	B	42	.30	2	0	8	2
	A2	72	.28	0	0	11	1
3	A1	106	.23	0	0	8	4
	B	33	.11	0	0	8	4
	A2	37	.08	1	0	3	8
4	A1	70	.22	0	0	11	1
	B	31	.20	0	0	11	1
	A2	39	.21	0	0	12	0

Note. Types of RRCE: NP- No Problem; ABAN- Abandonment; ARB- Arbitrary Solution; OWS- Other World Solution.

number of SP turns during this condition. With the exception of Dyad 1, the types of RRCEs used in Condition B were comparable to those of Conditions A1 and A2.

In comparing the types of RRCE's used by Dyad 1, it is worthy to note that the frequency of RRCE types was nearly equal in pretreatment and posttreatment conditions. Hence,

the finding of essentially no change in number and percentage of total turns should not be surprising. Data in Condition B evidenced an increase in NSP solutions, particularly regarding routes and conflicts involving more than one referent with the same name. Disagreements in maps occurred on three of the seven instances in which a No Problem solution was utilized.

Dyad 2 evidenced the exact same number of RRCE types in pretreatment and posttreatment conditions. The slight increase in number and percentage of turns was a result of one long episode (consisting of 28 turns in map trial 9) which began with an arbitrary solution and turned into an Other World Solution as the partners attempted to resolve the conflict.

The percentage of total turns evidenced by Dyad 4 did not change from pretreatment and posttreatment conditions, however, the total number of turns in Condition A2 decreased. This change resulted from the overall reduction in number of turns and the reduced amount of SP participation in Condition A2. The number of RRCE turns in both conditions was lower than that of any of the other dyads, with the exception of Dyad 3 in Condition A2. This suggests that the strategies utilized by Dyad 4 were successful in resolving referential conflicts in a fairly efficient manner.

A different pattern emerged in the performance of Dyad 3. Number and type of RRCE types changed to predominantly Other World Solutions in Condition A2 and there was a dramatic reduction in the number and percentage of RRCE turns. These data indicate that the strategies used by Dyad 3 based on Other World Solutions were particularly effective in terms of accurate transfer of information in a fewer number of turns.

Summary and inter-dyad comparisons. The strategies used in resolving referential conflicts by the participants were generally effective in resolving differences in the maps. Based on the interactive behaviors of Dyad 4, it would appear that providing the SP (receiver) with step-by-step specifics regarding the routes and locations allows her to engage in a process of elimination sufficient for identifying these conflicting references and routes without the need for further specification or flagging the NSP (sender) about the apparent differences. Despite the successful outcomes, the nature of these arbitrary decisions and the insensitivity of this SP regarding the need for clarification and confirmation can eventually cause misidentifications to occur. From an information transfer point of view, this type of strategy would appear to be risky, since the SP bears the ultimate responsibility for accuracy.

The negotiated process used by Dyad 3 based on Other World Solutions appears to be a preferable strategy. Rather than relying solely on the SP to pinpoint differences in the maps, the NSP in this dyad actively sought to learn about the other's map in an effort to identify possible conflicts before they arose and offer viable solutions. Likewise the SP frequently inquired about the NSP's map and provided nonsolicited clarifications. The use of Yes/No Confirmations was an effective one, not only for the sake of efficiency, but for allowing the NSP to visualize the SP's map and make useful comparisons.

Able-Bodied Versus Disabled Bodied Nonspeaking Partner Dyads

Differences in interactional patterns of dyads incorporating able-bodied and disabled nonspeaking partners (research question #3), as expected, did occur. These interactive differences can be explained primarily on the basis of their motivations and perceptions and are discussed here in four general categories of interactive behavior: 1) variance in the dyads' use of eye gaze; 2) variance in number and type of Insertion Sequences used by the dyads; 3) variance in the amount that each SP used the VOCA during the Treatment Condition B; and 4) variance in interactive behaviors as a result of role relationships. Each of these categories of communicative behaviors will be substantiated and discussed in relation to the disabled NSP

dyads (i.e., Dyads 1 & 3) and the able-bodied NSP dyads (i.e., Dyads 2 & 4).

Use of Eye Gaze

Results substantiated a striking overall difference in the amount of eye gaze used by each dyad, with a greater amount of eye gaze used during turns and turn exchanges on the part of dyads including disabled NSPs. Figure 7 displays the total percentage of turns in which eye gaze was used by one or both partners in each experimental condition. Dyad 1 used eye gaze in 61% of the turns in Condition A1, 62% in Condition B, and 62% in Condition A2. For Dyad 3, these percentages were 41% in Condition A1, 54% in Condition B, and 29% in Condition A2. The dyads including able-bodied NSPs utilized eye gaze less often in nearly all experimental conditions. Dyad 2, presented the following percentages: 32% of the turns in Condition A1; 36% in Condition B; and 16% in Condition A2. Dyad 4 used minimal, if any eye gaze during the map tasks, with 11% of the turns incorporating eye gaze in Condition A1, 2% in Condition B and, 0% or no occurrences of eye gaze during map tasks in Condition A2.

In terms of the disabled NSP dyads, a majority of the eye gaze was used by the SPs as a way to check the status of their NSPs and to aid in regulating turntaking behavior. The majority of all dyads used more eye gaze in the pretreatment condition compared to posttreatment, as a way

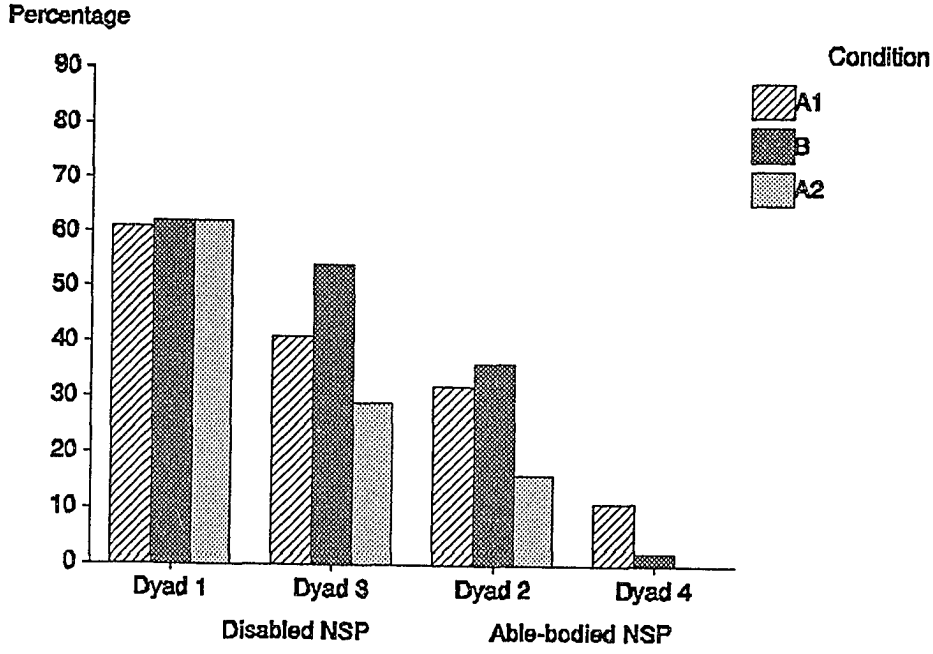

Figure 7
Percentage of Turns in Which Eye Gaze Was Used by One or Both Partners in Disabled Nonspeaking Partner and Able-Bodied Nonspeaking Partner Dyads.

of familiarizing themselves with the interactive behaviors of their partners and to facilitate comprehension, particularly during map conflicts. The NSP in Dyad 3 evidenced a reduced amount of eye gaze in Condition A2 compared to that of Condition A1. The increased use of Yes/No confirmations by this Dyad in the posttreatment condition satisfactorily accounted for this, in that the NSP was looking at his map while his SP was asking the Yes/No confirmations. Furthermore, a majority of the dyads used eye gaze during the treatment condition (Condition B), apparently to facilitate turn-taking behavior and to avoid interrupting while both partners were communicating with devices.

Insertion Sequences

The total percentage of Insertion Sequences used by each dyad throughout all conditions, as well as the total percentages for the disabled NSP dyads and able-bodied NSP dyads are presented in Table 23. These data were derived from the total number of turns for NSPs and SPs in all conditions. Repetitions, Guesses, and Confirmation percentages were figured on the total number of SP turns. The percentage of turns incorporating abbreviations, was included in the data and was figured on NSP turns, since by a large majority, the NSPs in these dyads used word abbreviations. Clarifications and Information Queries were figured on both NSPs and SPs.

Table 23
Percentage of Insertion Sequence Turns Used by Each Dyad and for the Disabled Partner and Able-Bodied Partner Dyads.

Insertion Sequences	Dyad 1	Dyad 3	Tot. Disable	Dyad 2	Dyad 4	Tot. Able
REPETITIONS*	18	6	14	16	5	12
GUESSES*	28	8	22	3	9	5
CONF*	10	38	19	42	54	47
IND CONF*	2	3	2	5	28	14
Y/N CONF*	1	10	4	6	0	3
IQ-SP	14	21	16	25	18	22
IQ-NSP	1	5	2	.9	1	1
CLAR-SP	3	13	6	7	5	6
CLAR-NSP	1	20	7	21	35	26
ABBREV.	0	0	0	21	6	15

Note. Definitions for the Insertion Sequence codes may be found in Appendix B.
* Insertion Sequences figured on number of SP turns only.

Data revealed that all dyads performed similarly in terms of total percentages on Repetitions, Yes/No Confirmations, Information Queries by the NSP, and Clarifications made by the SP. However, differences in total percentages for individual dyads were noted, and an "averaging" effect for each group of disabled and able-bodied NSP dyad was evident. On Repetitions, Dyad 1 and Dyad 2 evidenced higher total percentages than the other two dyads. Although Yes/No Confirmations resulted in similar overall percentages between the two groups, not

evident is the pattern of Yes/No Confirmation use by the SP in Dyad 3, who used an overwhelming majority of Yes/No Confirmations in the A2 Condition. Clarifications by the SP was also used more in Dyad 3, although the performance of Dyad 1 resulted in a near equal total percentage of SP Clarifications by both groups.

Differences in total percentages between the groups are noted on all of the other Insertion Sequences. There was a marked difference in percentage of Guessing between both groups as a result of the interactive patterns used by Dyad 1. The SPs in the able-bodied dyads used more Confirmations and Indirect Confirmations than the disabled NSP dyads. In many instances, Confirmations were the only form of SP participation in the able-bodied dyads, particularly in Dyad 4. The total percentage of Information Queries used by the able-bodied NSP dyads was more than that of the disabled NSP dyads. Nonspeaking partner clarifications percentages were also higher in able-bodied dyads, although here too, there is an "averaging" effect based on the distinct differences in NSP clarifications between Dyads 1 and 3. The NSP in Dyad 3 used nearly the same percentage of NSP clarifications as the NSP in Dyad 2. The able-bodied NSPs were the only participants to use abbreviations, hence the marked difference between the two groups in terms of abbreviations.

Results indicate, then, that there were distinct differences in the percentage and type of Insertion Sequences used between the two groups. Similarities in total percentages were evident, but did not take into account individual dyad variation. It is important to note that the Insertion Sequences in which variance in interactive performance was most prominent (i.e., CLAR-NSP, NSP Abbrev., SP Guessing, IND CONF) point to an underlying distinction between the two groups in terms of the amount of NSP (sender) control and SP (receiver) participation. This difference in role relationships between the two groups will be addressed later in this section.

Speaking Partner Use of Device

Study of the data in terms of the SP's use of the device during Condition B revealed slight overall differences between the two groups. Figure 8 presents the total percentage of turns in which SPs utilized the VOCA for each dyad. The percentages for each dyad was as follows: Dyad 1, 20%; Dyad 3, 55%; Dyad 2, 30% and Dyad 4, 35% The overall percentages of device turns for the SPs in the disabled and able-bodied NSP dyads were 37.5% and 32% respectively. The marked difference between the two SPs in the disabled NSP dyads in using the device is most obvious. The SP in Dyad 3 used the device more

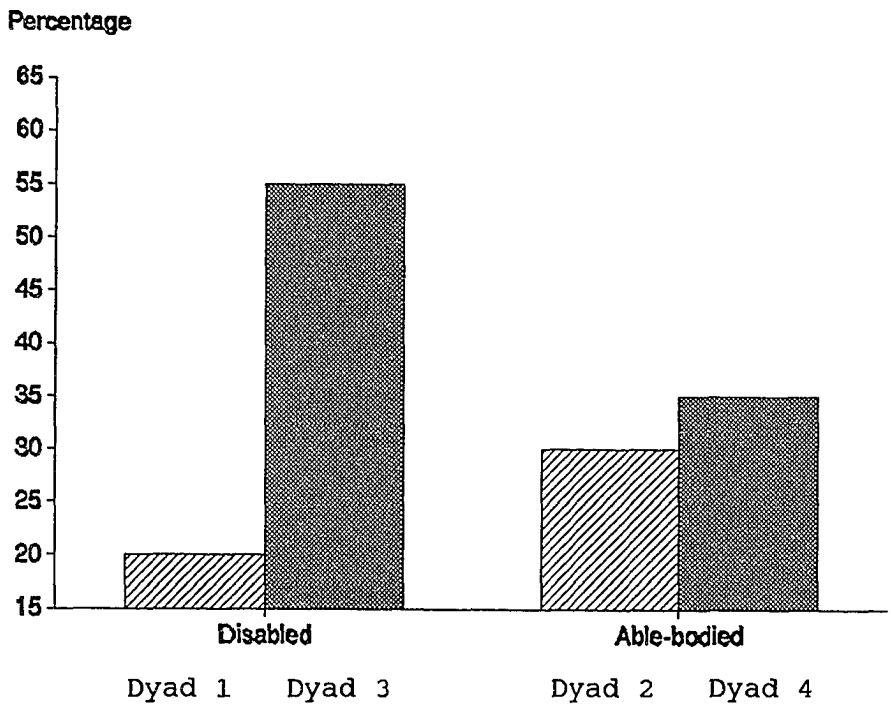

Figure 8
Total Percentage of Turns in Which Speaking Partners Utilized the VOCA During the Treatment Condition.

than any other and the SP in Dyad 1 the least. Reasons for this, in terms of role relationships have been discussed. However, during the postexperimental interview the SP of Dyad 3 stated that she felt she was more efficient on the device and wanted to be responsible for part of the information due to the physical limitations of her NSP. Additionally, both SPs and NSPs of the able-bodied dyads expressed that they preferred the SPs not to use the device during this condition unless it was necessary. The primary reason for these differences in use of the device was apparent in the roles assumed by the SPs in relation to their NSPs. Comparisons in the role relationships between these two groups will be discussed next.

Role Relationships

The role relationships, that is, the amount of sender control and receiver participation of the participants has been discussed for each dyad. When we consider the role relationships between these two groups and the apparent reasons for them, we find differing expectations, perceptions, and motivations. This was particularly true for the NSP participants. The disabled NSP partner in Dyad 3 was influenced primarily by his underlying need to display himself in a positive light as a competent communicator. The NSP in Dyad 1, was primarily driven by his need to display more natural modes of communication other than the device, and hence his frequent use of

gesture. This NSP had the motivation to convey his personality, as an intelligent, and witty conversationalist. These motivations of the disabled NSPs were due to past experiences and the attitudes of society in general toward the disabled. Their desire to appear "normal" and competent was seen in their choices of interactive behaviors. The NSPs and the SPs in the able-bodied dyads, however, did not display these same competing motivations. Their only goal was towards accurate and efficient task completion. There were noted differences in the SPs' motivations in the disabled NSP dyads as well. As a general rule, these SPs assumed a greater, more active responsibility towards task completion in order to make the contributions of the NSP less laborious, as evident in the types of Insertion Sequences utilized.

Summary

Comparing the results of disabled NSP and able-bodied NSP dyads in this investigation offers distinct differences in the performance of these two groups. A variance in roles and motivations of the participants accounted for all the differences noted, in terms of amount and type of Insertion Sequences, eye gaze, and the SPs' use of the device. The SPs and NSPs in the disabled NSP dyads used a greater amount of eye gaze and gesture in regulating conversation and in the exchange of turns. Data involving

the use of Insertion Sequences resulted in similarities and differences. Similarities in the total percentages on Repetitions, Yes/No Confirmations, Information Queries by the NSP, and Clarifications made by the SP were observed. However, the similarities in total percentages did not take into account individual dyad variation. There was a marked difference in percentage of guessing between the groups, with disabled NSP dyads using more guesses, as well as in the use of Abbreviations, Confirmations, Clarifications, and Information Queries; the latter four Insertion Sequences used more predominantly by able-bodied dyads. Furthermore, the physical limitations of the disabled NSP in Dyad 3 resulted in a greater use of the device during the treatment condition by the SP in this dyad, with an overall slight increase in the total percentage of turns of SP device use in the disabled dyads. These results question the presumed similarities of performance between able-bodied and disabled NSP dyads, and discourages the use of able-bodied individuals posing as NSPs in AAC research.

DISCUSSION

Results will be discussed with respect to four primary issues. First, the consideration of role-taking as a viable training method will be discussed. Second, the issue of interaction as a collaborative process involving mutual understanding and the minimizing of effort is discussed, along with issues of dominance and control. Third, a summary of the effective interactional management strategies identified in this research is provided, with specific consideration to the apparent influence of individual perspective and social factors. Suggestions for effective strategies in resolving referential conflicts is included in this discussion. Finally, the use of able-bodied individuals in AAC research is considered, with regard to the similarities and differences found among disabled and able-bodied NSP dyads in this investigation.

Role-Taking as a Training Method

As noted earlier, studies of nonnative English speakers have documented the beneficial effects of role-taking towards the use of more facilitative communicative strategies. In the current study, role-taking was defined as the SP's interactive use of the VOCA, and was examined as a method to potentially facilitate effective interactional management strategies in NSP-SP dyads.

Unlike the majority of prior research with augmented communicators, this study sought to investigate role-taking as a training method with subjects capable of generating their own utterances, on voice output systems, and during information transfer tasks. Role-taking was considered an effective training method to the degree that it promoted rate-enhancement strategies on the part of three dyads. In these dyads, the awareness of slow rate of message transmission and time constraints was enhanced by the experience of both partners interacting via devices. Responsibility for the rate enhancement was taken by the SP in one dyad (through Yes/No Confirmations) and the NSPs in two of these dyads, who evidenced an increase in the number of word abbreviations. There was a significant increase in use of these rate enhancement strategies either during the treatment condition or immediately following. Role-taking did not affect the number of length of Message Reformulation Episodes, as hypothesized. The number of MREs based on message elements, or SP understanding of the device, and message meaning was minimal in all dyads from the beginning of the experiment resulting in minimal potential for change.

As documented in results, training methods need to account for the attitudes and experiences of each interlocutor. The advantage of role-taking as a training method, is that the perceptions of the learners are

internal to this process and the strategies that emerge are spontaneous, and based on meanings that the participants construct for themselves and their interactive partners. To the degree that role-taking affected the interactive behaviors of the participants, it increased their motivation toward change, and made them accountable for the interactive changes that occurred. Most importantly, the internal dispositions (i.e., communicative goals, motivations, and perceptions) of the participants were related to the selection of the communication strategies utilized. Additionally, a process of describing effective interactional strategies with consideration paid to the roles and attitudes of the participants was presented. Unlike current training methods in which behaviors are externally imposed, this process incorporated the attitudes, motivations, and roles of the interactants as a first consideration, and viewed them as crucial to the types of strategies selected.

What was not predicted, was the degree to which the participant's goals and motivations affected the SP's use of the device, resulting in a diminished effect of the experimental treatment. In the able-bodied NSP dyads, the NSP roles were defined primarily by the underlying drive for greater efficiency or speed in transfer of information. This was also true of the SPs in these dyads, who viewed their use of the device as contradictory to the drive for

greater efficiency. Thus, the SPs utilized the device only in situations where confusion arose with a sufficient risk to accurate transfer of information. Due to this diminished effect of the independent variable, we cannot claim to understand the precise nature of the effects of role-taking on a variety of speakers in augmented interactions. The interactants in this investigation viewed their roles as partners in the interaction, rather than as facilitators, coaches, or advocates for increased use of the device. Subtle and important differences in these roles may indeed exist, resulting in different communicative behaviors than those displayed in this investigation. The interactive behaviors of B.L. and his mother in the pilot investigation, for example, were qualitatively and quantitatively different from those of the nonfamiliar partners. It seems plausible that B.L.'s mother viewed her role as facilitative, and used the device in the treatment condition to model effective rate enhancement strategies. Additionally, B.L. was more motorically impaired than the nonfamiliar disabled NSPs in the current investigation. B.L.'s mother apparently recognized that her use of the device during treatment would promote efficiency, since she was a faster typist. This finding is consistent with the SP's greater use of the device in Dyad 3. Hence, as often the case in interactive research, the difference in status and familiarity between

the interactive partners resulted in different findings. Also, it appeared that the severity of a NSP's physical impairment was a factor in the SP's use of the device, with SPs evidencing more use of the device with more physically involved NSPs. These issues have particular relevance to the clinical applications that can be made and the needs for further research.

Interaction as A Collaborative Process

Results of this investigation support current models of communication that focus on interaction as a cooperative and collaborative effort in achieving mutual understanding (Clark & Wilkes-Gibbs, 1986). As suggested by Clark and Wilkes-Gibbs, the participants mutually accepted each contribution before going on to the next contribution. The NSP's initial verb phrase (i.e., <Go to _____>) was marked by the SP for its status, that reflected the SP's confidence in the verb phrase produced. If the SP felt that the verb phrase needed refashioning, she asked for specifics and expanded on it. Subsequently, both partners engaged in a process of refashioning the original verb phrase until a mutually accepted form was reached. Clark and Wilkes-Gibbs (1986) described this process as the principal of mutual responsibility. The participants tried to establish with each contribution the mutual belief that the listener had understood, given the least amount of collaborative effort. Hence, a collaborative model of

conversation appears particularly relevant to the analysis of NSP-SP communication.

One aspect of communication that is crucial to collaboration is that the interactive partners be sensitive to and have awareness of their partner's interactive needs, and design their communication to the needs of their interlocutors (Bell, 1984; Giles, Taylor & Bourhis, 1973; Krauss & Glucksberg, 1977). Bell (1984), contends that persons respond mainly to the personal attributes and perceptions of their hearers in designing their talk. This contention holds true for the participants in this investigation to a large degree, in that the SPs and NSPs engaged in a collaborative effort to discover the realm of shared knowledge, and the amount that each partner set aside his or her own motivations to heed to the needs and motivations of the interlocutors.

Furthermore, the behaviors used by the participants were consistent with Speech Accommodation Theory (SAT) (Giles, 1980). The participants accommodated and adjusted their speech styles to that of their interactive partners in an effort to increase intelligibility and efficiency. The disabled NSPs, in particular, utilized speech styles which they felt would allow them to gain the partner's social approval and to maintain a positive social identity.

The SP in Dyad 3 adjusted her style through the use of Yes/No Confirmations as a way of increasing efficiency yet

accommodating to the underlying motivations of the NSP regarding his need for control. Similarly, the NSPs in all dyads assumed greater control while both partners were communicating with a device to spare their communicative partner the agony of laboring through what they perceived to be difficult communicative exchanges.

The one exception to this accommodation with the other partner occurred with Dyad 1. The SP in this dyad removed herself from the interaction by not guessing or turning away in reaction to the NSP's solicitation of multiple guesses. Her actions were consistent with what Giles (1980) refers to as divergence or not accommodating to the other partner's speech style. More specifically, the SP diverged so that the NSP would interact in a way that was acceptable and accommodating to her. As explained by Giles, individuals diverge when they react unfavorably to the personal characteristics of their interactants. All interactants simultaneously converged or diverged from the other partner's interactive style to reach a preferred balance based on their underlying goals and motivations.

A similarity among these aforementioned theories is that they explain interactional variation as a result of attributes of an audience or hearer. Clark and Wilkes-Gibbs (1986) primarily focus on the process of how individuals vary the strategies used in identifying shared referents. Giles (1980), attributes variance in language

behavior to the underlying moods, feelings, motives, and loyalties of the participants, as based on socio-psychological theory. Given that the task in this study was primarily a "transactional" task, as opposed to "interactional task" (Brown & Yule, 1983) the principles discussed by Clark and Wilkes-Gibbs account for the majority of the variance in interactive behaviors. For example, the NSPs varied in their ability to present accurate or sufficient initial presentations. As explained by Clark and Wilkes-Gibbs (1986), in selecting an initial verb phrase, the speaker presumably seeks to attain a form that is sufficient in detail (but no more prolix than necessary), free of errors, and not in need of further refinement. The NSP in Dyad 4 was perhaps most adept at presenting an "ideal" form that was acceptable to his partner. Thus, participation of the SP in this dyad towards accuracy was minimal. The NSP in Dyad 1, however, required and solicited more contributions from the SP, particularly when he presented analogies requiring more effort from the SP in identifying the referent than necessary. The ability of the NSP to be aware of the shared knowledge or information of his listener is often the result of experience with the task (Krauss & Glucksberg, 1977). It is likely that the NSP in Dyad 4 had more prior experience in giving instructions involving specificity.

Furthermore, all dyads differed between trials and conditions in what Clark and Wilkes-Gibbs (1986) refer to as a criterion sufficient for current purposes. More specifically, the participants did not trying assure perfect understanding of each utterance, rather, they established a degree of understanding on a continuum of high to low, depending upon their goals, motivations, and perceptions. Initially, most of the interactive partners utilized a rather high criterion for understanding. The dyads consistently utilized repetitions from the SP to assure accuracy, started over when there were chances of confusion, and frequently rechecked all locations and routes. However, in the treatment condition, the SPs were in better positions to accept contributions that avoided the laborious use of the Touchtalker. Additionally, the NSP tolerated less uncertainty about the listener's understanding of the referent for the same reason.

As documented previously, however, the internal drives and motivations of the participants accounted for variance in interactive behavior as well. Participants were concerned about meeting the desires of their interactant in combination with their own motives. These attitudes and perceptions varied throughout trials and experimental conditions. This finding lends support to Giles' theory of Speech Accommodation, based on the motives and perceptions of the participants.

Minimizing Collaborative Effort

The NSPs and SPs in this study collaborated and developed strategies in the interest of saving energy or effort. Often, the participants attempted to devise strategies that limited the amount that either partner used the device in order to "speed things along" and require less physical effort by the NSP. Hence, increases in word guesses, abbreviations, and SP Yes/No confirmations were evident. The SP in Dyad 3, for example, utilized the device more during the treatment condition than any of the other SPs due to the more extensive motoric limitations of the NSP in this dyad. The NSP in Dyad 1 often used gestural forms and pantomime to supplement his use of the device and contribute to the progress of discourse. Similarly, the NSP in Dyad 4 elected to offer more specifics and clarification in his initial presentation to minimize the number of turn exchanges needed towards mutual acceptance. Although certainly not representative of novel communicative behavior, this drive for efficiency did account for many features of the acceptance process.

Researchers have observed that AAC users contribute to conversations and/or use their device primarily when they feel obliged to do so, or when the potential rewards of communicating exceed the amount of communicative effort (Harris, 1982; Light, 1988). Simmons, in an investigation of the compensatory strategies used by aphasics, observed

that the aphasics employed more conscious behaviors and utilization of novel communicative modes, such as writing and a communication board, only when motivated and enthusiastic about communicating. Harris (1982) reported that physically handicapped children employed modes of communication, primarily gestures, which required less effort than a communication board, even if these modes resulted in ambiguous or nonspecific information. Additionally, investigators have provided illustrations of those with communication difficulties avoiding conversation altogether (Gass & Varonis, 1989; Simmons, 1993). Gass and Varonis have termed this avoidance of communication as the "path of least resistance," in which the "perceived loss of energy necessary for communication outweighs the perceived benefit (social or otherwise) to be gained" (p. 46). The participants in this study were continually collaborating on strategies that would meet the need to be accurate, yet required the least amount of energy in terms of use of the device. This drive towards minimizing effort was pervasive in the behaviors and underlying motivations of many of the interactants in this study.

Issues of Dominance and Control

In pursuit of task completion, the participant role relationship extended from the NSP being dominate with near complete sender control, to active receiver participation by the SP. The role relationship of each dyad varied

throughout the experimental conditions and between dyads, and dictated the types of interactive strategies used. NSP contributions to information transfer were not only in the form of standard verb phrases, but also signalled by the use of clarifications, information queries, and solicited repetitions. SP interactive behaviors provided refinement of the initial presentation through information queries and clarifications, and through the nonsolicited repetition of messages and words. In Dyads 1 and 2, the SP assumed greater responsibility for accuracy and specificity during the pretreatment and posttreatment conditions. In Dyad 4, the NSP was the greater contributor to information transfer, whereas in Dyad 3, the NSP and SP were near equally responsible. During the treatment condition, all dyads evidenced a shift towards more participation and control on the part of the NSP. Variance in roles was attributed primarily to the changing communication goals of the participants as based on their underlying drives, perceptions, needs, and attitudes. The amount of sender control and receiver participation was often dictated by the sender (NSP), since he was in control of the information to be transmitted. However, the SPs, particularly in the disabled dyads, demonstrated instances of assuming more control for the information, primarily for the sake of time efficiency and physical effort by the NSP in activating the device.

The use of the information task in this experiment was to offset the SP's presumed dominance in conversational tasks that is often reported in the AAC literature. Farrier and colleagues (1985), documented that NSPs evidenced more control, in terms of number of turnsand patterns of initiations in a direction-giving task, than in a decision-making task which allowed for more equal control to both NSP and SP. Subjects produced from 54% to 68% of the total number of initiations in direction-giving task samples, and produced 74-84% of the total words produced by both members of the dyad. In comparison, the NSP participants in this investigation engaged in slightly more turns for each condition than their SPs, although looking at general patterns, the number of turns for NSPs and SPs were relatively equal. This appears to be a greater number of turns than NSP participants in conversational tasks from previous investigations (Morningstar, 1981; Light, et al., 1985). Additionally, post hoc comparisons were made of the types of Insertion Sequences that dictated more responsibility for information transfer and linguistic SP participation (i.e., Information Queries, SP Clarifications, Guessing, and Yes/No Confirmations), from those Insertion Sequences which were in the form of responding or confirming (i.e., Repetitions and Confirmations). This analysis revealed that 51.5% of the SP turns contained Insertion Sequences which were more

responsible for information transfer and control, compared to 48.5% of SP turns containing Insertion Sequences in the form of responses and confirmations. Although this direction giving task was designed to perhaps allow less control to the SP than documented in other studies, it is evident that the task does promote greater NSP participation than decision-making or conversational tasks.

Interestingly, there appears to be some debate as to whether SP participation and dominance in augmented interactions contributes to the communicative competence and effectiveness of AAC users. The pervasive view in earlier AAC investigations was that SP contributions to interactions with NSPs were interruptive and interfered with linguistic performance of the AAC user. Researchers suggested that SPs relinquish control and allow the NSP to formulate compete utterances before responding (Harris, 1982; Morningstar, 1980). Higginbotham, Mathy-Laikko and Yoder (1988), and Blau (1986) contend, however, that this suggestion may be premature, and not representative of the co-constructive process of message formulations in NSP-SP interactions. In their investigations, it was reported that mutually coordinated interaction between NSPs and SPs maximizes intelligibility of the NSP's board related communication and permits rapid and efficient exchange of turns. Further, the NSP often solicited participation of the SP to confirm their board messages and to guess. This

finding is supported by the NSP participants in this investigation who solicited word and message guesses and encouraged the SP to specify referents and routes. Given these findings, then, the SP's participation may be viewed as a positive demonstration of the NSP's sensitivity to the orderly flow of interaction and the need for confirmations.

Still, a majority of research indicates that control exerted by the conversationalist can impede the linguistic performance of individuals with communicative difficulties, as well as the individual's internalization of attitudes of being an adequate communicator (Light, 1988; Mirenda & Donnellan, 1986; Norris & Hoffman, 1990). Additionally, the active participation of AAC users may be a critical component in promoting positive SP attitudes towards the NSP as a competent communicator. Strategies and tasks which promote a more equal balance of turns and participation on the part of NSP and SP interactants, including information transfer tasks, appear to be useful for developing the AAC user's linguistic competence and awareness as an adequate interactant.

Light (1988) contended that future AAC interactive research must address the issue of communicative competence in individuals who use AAC systems. Given the constraints of an augmentative communication system and impaired gestures, one cannot assume that the interactional requirements of AAC users are like those of verbal

interactants. By defining a realistic paradigm of communicative competence in AAC user interactions, we may gain understanding of those aspects of AAC interaction that enhance AAC user control and efficiency, and are rewarding to the AAC user and their conversational partners.

Effective Communication Strategies

Effective interactional management strategies during the information transfer task were identified for each dyad in terms of those which promoted an optimal balance of accuracy and efficiency in consideration of the role relationships assumed by each member of the dyad. Previous investigations have suggested that intervention for NSP-SP dyads should be individualized, given the variety of discourse styles apparent (Blau, 1986; Rauck, 1991). However, little attention has been directed to why these individual variances in communicative behavior occur. Results of this investigation suggest that the internal dispositions (i.e., their goals and motivations) of the interactants plays a significant role in the variety of interactional styles and strategies derived.

A summary of the strategies judged as "effective" for each dyad is presented in Table 24. The majority of participants demonstrated these strategies during the posttreatment condition. Familiarity with the task, device and interactional partner contributed to the use of viable strategies, as well as the use of rate enhancement

Table 24
Effective Interactional Management Strategies for Each Dyad.

Dyad	Role Relationship	Rate Enhancement Strategies	Strategies That Promote Accuracy
1	Sender Control Some Receiver Participation	WLG-NON WCQ-G NON Combination of NSP on device and gesture for predictable words and messages	CLAR-NSP Present information in installments CLAR-SP IQ-SP MLR CONF
2	Sender Control Some Receiver Participation	CLAR-NSP on difficult routes and stops CLAR-SP otherwise Abbreviations of frequent words and established referents Y/N CONF (NSP control)	CLAR-NSP Present in installments CLAR-SP MLR CONF
3	Sender Control Active Receiver Participation	Y/N CONF (SP control) Use of word level vocab on device	CLAR-NSP IQ-NSP IQ-SP CLAR-SP MLR CONF
4	Predominant Sender Control Minimal Receiver Participation	Abbreviations on frequent words and established referents Use of word level vocab on device	CLAR-NSP CLAR-SP IQ-SP MLR CONF

strategies as prompted by, or the direct result of the SP's interactive use of the device.

It is certainly plausible that these strategies do not represent the "best set" of interactive techniques for any one dyad. There may well be additional strategies or a different combination of strategies that each dyad can utilize which would result in greater efficiency or accuracy. Furthermore, as demonstrated by the interactants, what has been determined to be an effective strategy for participants can shift depending on their current roles and motivations and the motivations of their interactive partners. Nor is it suggested that this list is, by any means, comprehensive. Although a variety of sender and participant roles are evidenced, additional strategies not incorporated here have already been noted by other researchers (Blackstone & Cassatt-James, 1988; Rauck, 1991). Then too, this list does not represent all effective behaviors on the part of the participants. For example, the establishment of referents and directions (e.g., left-right, east-west) prior to initiation of the map tasks, and waiting to clear the device after the SP has confirmed the message proved to be positive strategies for two of the dyads.

What can be satisfactorily accounted for in this analysis are viable strategies that are learner derived, rather than facilitator imposed. These strategies were

spontaneously derived by the participants and effectively dealt with information transfer and communication difficulties. Moreover, the training method utilized assured that the strategies identified represent those that begin with current participant expectations and perceptions rather than a lack of consideration for these factors, or identifying roles and motivations after other strategies have failed.

Perspective of the Individual Participants

The disabled NSP's underlying motivations and goals to appear as independent, competent communicators, and to utilize more natural forms of communication dominated the types of strategies used. Of interest was the motivation of one NSP in using the device to interact socially and to convert the transactional task into a communicative game. This NSP demonstrated a marked sensitivity to the social, interactive goal of communication in establishing and maintaining social relationships. The existence of both message transmission and interactional goals of communication has been discussed in the sociolinguistic and discourse literature for a number of years. Too often, however, researchers and practitioners are concerned with the transactional goals of communication in conveying information while ignoring the social aspects. As Light (1988) discussed:

> "In reviewing the interaction studies in the [AAC] field, it is apparent that most

> researchers have inferred that the goal of the participants in their interactions was to exchange information; the measures and data analysis employed in most studies have reflected this assumption" (p. 70)

In presenting the results of an investigation regarding the issue of social closeness, Light adds further:

> "...if the goal of the interactants is to establish social closeness, a certain level of communication breakdown, provided it is not excessive, may be perfectly acceptable to the participants. Such breakdown would not impinge on the 'effectiveness' of the interaction at all, since the information exchanged is not of central importance and since the process of clarification may in fact serve to maintain the interaction and thus promote social closeness" (p. 71)

The interactive behaviors that practitioners consider as most important for communication may not coincide with the interactive goals of the AAC user. Perhaps, this difference is a reason for the evidence that AAC users and their interactive partners do not employ trained strategies outside of the clinical situation or context (Glennon & Calculator, 1985; Rauck, 1991). Traditionally, a lack of generalization of communicative behavior to environments outside of a trained setting has been viewed as a lack of facilitation of those trained behaviors in more than one context. Although this may indeed be the case, we must also consider that the modes and strategies that we are suggesting or "imposing" on AAC users may be of little importance to them. Hence, a definition or description of those strategies that are effective must also include

the perspectives of the AAC user and their communicative partners, since without this acceptance, strategies suggested may not be functional or utilized.

The Influence of Social Factors

In addition to individual perspectives, practitioners and researchers must examine the interactions of AAC users from a social perspective. As elucidated by Swiedel (1989), perceived interactive roles are often based on the "attitudes, values and behaviors" ascribed to them by society (p. 166). Society often ascribes a role of helplessness, low power, and incompetence to disabled individuals. Further, success of communication relies on the willingness of the communicative partner to accept the nonspeaking participant as a capable communicator (Mirenda & Iacono, 1990; Swiedel, 1989). As Warrick (1988) suggested, many nonspeaking clients are more challenged by social/relational factors than physical or cognitive inadequacies.

The disabled NSPs in these dyads avoided projecting a negative image of being handicapped. Certainly the presence of a wheelchair or walking cane, the exaggerated unnatural movements and gestures, and the presence of the augmentative device did not help in promoting feelings of normalcy and self-esteem. The NSP in Dyad 3 attempted to compensate for this by active attempts to control the situation via selected presentation of new and novel

information, and continuation of typing when the NSP provided accurate guesses. The NSP in Dyad 1 chose to predominantly use more natural forms of communication, such as guessing and frequently used analogous expressions (e.g., <W-e b-u-y U-S-A>) which reflected his intelligence and world knowledge. Other investigations have provided illustrations of individuals with communication difficulties who avoided conversing altogether so as not to appear different or handicapped and/or impose on their communicative partners (Light, 1988; Simmons, 1993). No doubt, their motivation was based on past experiences, and avoiding what Goffman (1963) described as a social prejudice and stigma against those with undesired differences.

Further, the participants in all dyads selected strategies which they believed would not impose on their communicative partners. Three of the SPs, for example, avoided guessing so as not to interrupt and violate rules of politeness (Brown & Levinson, 1978) and were sensitive about imposing on the NSP unless expectations or the need demanded.

Similar results were described in ethnographic research by Simmons (1993), who investigated the communicative compensatory strategies of two adults with aphasia. In addition to the underlying motivation towards economy of effort, Simmons explains the behavior of the

interactants in terms of the mechanisms of politeness, avoidance of stigma, and awareness of interactional power. The aphasic subjects in her investigation avoided projecting a negative image that would classify them as handicapped, even to the extent of avoiding conversation all together. Additionally, Simmons explained the influence of power as a compelling force underlying the aphasic's use of compensatory strategies. That is, the aphasic's use and choice of compensatory strategies were also a result of the subject's attempts to "maintain face in order not to lose status and position as a competent communication partner" (p. 297). These same underlying motivations, economy of effort (efficiency), politeness, avoidance of stigma and interactional power all gave rise to the strategies used by the subjects in this investigation as well.

Results from prior investigations indicate that the communication problems of those with communicative difficulties is less that of the disability itself and more that of the interactive partner's directive behaviors and attitude (Mirenda & Donnellan, 1986; Norris & Hoffman, 1990). As suggested by Mirenda and Donnellan (1986), the "verbal/conversational disability ought to be viewed in relationship to the interactive partner's behavior rather than in absolute terms" (p. 139). Mirenda and Iacono (1990) discuss the importance of identifying social biases,

and the use awareness education, sensitization, and advocacy efforts in helping to overcome these negative social influences. Additionally, facilitators and practitioners need to be aware and sensitive to the NSPs' need for not projecting an image of helplessness and being handicapped and work cooperatively with NSPs and SPs in overcoming social stigmas and perceptions (Simmons, 1993).

Strategies in Resolving Referential Conflicts

Strategies were identified which resulted in successful and efficient resolution of referential conflicts during the information transfer task. These strategies are important to consider, particularly with those who evidence communication difficulty, since conflicts in understanding shared referents and concepts often arise in their interactions. Solutions identified by Yule (1991) in investigations of nonnative English speakers were used and modified for the task employed by NSP-SP dyads. Yule documented in his investigations that solutions which do not take into account a negotiated mutual understanding of each participant's comprehension or "world of reference" are ineffective. Such was the case of the solutions presented by the participants in this investigation. Situations whereby the interactants assumed "no problem," and acted as if no referential problems existed often resulted in nonsuccessful solutions. In other instances, the interactants would make arbitrary or non-negotiated

decisions based on what they believed to be the correct locations, generally through a process of elimination. That is, rather than check with the other person and share information regarding each partner's world of reference, the participants assumed that the identified referent "must be it" since other possibilities appeared not to exist. This strategy was used by a majority of the participants and often resulted in successful identification of locations and routes. A partial reason for this success was that the particular maps used did not include a large number of referents and routes, making the process of elimination easier. Additionally, once familiar with the types of conflicts that were presented, the partners were more secure and confident about making arbitrary decisions, and engaged in more negotiated strategies if confusions continued. The NSP in Dyad 4, for example, was adept at providing specifics based on what he presumed were conflicts from prior map confusions. As Clark and Wilkes-Gibbs (1986) propose, participants aren't trying to assume perfect understanding, but understanding to a "criterion sufficient for specific purposes" in order to minimize collaborative effort. The determination of how much is sufficient depends on the purpose of the interaction (i.e., some situations involve more specificity and detail), the motivations and perceptions of the participants, and the participant's level of confidence that the mutually agreed

referent is indeed correct. These variables may change on a moment-to-moment basis.

The negotiated process used by Dyad 3 was particularly useful in offering successful solutions. Generally, both participants would inquire about the other's map prior to and during the establishment of referents by providing unsolicited map clarifications and inquiring about specific referents along each route. It may seem that this strategy involved more exchanges of information and was more prolix than necessary. Yet, in the end, the strategy often resulted in greater efficiency, as well as assured successful solutions, since both partners learned and visualized the other's world of reference prior to establishing referents and thus, prevented conflicts from occurring.

Suggesting that any one strategy would be most preferred would not take into account the variables previously described in terms of the task and context, prior shared knowledge of the participants, familiarity of the interactants, and each partner's level of confidence. Further, the drive to minimize collaborative effort is an important focus for NSP-SP dyads. The strategy of negotiating outcomes based on Other World Solutions involves less risk towards successful outcomes, particularly if the need for specifics is required and in unpredictable or unfamiliar contexts or tasks. However, in

order to minimize effort, a process of arbitrary elimination may be advantageous depending on prior shared knowledge and familiarity of the participants. Interactants need to be aware of and gauge the strategies used in accordance with these variables.

The Use of Able-bodied NSPs in AAC Research

Comparing the results of disabled and able-bodied dyads in this investigation with those of previous research utilizing able-bodied persons on augmentative devices or aids (Farrier et al., 1985; Higginbotham, 1985; Rauck, 1991) is difficult, at best, given the variety of tasks, contexts, types of communication aids and focus. Higginbotham, for example, used a different task in which the NSP informed the SP on how to play a computer game, and he, as well as Rauck, incorporated a different type of augmentative communication device than the one employed here. These methodological differences alone may account for any differences in the data reported with that of this investigation. However, general comparisons can be made regarding the discourse styles of the participants here with those of prior studies. In his investigation utilizing two able-bodied dyads, Higginbotham reported that one dyad used a "grammatical" discourse style, while the other dyad utilized a more "telegraphic" speech style with a slightly higher percentage of word level guesses and confirmation queries. Rauck (1991) observed a similar

variance in discourse style in her investigation with three able-bodied dyads. Specifically, Rauck reported that two dyads utilized a complete utterance style in spelling out much of the information with no abbreviations. The third dyad, however, was reported to type out minimal information on the board and utilized gestures and abbreviations while allowing the speaking partner to ask Yes/No confirmations and make guesses. In comparing these results with the disabled and able-bodied dyads in this investigation, it would appear that the disabled dyads used a style similar to the dyads in these previous investigations that incorporated more "telegraphic" speech and allowed participation of the speaking partner in the form of Yes/No confirmations and guessing. The able-bodied dyads, however, used discourse patterns that were similar in a majority of the able-bodied dyads in these previous investigations. Although no hard claims can be make on the basis of this comparison alone, it would appear that able-bodied NSP dyads may well use different styles of discourse while interacting on devices than those used by disabled NSP dyads.

No doubt, the characteristics of using the augmentative communication system resulted in interactive similarities between the participants in this investigation. As documented by Higginbotham (1986), all dyads used a device activation-verbalization phenomena and

a co-constructive process in the form of MFEs. Further, all dyads demonstrated some similar interactional problems which could be attributed to the properties of the augmentative device itself. The interactional problems that were device specific included difficulty in synthesizing spelled information, and in understanding the speech of the device. The particular types and amount of difficulties varied within and across dyads based on this feature alone.

As demonstrated by the participants in this investigation, however, the similarities due to the device itself could account for only a small portion of the interactive behaviors observed. The strength and consistency of the communicative behaviors displayed as a result of the differing roles, perceptions and motivations of the disabled participants and their partners is inescapable. This variance in roles and motivations accounted for all of the differences noted, in terms of the amount and type of Insertion Sequences, eye gaze and the SP's use of the device. Furthermore, the physical limitations of the disabled NSPs, particularly in Dyad 3, resulted in a greater use of the device during the treatment condition by the SP in this dyad. The SPs and NSPs in the disabled NSP dyads used a greater amount of eye gaze and gesture in regulating conversation and in the exchange of turns. This finding adds further support to

results of an investigation by Buzolich and Weimann (1988), who noted eye gaze and other forms of gestural communication as prominent signals of turntaking in the augmented interactions of NSP and SP partners.

Few, if any researchers and practitioners would deny that these differences exist and that generalizing from data obtained from normal dyads to the disabled population is limited. At last, we have some evidence as to the degree to which these generalizations can be made and the specific aspects of interaction that differ. It appears that future investigations incorporating the use of able-bodied NSPs would need to be complemented by additional studies employing disabled populations in order for useful comparisons to be made.

IMPLICATIONS AND CONCLUSIONS

This study of the effect of role-taking as a training method suggests several clinical implications and opportunities for research. Implications for the training of Speech-Language Pathologists and teachers are discussed, as well as caveats which should be considered in understanding the implications of this research.

Clinical Implications

Although further investigation of role-taking as a training method is warranted, the results of this study lend support to providing SPs with interactive experience using a VOCA as a first step in training facilitators as well as AAC users. Unlike current device training programs and workshops which emphasize operational competence on a device through intermittent practice, it appeared that the interactive use of the VOCA by both partners was necessary for more effective strategies to emerge. Interaction promoted awareness of time constraints and effort needed to maintain a conversational flow. Perhaps it was the interaction of both participants on separate devices that precipitated this effect. Whether or not this same effect could be achieved with both interactants exchanging turns on one device is a question for further research.

A primary finding of this investigation was the pervasive effect that underlying goals, motivations, and

perceptions had on interactive behaviors. This finding has particular relevance for the training methods used in teaching others to be effective partners and facilitators. It lends support to those methods which consider the preferences and motivations of the communicative partners. Armed with this information, one can determine which particular strategies might be effective for the parties in question. A process of deriving effective strategies for information transfer and resolving referential conflicts given the interactant roles of the participants was demonstrated. It should be noted that no provisions were made to alter the experimental device or to include additional, perhaps more useful, vocabulary items or conversational regulatory messages (e.g., "Did ya get that?" or "Let's start over"). These additions to the vocabulary set, may have prevented losses in accuracy and efficiency. Given the particular constraints of the task and situation, as well as the particular motivations of the participants, these techniques may offer simple guidelines regarding which strategies may be effective during information transfer tasks and situations.

There are situations in which the underlying motivations and attitudes of the AAC user or significant others may impede their progress in meeting communicative goals. Without question, informing participants about the advantages of augmentative communication systems and the

types of communication strategies that may be useful can result in a change in the goals and motivations of the AAC user and their communicative partners. This has been demonstrated repeatedly in clinical situations and in prior research. Even so, there appears to be a limit to the degree to which these attitudes can be changed, as evidenced by a significant finding of an ethnographic investigation by Damico and Damico (1990) with an adult head injured, augmentative communication user and her primary interactants. Despite the facilitator's imparting of information and suggestions regarding "effective" communication strategies, this AAC user persisted in utilizing more natural modes and strategies of communication which were preferred by her, as well as those in her environment who were significant to her. This case leads us to the realization that although knowledge regarding augmentative systems and strategies may influence the user's perspective, it does not define them. What may more richly define them is the AAC user's background, experiences and personal preferences. As discussed by Goodwin and Duranti (1992), knowledge of one's extrasituational context involving variables and issues that are not subject to local interpretation is essential when attempting to truly interpret and understand one's communicative interactions and why those interactions were organized in certain ways.

The observation that the NSPs and SPs in this investigation derived effective strategies spontaneously without suggestions or training by the experimenter has important clinical relevance. The participants utilized unique strategies that served their goals and motivations, some of which could not have been predetermined or predicted. Training methods that initially allow interactants the opportunity and freedom in deriving strategies to fit their particular needs not only assures that these strategies may indeed be functional and useful, but affords the interactants some degree of autonomy and control, as well as a sense of responsibility towards the use of these strategies. Other investigations have documented the use of effective, spontaneously emerged strategies in the behaviors of essentially nonverbal individuals and their interactive partners (Simmons, 1993; Sweidel, 1989). As discussed by Simmons, these emerging interactive behaviors should not be overlooked in the clinician's enthusiastic pursuit of treatment options. Clinicians and facilitators should initially look to the AAC user and interactive partners in deriving successful strategies. Forearmed with this information, existing successful ways of communicating can be reinforced and additional strategies suggested if necessary. Using such a process will enhance our understanding of the participants interactive needs and motivations and improve our ability

to intervene in an effective manner. Additionally, allowing the interactants the autonomy to devise strategies independently of the facilitator may lead to the AAC user's internalization of being a competent communicator.

Finally, the measurement techniques utilized (i.e., MFEs and Insertion Sequences) as originally defined by Higginbotham (1985) and modified for this investigation, offer a viable way that facilitators and practitioners can describe the communicative behaviors and measure change in the interaction of NSP-SP dyads. Indeed, as the field of communicative disorders moves progressively toward richer descriptions of human communicative behavior and socialization, such descriptive methods and units of analysis will become essential to our further progression in the field.

Implications for Professional Training

The advantages of using role-taking, or the interactive use of a VOCA, as an initial training method for clinical students and professionals in speech-language pathology, as well as teachers should be considered in university training programs and school environments. Role-taking did enhance an increased awareness of the interactional difficulties and needs of NSP-SP interactions on the part of both SPs and NSPs in this investigation as evidenced in the postexperimental interviews. Several participants offered opinions of ways in which the device

could be altered for more successful communication, as well as strategies which may increase successful and efficient transfer of information. Interestingly, the participants made comment on the need for SPs to be "patient" in interacting with NSPs and that SPs should not be quick in "interrupting." The amount of SP participation while both interactants were communicating on the device decreased significantly, and this effect continued into the posttreatment condition for a majority of the dyads. Thus, role-taking appeared to facilitate the participants' awareness of the need to be patient and the laboriousness of using a device for communication. Additionally, we cannot dismiss the fact that a "trainee's" interactive use of the device will familiarize him or her with a nonfamiliar mode of communication. This, in and of itself, may encourage interaction with AAC individuals and prevent persons from immediately disregarding AAC users in interactions due to the SP's nonfamiliarity or confusion with the augmentative system. Further, interactive use of the device by speech-language pathologists and teachers may help some to realize that those who are disabled are not necessarily incompetent communicators. Hence, this method may help to facilitate positive views of AAC users as capable communication partners.

Qualifications and Cautions

Use of Normal Subjects

Since distinct differences occurred between dyads employing able-bodied and disabled NSPs, generalization from the data obtained by the able-bodied individuals to a heterogeneous disabled population is limited. The differences noted, in terms of eye gaze, amount of SP device participation, and use of Insertion Sequences, need to be considered in generalizing able-bodied data to disabled individuals. No doubt other differences may exist, which were not recognized in this research. However, the pervasive effect of the disabled NSPs' motivations and perceptions on the strategies used, discourages further use of able-bodied persons in AAC research, at least without accompanying studies incorporating disabled individuals.

Visual Use of the Communication Device

The spatial relationship of the dyads in this investigation, along with the barrier, shielded the SP from visual availability of the device. This arrangement occurs with NSP-SP dyads during face-to-face interactions and in classrooms, while NSPs are often projecting from a distance. However, availability to the visual display and board topography to the SP may have facilitated comprehension and prevented message reformulations, as evidenced in an investigation by Higginbotham (1985).

Further work in this area may consider the spatial relationships of the interactants and the provision for visual availability of the device by the interactive partners.

Task Experience

One additional consideration is the amount of shared experience and knowledge by the subjects about the direction-giving task. This has particular relevance to the disabled NSPs who may not frequently engage in direction-giving interactional experiences in the nature of routes and locations. In support of the selection of the task employed, it should be noted that these particular disabled subjects had engaged in a variety of "world experiences," and had adept linguistic abilities. More importantly, both disabled subjects appeared well versed with regard to directions (i.e., left-right, horizontal-vertical) at the start of this experiment. The information task utilized is unique from other research in that it allowed the NSP some control in providing a majority of the information, and allowed for equal amount of turntaking on the part of both participants. The task also prevented the NSPs from "opting out" of communicating, which is frequent in NSP-SP conversations, particularly when it's not necessary for the NSP to communicate. Thus, the use of NSP-SP strategies under these "optimal" conditions was possible. Additional research employing

such tasks will prove to be fruitful, particularly since persons frequently find themselves in situations where information-related talk is necessary (e.g., classrooms, jobs, talking to customers). Information related talk is also a part of social conversation and discussion when it is necessary that the message is clearly understood by listeners (Brown, et al., 1984). As discussed by Brown, Anderson, Shillock, and Yule (1984), information talk is not more necessary than social conversation, rather, it demands different strategies and different appropriate language.

Future Research Endeavors

This investigation serves as an initial endeavor in the study of role-taking as a training method for interactants in NSP-SP dyads. Given the positive effect of role-taking on the part of three of the dyads, as well as in the investigations of nonnative English speakers, the potential effect of this training method in a wider AAC population is apparent. Although participants in this investigation, particularly the disabled NSPs, represented distinct interactive patterns, motivations, and preferences, the inclusion of nonspeaking individuals with varying motoric, experiential, and communicative abilities may well produce a difference in the treatment effect than those obtained here. This holds true for SPs as well, particularly those of varying status, backgrounds,

experiences, familiarity with the NSP, and assumed roles than the SPs represented. Perhaps the use of persons who view their role as facilitators, rather than partners in interaction, will evidence different interactive behaviors and strategies, and allow investigators to view how roles interact with the individual's communicative behaviors.

Additionally, there is a need to extend research to examine this training method in other contexts, such as conversation, in which interactive behaviors may vary according to a number of interrelated contextual factors. The advantage of this method in highlighting the interactants' awareness to the needs of the interactive dyad, as well as providing individualization of learning may result in increased generalization to other situations and maintenance of these strategies over time. Future research may look at these factors as well. Finally, the investigation of role-taking while two partners are interacting with one device may result in findings that are advantageous to clinical situations in which only one device is available for training.

The overwhelming effect of the participant motivations and perceptions on their interactive behaviors justifies the need for further investigations that explore the attitudes and perceptions of nonspeaking individuals and their significant communication partners. Over the years, an increasing number of disciplines have developed interest

in the measurement of attitudes and attitude change of nondisabled persons towards the disabled. Few empirical studies have been conducted on attitudes towards nonspeaking individuals utilizing AAC systems (Gorenflo & Gorenflo, 1991) or of the NSP interactants themselves. In spite of these efforts, and a growing concern towards identifying perceptions and attitudes, there is little substantial evidence on the internal dispositions of individual NSP-SP interactants and the ways in which these attitudes are defined. Investigations are needed which explore viable methods through which practitioners could develop an understanding of what these attitudes are and how they are translated into interactive behaviors.

As AAC users become integrated into society and come into contact with other AAC users, there is a growing need for studies which explore the interactional patterns and discourse regulatory devices of dyads in which both partners are using forms of augmentation. The participants in this investigation, for example, evidenced an increase in the use of eye gaze and more "overlap" in talk while both partners were interacting with devices. There is little empirical evidence with regard to how individuals communicate in these situations as they attempt to regulate turn-taking, gain attention, and so forth, while adapting to the constraints of both interactants communicating on a device. With an increasing number of nonspeaking

individuals who are utilizing technology and a variety of augmentative communication systems, the implications of such research are just now being realized.

In regards to the measurement techniques used in future investigations, researchers must be cognizant of including measurements which take into consideration the co-constructive nature of NSP-SP interactions (Buzolich & Wiemann, 1988; Higginbotham, Mathy-Laikko & Yoder, 1988; Light, 1988). As documented by these researchers, analyses which do not reveal how repetitions, guesses, inquiries, and other "within-message phenomena" function in NSP-SP dyads, may lead to inappropriate suggestions for clinic use (Higginbotham, 1985). Additionally, measures of the effectiveness of interactive behaviors need to incorporate the perspectives of the participants involved, through interviews, self-ratings, needs assessments and similar approaches (Light, 1988). Investigations have begun to include the incorporation of judgements from a social perspective, either by utilizing nondisabled individuals or professionals, in order to offer social validity of experimental treatments (Cassatt, 1989; Light et al., 1992). Since judgements of professionals regarding effective or appropriate communicative behaviors may be biased or different from that of AAC users and partners, further research that delineates possible differences in these judgements is warranted.

Conclusions

In recent years, there has been a paucity of research examining the communications of AAC users and their communicative partners as researchers and practitioners devote attention to the many issues surrounding the communicative, educational, environmental, and emotional welfare of individuals utilizing AAC systems. Results of studies on interaction to date have gleaned valuable evidence as to the interactive patterns that occur primarily in conversation and how interactions are influenced by AAC user and partner characteristics, contextual variables, and characteristics of various AAC systems. Further, investigations have begun to consider training methods which may alter interactive patterns to facilitate the communication of AAC users. This investigation offers one more piece to a fragmented and incomplete puzzle. Clearly, more research is needed to explore the complex interactive issues and unanswered questions that continue to arise.

Not surprising, is the amount of variation that occurs in interaction, in particular, the interactions of AAC users and their communication partners. No doubt, interactive variation is due to numerous interrelated contextual factors and characteristics of nonspeaking and speaking partners. Perhaps one of the major findings of this study is the documentation of social and intrapersonal

influences that account for interactive variation, as communicators engage in a collaborative process of mutual understanding influenced by social factors, their own motivations and needs, as well as the perceived needs of their interactive partners. Unlike the majority of sociolinguistic research that explains communicative variation based on variable rules and may characterize speakers as a kind of "sociolinguistic automation" (Giles, 1980), this investigation attempts to explain linguistic variation partially on the basis of socio-psychological theory (Giles, 1980), as interactants appeal to the characteristics of their listeners (Bell, 1984), and engage in a collaborative and organized interactive sequence to achieve mutual understanding (Clark & Wilkes-Gibbs, 1986).

Practitioners must learn to deal with these complex interactive variables and strive for intervention methods which take them into account. Findings of this investigation support the use of role-taking, or the SP's interactive experience with a communication device, is one training method which accounts for the internal motivations of the participants, and enhances awareness of the communicative needs of interactants. Further, this method allows communicators the opportunity to naturally derive strategies that result in effective communication, and increases the likelihood that the emerging strategies are functional and realistic to the partners involved.

Additional research will help to validate this method with a variety of AAC users and interactive partners.

Professionals in the field of AAC have come to realize the dilemma of helping AAC communicators in a world of preexisting norms, expectations, and attitudes. We must continue to search for viable methods that support the emerging interest in socio-communicative issues among those engaged in the promotion and support of AAC users in interactive contexts.

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APPENDIX A

Results of Pilot Investigation
Frequency of Insertion Sequences

REPETITIONS

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
WLR	1	4	1	2
MLR	3	3	3	2

GUESSING

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
WLG	4	2	14	21
MLG	1	1	8	2
SOL	1	1	8	9
NON	4	2	14	14

CONFIRMATION QUERIES

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
WCQ-R	3	5	0	1
MCQ-R	3	1	0	2
WCQ-G	5	9	11	19
MCQ-G	3	6	9	3
SOL-G	2	3	6	12
NON-G	6	12	14	10

YES/NO CONFIRMATIONS

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
	0	1	3	2

OFF TASK/INTERRUPTIVE

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
OT-T	5	5	0	1
OT-S	4	0	0	0

INFORMATION QUERIES

	Condition A1 Trial		Condition A2 Trial	
	2	8	12	13
	11	14	12	10

MESSAGE REFORMULATION EPISODES (MRE)

Trial	Frequency	Type
2	3	OI-MM-RRCE-NSP OI-MM-SP OI-MM-RRCE-NSP
8	2	OI-EM-SP OI-EM-RRCE-NSP
12	0	
13	0	

APPENDIX B

Definitions and Procedures Used to Identify Communication Turns, Message Formulation Episodes and Insertion Sequences

(Source: A modified version of Higginbotham, 1989; Rauck, 1991)

Communication Turn

The communication turn is defined as "talk" (verbal or gesture) produced by one conversant until voluntarily relinquished or interrupted by the interlocutor. A voluntarily relinquished turn is identified by grammatical closure and/or the exhibition of one or more turn-relinquishing behaviors : a) cessation of activity for 2 seconds; b) movement of the head, torso, or hand away from the communication board ; and/or c) clearly observable visual orientation toward the other partner. An overlap in talk is defined simply as both interactants communicating at the same time. Conventions for segmenting overlapped talk are as follows:

1. When the SP talks between the NSP board points without exhibition of NSP turn-relinquishing behaviors, the SP is considered to have taken a turn, and the turn sequence is written as NSP-SP-NSP.
2. When the NSP begins to point to his communication board while the SP is talking, the NSP's turn is placed at the termination of the SP's talk. The location of the initiation of overlaps are generally noted in the transcription of the current speaker's turn.

Turn length will be defined by the number of words per turn. Partial words and gestures (nods, shakes, hand up to wait) will be incorporated into the single word count.

Message Formulation Episode (MFE)

A message formulation episode consists of: a) a statement delivered by the NSP that possesses a phrase or sentence-level status; or b) a response, other than yes/no, by the NSP to a question or continuation posed by the SP. SP talk produced within the context of the NSP's statement or answer is also included as part of the MFE. The initial boundary of the MFE is identified by the beginning of a multi-point message (NSP initiated) or a question posed by the SP requesting a new information regarding a topic (SP initiated). For the map task employed, a topic would include the "place" with the

"activity" representing a different topic. The end point of a MFE is the last turn produced by either the NSP or SP pertaining to the message formulated by the NSP. An example of a message formulation sequence is shown below:

NSP: "P-l-a-y some t-e-n-n-i-s . . "
SP: "Play some tennis, Ok, now where?"
NSP: "(gaze at SP) "uh-uh-uh"
SP: "That's not all?"
NSP: "uh-uh" (no)
SP: "ok"
NSP: "With two f-r-i-.."
SP: "Friends?"
NSP: "uh-huh" (yes)
SP: "Play some tennis with two friends?"
NSP: "uh-huh" (yes)

Insertion Sequences

Nine types of Insertion Sequences are identified for coding. These sequences are all included as part of the current MFE.

1. REPETITIONS

WLR Word-level repetition. Consists of a complete spelling of the word by the NSP, followed by a confirmation via repeat of the word by the SP (indicating that word was received and/or understood), which is confirmed or disconfirmed by the NSP:

NSP: "r-e-c-o-r-d-s"
SP: "records"
NSP: "uh-huh" (yes)

MLR Message-level repetition. consists of a full formulation of a phrase or sentence by the NSP followed by a full repetition by the SP (indicating that word was received and/or understood), which is confirmed or disconfirmed by the NSP:

NSP: "p-i-c-k up a-u-n-t B-e-t-t-y"
SP: "pick up aunt Betty"
NSP: "uh-huh"

PMLR Partial message-level repetition-- partial repetition of message when it's

not certain whether all of message was understood by SP

NSP: Pick up an emerald bracelet
SP: Pick up (gp) (writing)
NSP: <speak> pick up an emerald bracelet
SP: OK (writing)

2. GUESSING

WLG Word-level guessing. Consists of a partial spelling of a word by the NSP, followed by an elaboration or guessing of the word by the SP, followed by a confirmation or rejection by the NSP or further message formulation:

NSP: "m-a-g-"
SP: "magazine"
NSP: "uh-huh"

MLG Message level guessing consists of a full or partial formulation of a word or phrase or sentence by the NSP followed by its repetition or partial repetition by the SP with the addition of information not found in the prior message formulation (elaboration or guessing). That is, the SP attempts to guess what the NSP is trying to say. Note that the SP must provide new information to the MFE, not a repetition of previously formulated information:

NSP: "I go t-h-e-r-e to g-e-t my t-e
SP: "to get my teeth cleaned"
NSP: "uh-huh"

SOL Solicited. The word or message level guess is solicited by the NSP.

NON Nonsolicited. The word or message level guess is nonsolicited.

3. CONFIRMATION QUERIES

Word-level or Message-level confirmation queries consists of an SP-produced query for the confirmation of the previously formulated word or message followed by a confirmation or rejection of the SP query by the NSP. These are different from word-level and message level repetitions and guesses in that the SP solicits confirmation from the NSP consisting of one of the following SP behaviors: a) a SP looks at NSP coupled by SP talk, b) partial or full repetition by the SP of the last NSP turn coupled with upward intonation, c) exaggeration of word duration by the SP, and D) an explicit request for confirmation (e.g., "did you say match?"). A confirmation sequence can also be initiated by the NSP, particularly to solicit a SP confirmation for a previous NSP turn or message, as if to say "did ya get that?" Confirmation sequences initiated by the NSP will be coded as such.

WCQ-R Word-level confirmation query-repetition. Consists of a confirmation query in which the previous word is repeated.

NSP: "go to the 7-1-1"
SP: "7-11?" (gaze at NSP)
NSP: "uh-huh"

MCQ-R Message-level confirmation query-repetition. Consists of a confirmation query in which the previous message is repeated.

NSP: "p-i-c-k"
SP: "pick"
NSP: "up your r-e-l-a-t-i-v-e-s"
SP: "did you say, pick up your relatives?" (gaze at NSP)
NSP: "uh-huh"

PMCQ-R Partial message-level confirmation queries

WCQ-G Word-level confirmation query-word guess. Consists of a confirmation query in which the previous word is guessed or elaborated on by the SP.

MCQ-G Message-level confirmation query-message guess. Consists of a confirmation query in which the previous message is guessed or elaborated on by the SP.

SOL-G Solicited. Word or message level confirmation query-guess is solicited by the NSP.

NON-G Nonsolicited. Word or message level confirmation query-guess is nonsolicited.

4. CLARIFICATIONS

CLAR-NSP Clarification- Nonspeaking Partner. Consists of the NSP providing specifics regarding the map, route or activity generally to prevent the SP from having to query for the information. This represents information other than the name of the place and the associated activity.

NSP: g-o t-o t-h-e f-i-r-s-t
m-a-i-n r-o-a-d
SP: "yes"
NSP: t-u-r-n r-i-g-h-t
SP: "ok"
NSP: t-a-k-e the n-o-r-t-h-w-e-s-t-
p-a-t-h to the z-o-o
SP: "got it"

CLAR-SP Clarification-Speaking Partner. Consists of the SP providing specifics about her map to the NSP (solicited or nonsolicited).

SP: "ok, I have three drug stores, one above the Circle K, one a little below the Circle K and one next to the library. I don't have anything else next to the Circle K.
NSP: b-e-l-o-w
SP: "below the Circle K"
NSP: "uh-huh"

5. CONFIRMATIONS

CONF Confirmations only

NSP- go to g-r-o-c-e-r-y <speak> go to grocery
SP- "Ok" or "yes"

IND CONF Indirect confirmations

The SP doesn't assert but rather passively accepts the NSP's previous utterance

NSP: B-u-y n-e-w s-t-e-r-e-o s-p-e-a-k-e-r-s (gaze at speaking partner)
SP: (writes and puts pen down)
NSP: (gaze at paper, gaze at device) g-o n-o-r-t-h

YES/NO CONF Yes/No confirmations

Consists of the SP phrasing utterances to elicit Yes/No responses from the NSP.

NSP: "c-l-o "
SP: "clocks?"
NSP: "uh-huh" (yes)
SP: "Ok, I have two of them. Is it the one on the same block as the dry cleaners?
NSP: "uh-uh" (no)
SP: "Is it the one on the block next to carpets?"
NSP: "uh-huh?"
SP: "OK, I got it"

NSP: take a left or north
SP: Ok. North.
SP: Do I go to cellular phones from there?
NSP: (shakes head no)
SP: Do I go to K-Mart?
NSP: (shakes head no)
SP: Seven-eleven?
NSP: (nods head yes)
SP: Ok, that's number 7?
NSP: (nods head yes)

6. INFORMATION QUERIES

Information queries consist of a SP-produced query for the confirmation of information about a previous word or utterance, or information regarding the NSP's map or activity in general. Often, the SP needs confirmation regarding specifics about the place or activity.

IQ Information query

NSP: "go to the e-m-e-r-g-e-"
SP: "go to the emergency room?"
NSP: "uh-huh"
SP: "is that all we do is go to the emergency room?"
NSP: "uh-huh"
SP: "ok"

IQ-NSP Information query- Nonspeaking partner
Occasionally the NSP will ask the SP specifics about her map such as "w-h-a-t i-s n-e-x-t to k-m-a-r-t?" or "w-h-e-r-e i-s i-t?"

7. OFF TASK/Interruptive

Consists of statements or questions initiated by the SP or the NSP which are not necessary for successful completion of the task and interfere with or delay t the NSP's formulation of utterances. These turns or sequences are included as part of the current message formulation episode since they pertain to the original formulation utterance.

OT-T Off-task turn. A single turn by the SP.

SP: "Is that all we do is go to the emergency room?"
NSP: " uh-huh"
SP: "OK, go on"
NSP: "g-e-t your a-n-k-//"
SP: " OK, going to the emergency room to get..."
NSP: (gaze at SP)
SP: you all fixed up huh?"
NSP: (gaze at paper and back to device) - a-n-k-l-e c-h-e-c-k-e-d a-f-t-e-r

SP: "Oh, that crazed duck at the pond hurt you"
NSP: (gaze at SP, gaze back to paper, gaze back to device) you h-u-r-t it by the p-o-n-d"

OT-S Off-task sequence. An off-task sequence initiated by the SP which is acknowledged and/or responded to by the NSP and pertains to the original formulated utterance.

NSP: "b-a-n-k"
SP: "bank, OK"
NSP: "T-a-k-e //"
SP: "Oh-oh, you're not going to rob it are you?
Ben's gonna rob the bank.
NSP: (gaze at SP) "uh-uh" (no)
SP: (gaze at NSP and laughs) "Oh, OK"
NSP: (gaze at paper, gaze at device) "out a l-o-a-n for your h-o-u-s-e"
SP: "ok, got ya."

8. MESSAGE REFORMULATION EPISODES (MRE)

Definition of Message Reformulation

A message reformulation is the partial or full repetition by the NSP or SP of a previously formulated message or message element(s) occurring within a single message formulation episode. It is usually initiated by the SP's or NSP's request for repetition or clarification, or a confirmation query. A message reformulation ends when either both parties agree on the meaning of the reformulated message or when a new MFE is undertaken. A message reformulation may be self-initiated or other-initiated.

Self-initiated (SI) Reformulations

SI reformulations include reformulation sequences that occur as a result of a spontaneous repetition of message/message element(s) without any indication from the other partner of comprehension difficulties. These reformulations

include those instances in which the NSP may be having problems with the device and flags that to the SP.

SI-NSP Self-initiated reformulations made by the NSP

SI-SP Self-initiated reformulation made by the SP

Other-Initiated (OI) Reformulation Types

OI reformulations include reformulation sequences that occur as a result of an indication by the other partner that a message or message element was not understood. Partner may indicate a lack of understanding through verbalization (e.g., request for repetition, confirmation query, incorrect guess), a head shake, or an extended pause with continued attention to the communication board or the other partner. An example follows:

OI-ME Other initiated-message element.

Occurs when the other partner initiates a reformulation sequence primarily as a result of a lack of understanding of the message element(s) produced by the VOCA.

NSP: "p-i-c-k up a l-i-m-o-u-s-i-n-e to take to the c-h-u-r-c-h"
SP: "pick up a what? Say it again, I didn't catch all that."
NSP: "l-i-m-o-u-s-i-n-e"
SP: "limousine?"
NSP: "uh-huh"
SP: "and you're going where? To the church?
NSP: "uh-huh"
SP: "ok"

OI-MM Other initiated-message meaning.

Occurs when the SP or the NSP initiates a reformulation sequences as a result of a lack of understanding of the message meaning (i.e., comprehends the message elements that have been conveyed but does

not comprehend the other partner's intended meaning).

NSP: "make an a-p-p-o-i-n-t-
SP: "appointment?"
NSP: "to...."
SP: "ok, let's see if I can spell appointment"
NSP: "have your c-a-r-p-e-t c-l-e-a-n-ed"
SP: "Wait, am I making an appointment or am I having my carpet cleaned?" (gaze at NSP)
NSP: (gaze at SP, gaze at device) a-p-p
SP: "appointment?"
NSP: "to have .."
SP: "make an appointment to have your carpet cleaned?"
NSP: "uh-huh" (yes)

OI-MM-RRCE OI-MM MRE during resolution of referential conflicts

OI-EM Other initiated element-meaning

Occurs when the SP initiates a reformulation sequence and it appears to be a combination of message elements and message meaning.

9. RESOLUTION OF REFERENTIAL CONFLICT EPISODES (RRCE)

RRCE consists of a sequence of utterances that occur once differences in maps are encountered. An RRCE is usually initiated by the SP (receiver) indicating a referential conflict related to her map and ends when the referential problem is resolved or when the partners agree to end it and continue with the map task. Occasionally, one RRCE may lead to another. For example, the partner's may begin to make an Arbitrary Solution and then go into an Other's World Solution; or they may begin an arbitrary solution and choose to Abandon. These strategies will be coded as to whether they are initiated by the SP or the NSP. A majority of the strategies chosen are those identified by Yule, 1992, based on examples of solutions used by nonnative

speakers. They have been slightly modified to describe behaviors that may occur with the NSP-SP dyads in this investigation.
(Source: Yule, G., 1991; 1992)

1. NP — No Problem: A problem exists but is not identified by the sender or the receiver, resulting in inaccurate transfer of information.

2. Non-negotiated solutions

ABAN — Abandon Responsibility: A problem is identified by the receiver and acknowledged by the sender, but the receiver (or sender) does not take responsibility for solving the problem, either by saying they'll skip it, leave it, never mind it or forget it, or by telling the receiver to choose any location or path.

NSP: "go to C-i-r-c-l-e K"
SP: " Circle K?"
NSP: "uh-huh" (yes)
SP: " I don't have Circle K"
NSP: (gaze at SP) "uh-uh?"
SP: "I have a 7-11" (gaze at NSP)
NSP: (gaze at map) (pause)
SP: "let's just go on--skip it"
NSP: "uh-huh" (yes)

ARB — Arbitrary Solution: A problem is identified by the receiver and acknowledged by the sender and the receiver (or sender) makes an arbitrary decision about some defining feature of the location or path. The key element here is not accuracy, but the arbitrariness of the decision in which the receiver does not attempt to make her map match the sender's.

SP: "Post office?"
NSP: "uh-huh" (yes)
SP: "Ok, I have two post offices. Is it the...when you leave the doctor's office, is it

the first one you come to or the one after that?
NSP: "a-f.."
SP: "The one after the first one?"
NSP: (pause) "uh-huh"

3. Negotiated Solutions

OWS Other's World Solution: A problem is identified by the receiver and acknowledged by the sender and the receiver then tries to find out what is in the sender's world and uses that information to modify her map and/or come to some solution which the sender agrees upon.

SP: "which road do I take to get to the Yogurt shop?"
NSP: (gaze at SP with puzzled look)
SP: "do you have two roads, leading to the yogurt shop?"
NSP: (gaze at paper) "uh-uh" (no)
SP: "oh, well I have two roads leading to it. Um, I wonder if we need to be concerned with this. Well, do you have a road that comes from the grocery and comes into the Yogurt shop from the top?"
NSP: "uh-uh" (no)
SP: "oh, ok, then your road comes in from the bottom?"
NSP: (pause) "uh-huh" (yes)
SP: "ok, well I have that one too. Ok,go on."

APPENDIX C

Transcription Notation System

INTERACTANTS	TRANSCRIPTION
Speaking Partner	SP
Nonspeaking Partner	NSP
VERBAL BEHAVIOR	
Verbalizations by SP transcription	Orthographic "Where now?"
Encoded linguistic output by NSP	Placed in < >
--Orthographic transcription of device output	
Spelled words indicated with hyphen (-) between letters	<p-o-l-i-c-e>
Whole words produced not hyphenated	<Go there>
Functions of device indicated within < >	<speak>,<clear>
Example of complete utterance	<Go to p-o-l-i-c-e <speak> go police>
Double oblique (//) indicates the point in which a current speaker's talk is overlapped by the other speaker's talk	NSP: <s-t-o-r//-e> SP: store?
Colon (:) indicates prior syllable prolonged	Yeah:
Message formulation episodes contained within brackets and labeled with number	MFE #1 MFE #1 [ ]
VOCAL BEHAVIOR	

Nonlinguistic and linguistic vocalizations (unintelligible speech)	International alphabet /m/,/o/, /jae/
grunt	(gr)
laugh	(lf)
audible inhalation	(h)

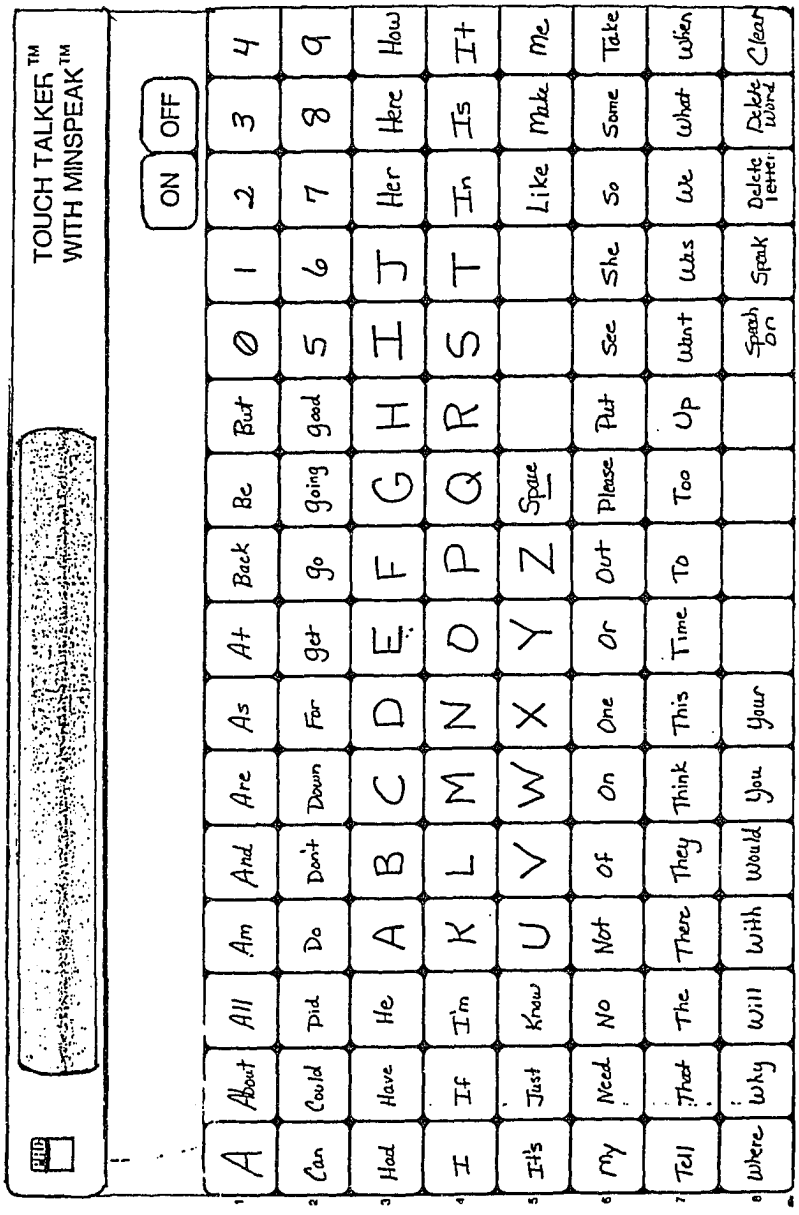
INTONATION/PROSODIC QUALITY	TRANSCRIPTION
rising	^
high rise (interrogative)	?
falling	.
sustained	,
exclamatory	!
increased volume	CAPITALS
stressed word	Underline

PAUSE LENGTH	
≤ 2 seconds	(2)
> 2 seconds	(#)

NONVERBAL BEHAVIOR	
Eye gaze:	
gaze at device	(gd)
gaze at paper	(gp)
gaze at SP's face	(gsf)
gaze at NSP's face	(gnf)
visual orientation towards SP	(vos)
visual orientation towards NSP	(von)
Body orientation or movements:	
movement towards device (away from SP)	(mtd)
movement away from device (towards SP)	(mad)
movement towards NSP	(mtn)
movement away from NSP	(man)
hand on device	(hod)
attempts to activate device	(aac)
hand over device, searching vocabulary	(sv)
Facial expressions:	
puzzled	(puzz)
surprised	(surp)
frustrated	(frus)

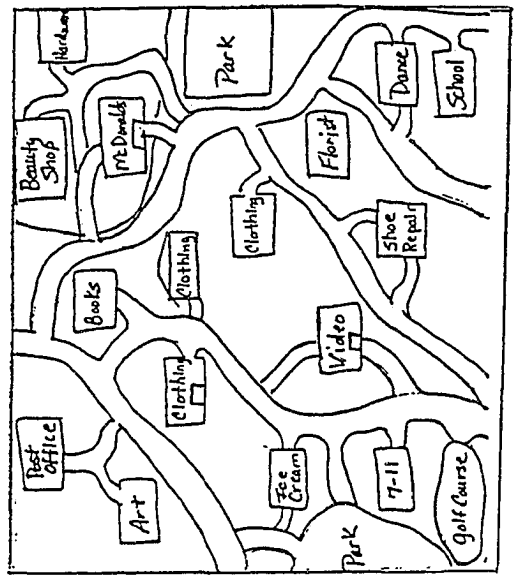
APPENDIX D

Sample Touchtalker Overlay with Vocabulary Items

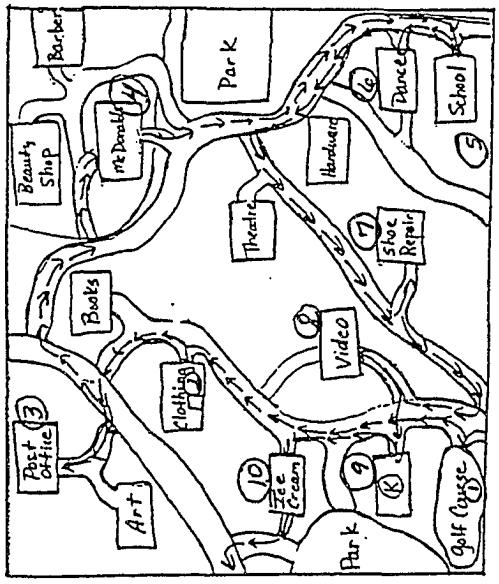


APPENDIX E

Sample Map and Associated Activities



RECEIVER'S MAP



SENDER'S MAP

1. Play a morning round of golf.
2. Buy two shirts to wear to work.
3. Pick up your mail and buy stamps.
4. Buy a hamburger, fries and shake.
5. Pick up a friend after school.
6. Drop off your friend for dance lesson.
7. Drop off a pair of shoes to be repaired.
8. Rent a video to watch that evening.
9. Buy a coke and a magazine.
10. Buy a gallon of chocolate ice cream.

APPENDIX F

Sample Transcripts

Dyad 1 (T.B.-P.P.)

NSP: (gp) (gd) 1. l-e-m-o-//
SP: limousine? (gp) <WCQ-G NON>
NSP: (nods)

NSP: <clear> r-e-n-t a
SP: (gp) limousine... <WLG NON>
NSP: (gp) "uh-huh^" (yes)(gp-d) to (gsf) (driving motion)
SP: to drive.. <WLG SOL>
NSP: (nods)
SP: around town? <MCQ-G NON>
NSP: (nods) (points to SP)
SP: to drive yourself.. <MLG SOL>
NSP: (shakes no) (points to SP)
SP: (gnf)
NSP: (points to SP) (gd) you
SP: drive you... <MLR>
NSP: (nods) (motion of going around)
SP: around <WLG SOL>
NSP: (nods head)
SP: town <WLG NON>
NSP: (nods and smiles)
SP: rent a limousine to drive you around town. <MLR>
NSP: (nods)

NSP: (gp) (gd) 2 (gp) (gd) c-r-a-//
SP: crafts? <WCQ-G NON>
NSP: (nods)
SP: Ok, I have two that are right next to each <RRCE-ARB>
other. One is to the .....right of the <CLAR-SP>
limousine, one is to the left of the lim....
well there are three, now that I'm looking.
One is like the//
NSP: "uh-uh." (no) (points finger down)
SP: (gnf) Is it directly beneath it? <IQ>
NSP: "uh-huh^"
SP: Is it a little bit, like, more to the left <IQ>
of it?
NSP: (gsf) (nods) "uh-huh^"
SP: Ok (draws) <CONF>

NSP: (gp) (gd) s-t-o-p (gsf)
SP: (gnf) stop? <WCQ-R>
NSP: (nods) (gestures for her to guess)
SP: (gnf) at the .... <MLG SOL>
NSP: (gestures a cut off sign)
SP: stop pulling....<MLG SOL>

NSP: (shakes no) (gd) o-f-f
SP: stop off at the crafts store? <MCQ-G NON>
NSP: (gd) "uh-uh." (no) (hand motion to continue and hums syllables)
SP: stop off at..... <MLR>
NSP: (gd) to (gsf)
SP: buy <WLG SOL>
NSP: (nods) (gd) get
SP: stop off to get <MLR>
NSP: (gp) (gd) s-o-m//
SP: some. Stop off to get some.. <WLG NON> <MLR>
NSP: (gsf) (gd)
SP: supplies? <WCQ-G NON>
NSP: (gd)
SP: some crafts? <WCQ-G NON>
NSP: (gd) p-a-i-n-t (gsf)
SP: stop off to get some paint? <MCQ-R>
NSP: (gsf) "uh-huh" (hand motion to continue and hums syllables)
SP: to... <WLG SOL>
NSP: "uh-uh." (continue hand motion to guess)
SP: for... <WLG SOL>
NSP: (continues gesture) (gd) s-s (gsf)
SP: stop off to get some paints <MLR>
NSP: (nods) (gd) and (gsf) (draws in air)
SP: crayons? <WCQ-G SOL>
NSP: (continues drawing in air)
SP: markers? <WCQ-G SOL>
NSP: "uh-uh."
SP: pens? <WCQ-G NON>
NSP: "uh-uh." (motions for her to guess)
SP: chalk? <WCQ-G SOL>
NSP: (shakes no) (motions for her to guess)
SP: stop off to get some paint and .... (3 sec) <MLR> brushes? <WCQ-G SOL>
NSP: (nods and smiles)
SP: paints and brushes (writes) <MLR>
NSP: (nods)

Appendix F (continued)

Dyad 2 (D.O.- K.W.)

NSP: t-i-r-e s-h-o-p <speak> tire shop (gsf)
SP: Ok, there are two roads to the tire shop. <RRCE-ARB>
Should I go west then south, then to the <CLAR-SP>
west or should I go all the way to the <IQ>
intersection and then go east, I mean go east.
NSP: (gp)
SP: go to ...the left then go south? <IQ>
NSP: "no"
SP: No? Go back the way I came? (gnf) <IQ>
NSP: (gd) b-a-n-k
SP: Tire shop's directly south of the bank? <IQ>
NSP: "yes"
SP: Ok, go west from the bank to that intersection <IQ>
NSP: (gp)
SP: Or, should I go all the way to the intersection, <IQ>
then go east, then north to the tire shop? (gnf)
NSP: (holds hands up) (gd) w-t-i-t-s t-i-r-e s-h-o-p
i-s-o-n y-o-u-r r-i-g-h-t <speak> w-t-i-t-s
tire shop is on your right (gsf) <CLAR-NSP>
SP: w-t-i... <MLR>
NSP: <speak> w-t-i-t-s tire shop is on your right <CLAR>
SP: w-t-i-t-i then tire shop is on the right? <MCQ-R>
NSP: <speak> w-t-i-t-s tire shop is on the right <CLAR>
SP: i-t-s. Ok, I got ya. (draws) <MLR> <CONF>

NSP: <clear> p-u-t s-o-m-e a-i-r i-n your t-i-r-e-s
<speak> put some air in your tires (gp)
SP: Ok (writes) <CONF>

NSP: (gp)
SP: Now, should I leave the tire shop going west the
way I came or go south? (gnf) <IQ>
NSP: (gp)
SP: the first one? <IQ>
NSP: "yes"
SP: (gp)
NSP: n-t-w-i (gp) "no" (gd) p-h-o-t-o s-h-o-// <CLAR>
SP: Ok (draws) <CONF>

NSP: <clear>
SP: and that's.....
NSP: (gp) (gd) p-i-c-k u-p s-o-m-e f-o-t-o-s t-h-a-t
u h-a-v-e t-a-k-e-n <speak> pick up some fotos
that u have taken (gp)
SP: Ok. Now the photo shop is northwest of the tire
shop? (gnf) <CONF> <IQ>
NSP: "yes"
SP: Ok <CONF>

Appendix F (continued)

Dyad 3 (P.W.-H.B.)

NSP: go a-r-o-u-n-d the l-o-o-p <speak> go around the loop (gp) <CLAR-NSP>
SP: Ok (draws) <CONF>
NSP: (gp)
SP: Now which way from there? Do I go to the restaurant? (gnf) <Y/N CONF>
NSP: (shakes no)
SP: (gp) Do I go to the library? (gnf) <Y/N CONF>
NSP: (nods)
SP: (draws) <IND CONF>
NSP: <clear> where is it <speak> where is it (gsf) <IQ-NSP>
SP: It's, uh, when I come around the loop it's <CLAR-SP> almost straight down from the loop. It's in the second block from the restaurant (gnf)
NSP: (gp)
SP: Well, maybe you don't have a restaurant there. <CLAR-SP> It has two entrances, one from the top and one from the bottom. I keep going straight from the curvy loop. Go straight to the bottom.
NSP: (gsf)
SP: (gnf) Is that all right? <IQ>
NSP: (shakes no) (gp)
SP: Ok, do you have a restaurant? <IQ>
NSP: (shakes no)
SP: What do you have next to your library? (gnf) <IQ>
NSP: <clear> (gp) (gd) the g-a-r-d-e-n <speak> <CLAR-NSP> the garden (gsf)
SP: (gp) I don't have a garden on here. The garden is the restaurant you think? (gnf) <CLAR-SP> <IQ>
NSP: (gp)(shakes no)
SP: No. (gp) My library is diagonal from the lake <CLAR-SP> (gnf)
NSP: (nods)
SP: Ok, that's probably it (draws) <CONF>

NSP: <clear> (gp) (gd) c-h-e-c-k out a (gp) (gd) b-o-o-k to r-e-a-d <speak> check out a book to read
SP: (gp) Ok (writes) <CONF>

NSP: (gp) (gd) go back to the s-e-c-o-n-d m-a-i-n r-o-a-d <speak> go back to the second main road (gsf) <CLAR-NSP>
SP: The second main horizontal or ver// <IQ>
NSP: "uh" (nods)
SP: (gnf) horizontal (gp) The middle of the three (gnf) <IQ>
NSP: (nods)

SP: Ok (draws) <CONF>
NSP: (gp) (gd) <clear> take a l-e-f-t <speak> take a left (gsf) <CLAR-NSP>
SP: Take a left where? (3) To storage? (gnf) <IQ> <Y/N>
NSP: (shakes no)
SP: That's the wrong place <Y/N>
NSP: (nods)
SP: (gp) The other magazine shop? (gnf) <Y/N>
NSP: (shakes) (gp) (gd)
SP: What's the name of the next place I go to? (gp) <IQ>
NSP: <clear> take a r-i-g-h-t at the i-n-t-e-r-s-e-c -t-i-o-n <speak> take a right at the intersection (gsf) <CLAR-NSP>
SP: Ok, what's next to the intersection? (gnf) <IQ> So, I know which one.
NSP: (gp)
SP: (gp) When you said take a left from the library, do you mean looking down at the map I would go left, or if I was coming out of library I would go left? (gnf) <IQ>
NSP: (gp)
SP: (gp) If I'm looking down at the map, you say take a left, I would be going west? (gnf) <IQ>
NSP: (nods)
SP: Ok (draws) <CONF>

Appendix F (continued)

Dyad 4 (J.J.-J.C.)

NSP: <clear> go up and take your f-i-r-s-t r-i-g-h-t
<speak> go up and take your first right <CLAR-NSP>
SP: Ok (draws) <CONF>
NSP: (gp) (gd) to the l-o-a-n-s
SP: (draws) past....
NSP: (gp) (gd) on your l-e-f-t <speak> first right to the
loans on your left <CLAR-NSP>
SP: Ok (draws) <CONF>

NSP: (gp) (gd) <clear> i-n-q-u-i-r-e about g-e-t-t-i-n-g a
l-o-a-n to h-e-l-p <speak> inquire about
getting a loan to help <space> p-a-y your
m-e-d-i-c-a-l e-x-p-e-n-s-e-s <speak> loan
to help pay your medical expenses
SP: (writes) Ok <CONF>

NSP: (gp) (gd) l-e-a-v-e to the l-e-f-t <CLAR-NSP>
SP: Ok (draws) <CONF>
NSP: take your f-i-r-s-t r-i-t-e <speak> leave to your
left take your first right (gp) <CLAR-NSP>
SP: Ok, go up (draws) <CONF>
NSP: "yeah." (gd) <clear> t-a-k-e your f-i-r-s-t l-e-f-t
to the s-p-a <speak> take your first left to the
spa (gp) (gd) <CLAR-NSP>
SP: (draws) Ok <CONF>

NSP: <clear> p-l-a-c-e i-c-e p-a-c-k-s on your
a-n-k-l-e w-h-i-l-e you <speak> place ice
packs on you ankle while you (gp) (gd)
<space> l-i-e in the j-a-c-u-z-z-i <speak> your ankle
while you lie in the jacuzzi (gp)
SP: (writes) <IND CONF>
NSP: (pause) <clear> g-o-t i-t <speak> got it
SP: Yeah, I don't know how to spell jacuzzi
NSP: (gp) (gd) j-a-c-u-z-z-i <clear>
SP: Ok, thanks

NSP: (gp) (gd) l-e-a-v-e the w-a-y you c-a-m-e <speak>
leave the way you came <CLAR-NSP>
SP: Ok (draws) <CONF>
NSP: go up and take f-i-r-s-t r-i-t-e <speak> go up and
take first rite <CLAR-NSP>
SP: Ok <CONF>
NSP: (gp) (gd) to the v-i-d-e-o <speak> go up and take
first right to the video (gp)
SP: Ok (draws) <CONF>

NSP: (gd) <clear> r-e-n-t a v-i-d-e-o to e-n-j-o-y that

e-v-e-n-i-n-g <speak> rent a video to enjoy that evening (gp)
SP: alright (writes) <CONF>

NSP: (gd) <clear> go back to the f-i-r-s-t i-n-t-e-r <CLAR-NSP>
SP: Ok (draws) <CONF>
NSP: (gp) (gd) <clear> go up to c-e-l-//
SP: to the cellular phones? <MCQ-G NON>
NSP: "yeah"
SP: Ok (draws) <CONF>

VITA

Sandra Koenig Damico received her B.A. in Speech Pathology and Elementary Education from Fort Hays State University in Hays, Kansas, and her M.A. in Communication Disorders in 1980 from the University of Kansas. Her initial position as a Speech-Language Pathologist was working in the schools in western Kansas, serving eight schools and two counties. After 2 years, she moved to Albuquerque, New Mexico to serve as a Speech-language Pathologist in a language impaired classroom in the public schools, and as a district Speech-language diagnostician. In 1984, she married Jack S. Damico, and moved to Baton Rouge, Louisiana, where she was employed by Louisiana State University as a clinical supervisor and instructor in the department of Communication Sciences and Disorders. Her experience in the field of Augmentative/Alternative Communication (AAC) began in 1987, as she coordinated an AAC grant in training students in the diagnosis and communicative treatment of essentially nonvocal individuals using AAC systems. Additionally, she has supervised in the LSU Preschool Language Program. She began her doctoral program at LSU in 1988 with an emphasis in AAC, which was completed in 1993. She has a 2 year old son, Tommy, and plans to move to the southwest to live in the arid climate and be near her family.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Sandra Koenig Damico

Major Field: Communication Disorders

Title of Dissertation: Interactional Experience with a Voice Output Communication Aid in Augmented Interactions

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

7/14/93