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Augmentative and Alternative Communication (AAC) for adults with severe aphasia: where we stand and how we can go further

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Abstract

Purpose: To review literature specific to the use of AAC with adults who have severe aphasia.
Method: The authors reviewed studies involving AAC interventions for adults with severe aphasia.
Results: Published data support the use of aided and unaided AAC with adults with severe aphasia in controlled treatment contexts. Reported gains in communication typically have not generalized to everyday settings.
Conclusions: The application of AAC with persons with severe aphasia must address factors potentially limiting treatment success outside of training environments.

Introduction

The communicative needs of persons with aphasia are varied and challenging making the implementation of meaningful and effective interventions a central priority of speech-language pathologists charged with their care. During the past three decades, Augmentative and Alternative Communication (AAC) has emerged as a treatment option for many adults with aphasia, specifically those with severe aphasia. While clinical intuition suggests that AAC should be both well received and successful, anecdotal treatment reports have often been discouraging. This article reviews literature specific to the application of AAC with adults with severe aphasia. Published treatment reports are presented from the past 30 years that have included unaided, simple aided, and more sophisticated aided AAC options. Augmented output and input devices and strategies are featured. This review is followed by a discussion of factors contributing to treatment outcomes. Finally, suggestions for promoting communicative success through AAC are provided.

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Severe aphasia

Aphasia, the loss of the ability to comprehend and/or formulate symbolic language, is not an all or none phenomenon. That is, persons with aphasia can retain aspects of comprehension and expression, but be unable to communicate functionally in ways that are acceptable to themselves or those in their environments. Severe aphasia refers to a degree of impairment that limits either comprehension or expression to the extent that, at least, verbal output is very limited. Obviously, individuals with severe aphasia would appear to be potential candidates for AAC.

Early unaided and aided AAC treatment results

Kraat[1] examined the results of multiple studies published during the late 1960s through the 1980s in which researchers attempted to teach non-speech modes of communication to individuals with severe aphasia. Her article reviewed the then prevalent assumption that AAC techniques offer minimal assistance to adults with acquired language disorders and discussed future directions for AAC use with this population.

Kraat's[1] review indicated that the results of studies during the late 60s and early 70s were encouraging in that individuals with severe language impairments could learn alternative means (e.g., signs, symbolic gestures and written words) of expression and comprehension. In addition, training signs appeared to facilitate improved spoken language in some individuals, which led to training that paired symbolic gestures with speech production.[2–7] According to Kraat, early research suggested that AAC techniques might have important roles in aphasia treatment.

During the late 70s, the focus of aphasia treatment shifted from phonology, syntax and semantics to prag-

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matics, further encouraging the use of AAC as an appropriate treatment tool. At the same time, new technologies such as personal computers and synthetic speech provided AAC devices that allowed viable communication alternatives for individuals with aphasia.

Kraat's[1] review of new technology in the early 80s again indicated mostly encouraging results. That is, individuals with severe aphasia acquired non-speech communication symbols and mastered the technical operation of AAC devices. However, doubts about the functionality of AAC use in this population began to surface. For example, although many individuals learned alternative means of communication, the rate of symbol acquisition was often slow and the vocabulary acquired was small (less than 100 words). Furthermore, the non-speech forms acquired were not actively used outside of the structured contexts in which they were taught. Other problems observed reflected deficits in language and cognition that limited success with alternative modes.

Kraat[1] summarized the findings of studies undertaken during the late 60s through the 80s as indicating, 'AAC techniques currently appear to have a very tenuous place in aphasia rehabilitation' (pp. 326). Before abandoning AAC as an aphasia treatment tool, however, Kraat suggested a more critical examination of the techniques that had been applied, how they had been applied, with whom, and with what expectations. In aphasia, techniques primarily had been applied in a global way with the expectation that non-speech forms would replace speech or restore functional levels of communication. Minimal attention had been directed towards supplemental or restricted applications of AAC, such as using written words to increase comprehension.

Other issues Kraat[1] addressed were the appropriateness of training procedures and the measures used to evaluate AAC applications. Her review found that the acquisition of non-speech communication modes typically did not result in pragmatic use of these alternate forms in social interactions. This suggests that more pragmatic and systematic training is required to effect functional change. Additionally, the measures used to evaluate the results of AAC applications assumed a direct relationship between the discrete acquisition of forms and communicative competence, in spite of evidence to the contrary. The studies Kraat reviewed rarely provided structured training protocols for integrating AAC techniques into natural settings; therefore, evaluation of the efficacy of such techniques was limited.

A final issue presented by Kraat[1] was the minimal attention to variables within AAC components. The studies reviewed indicated that AAC techniques were assigned randomly, rather than in terms of what might be best suited to the individual with aphasia. They further indicated a tendency to separate formally-taught non-speech forms (e.g., gestures, devices) from other communication strategies used by individuals with aphasia, such as pointing to objects/actions in the environment or using residual speech and intonation. Kraat suggested that when multiple natural and taught modes are integrated, they are more likely to result in functional changes. She further suggested that the lack of attention to vocabulary and language issues in the studies reviewed might have impacted the success of acquisition and use of AAC forms.

Kraat[1] concluded that some of the new AAC technologies might be applicable to aphasia rehabilitation and provided examples that illustrated applications in reading comprehension, conversational use and self-cuing. She emphasized, however, that the complex language, motor and cognitive deficits that have challenged aphasia rehabilitation efforts in general, 'will continue to challenge the new applications and technologies developed in AAC as well' (pp. 334).

Recent treatment studies

This section examines issues and suggestions outlined in Kraat's[1] review to determine if encouraging evidence to support the use of AAC in adults with aphasia has been reported in more recent studies. The following review is not comprehensive, i.e. only those studies incorporating some degree of experimental control and addressing treatment efficacy issues are included. Studies emphasizing unaided means are presented first followed by those featuring simple and more sophisticated aided options.

Two studies in the early 1990s[8, 9] used unaided AAC approaches with adults with moderate to severe nonfluent aphasia. Coelho[8] investigated manual sign acquisition using a single-subject multiple-baseline across-settings design with two participants with aphasia. They were taught 12 iconic signs representing various food items. Training was administered in two conditions: the clinic and a simulated restaurant setting. Results indicated that participants acquired the use of trained signs in both settings; however, only one participant generalized sign use to the natural setting. Maintenance of sign use was observed for the settings in which training occurred, but not in the natural setting. Coelho interpreted these findings as encouraging, but not an 'endorsement for recommending sign training with all aphasic patients' (pp. 216–217). He further concluded

that observations and family reports indicated that neither participant increased sign use in daily communication following treatment.

Conlon and McNeil[9] tested the efficacy of Visual Action Therapy (VAT)[10] on the communication skills of two participants with global aphasia. The objective of VAT is to train symbolic representation of line drawings and gestures so that individuals with severe aphasia can pantomime the associated symbolic gestures. Separate single-subject multiple baseline across behaviours experimental designs were used to examine treatment effects. The results indicated a positive treatment effect for 46% of trained steps for one participant and 86% for the other one; however, generalization from successfully trained steps to untreated steps was poor for both participants. Additionally, maintenance of the treated behaviour varied within steps and across participants. Conlon and McNeil concluded that, given the poor generalization, the positive VAT effects were not sufficient to conclude that this approach is effective in achieving the programme's original purpose of establishing 'symbolic representation.'

Bellaire *et al.*[11] used an aided AAC non-verbal approach to examine the acquisition, generalization and maintenance effects of picture communication board training. Two participants with severe nonfluent Broca's aphasia were trained in clinical and natural settings. Communication boards were constructed displaying 15 line drawings of items appropriate for the natural setting. Bellaire *et al.* used a multiple-baseline across behaviours design to evaluate ability to point to target drawings on the board across all study phases. Treatment in the clinic setting consisted of training pointing responses by cues, models, and physical assistance. If generalization to the natural settings did not occur, two programmes to promote generalization were applied. These programmes involved a role-playing procedure in either the treatment room or the natural setting. Results indicated acquisition of requesting and personal information responses for both participants. Neither participant acquired social responses. Additionally, generalization to the natural setting did not occur. Based on the lack of treatment effect for social responses, Bellaire *et al.* concluded that 'picture boards may not be useful for communicating information that can be conveyed through undifferentiated responses such as head nods' (pp. 225). The authors further concluded the role-playing procedure was not effective for achieving generalization and suggested that use of communication boards might best be trained in functional natural environments.

Although Bellaire *et al.*[11], Coelho[8] and Conlon and McNeil[9] demonstrated that non-verbal communication modes can be acquired by individuals with long-term chronic aphasia, their results did not demonstrate generalization to functional use outside of treatment settings. These findings may indicate that non-verbal communication methods are not embraced by individuals with aphasia because they seem unnatural. Avent *et al.*[12] evaluated the effectiveness of two treatment models: a compensatory (non-verbal) approach that incorporated written, gestural and drawing modes; and, a restitution (verbal) approach that incorporated accurate verbal sentence production. Three participants with mild to moderate aphasia received both verbal and non-verbal training to improve descriptions of picture stimuli. A single-subject alternating-treatments design was used to assess treatment differences. Verbal treatment was based on the Texas Aphasia Contrastive Series (TACS);[13] the non-verbal approach was based on PACE-like treatment.[14] A 15-point multidimensional system based on the *Porch Index of Communicative Ability* (PICA)[15] was used to score picture descriptions. Results indicated that none of the participants reached the accuracy criterion level in either of the treatment conditions within the 15 sessions administered and each responded to treatments in unique ways. For example, comparable improvements were noted in both conditions for one participant, accuracy was higher in the verbal condition for one participant and in the non-verbal condition for the third participant. All participants improved; however, 'one type of treatment was not clearly better' (pp. 300). Follow up testing 3 months post-treatment also indicated variable maintenance. Avent *et al.* concluded that their results raised questions about how treatment effectiveness is evaluated. It should be noted that these investigators provided no data relevant to functional use of the behaviours trained, again highlighting the lack of attention to social validity issues.

Verbal plus gestural training, a form of intersystemic reorganization wherein an intact gestural modality is paired with an impaired verbal one,[4, 6] has been used to improve verbal production in adults with severe aphasia and apraxia of speech.[2, 3, 5, 7] These early studies, as well as more recent ones,[16, 17] have documented the benefits of such training in mildly, moderately, and severely impaired individuals with aphasia. However, with the exception of the Raymer and Thompson[17] study, these investigations were not carefully controlled. Raymer and Thompson used a single-subject multiple-baseline across behaviours design to examine the effect of verbal plus gestural training on oral naming. One

participant with severe nonfluent Broca's aphasia and apraxia was trained to produce single words with initial phonemes chosen based on articulatory stimulability testing. Words were paired with appropriate unilateral hand gestures, primarily based on Amer-Ind.[18] Results indicated that repetition of three of four target phonemes was improved and generalized to untrained and related phoneme exemplars. An overall increase in gesture use that facilitated verbal responses was documented; however, little improvement of oral naming was demonstrated. Raymer and Thompson concluded that their findings stood in contrast to the optimism regarding other similar gestural treatment programmes for severely impaired individuals with language and motor speech deficits.

Schneider *et al.*[19] used Raymer and Thompson's[17] verbal plus gestural treatment sequence for another population of adults with aphasia, i.e. primary progressive aphasia (PPA). Schneider *et al.*[19] examined the effect of treatment on oral production of simple sentences (noun + verb + noun). One participant with a $2\frac{1}{2}$ year history of non-fluent progressive language decline was trained to use three verb tenses (present progressive, past and future) for four verbs in a sentence production task using a matrix training procedure. A single-subject multiple-baseline across behaviours design documented treatment and generalization effects within and across language matrices. Line drawings were used to elicit the target verb tenses in a simple sentence structure. Gestures that depicted noun, verb, and tense markers in the drawings were selected from Amer-Ind[18] and taught prior to training sentence production. A reversal component was introduced during treatment as a measure of control, i.e., gestural response was discontinued and only a verbal response was required. Results indicated improved production of grammatical sentences using trained verb tenses and generalization to untrained verbs within tense. Paired verbal plus gestural responses resulted in higher accuracy levels than verbal responses alone, and follow up testing 3 months after training indicated that gestural responses were maintained for all verb tenses while verbal responses declined for two tenses. In addition, comparison of pre-post treatment narrative language samples suggested that, while some linguistic behaviours declined in a manner expected in PPA, the percentage of simple sentences increased. Schneider *et al.* concluded that 'treatment was effective in maintaining specific linguistic behaviours despite the degenerative language decline ensuing from primary progressive aphasia' (pp. 312).

Two strategies currently used to facilitate interactive communication for adults with acquired severe aphasia are communication aids and conversational partner training.[20–23] Garrett and Beukelman's[21] investigation of Written Choice Strategy (WCS) used a technique they developed[24] to assist partners' conversations with individuals with global aphasia. The technique involves partners introducing a topic of mutual interest and initiating a conversation with a question before orally reading written choices and encouraging individuals to point to a choice. Following pointing responses, partners provided reinforcement based on the response intent and content. Follow-up questions and written choice supports continue to be provided until topics are exhausted. This technique focuses on the exchange of meaning, rather than the form, of the communication act and provides an alternative non-speech modality. It also expands beyond the individual with impairment to include communication partners.

Garrett and Beukelman[21] used an ABAB'B single-subject reversal design to measure the effects of three types of partner support during conversations: (1) no support (baseline); (2) thematically structured written choice support; and, (3) non-thematic written choice support. During each condition, communication mode, quantity (number of exchanges and topics), comprehensibility and accuracy of information transfer between the partner (Garrett) and a participant with chronic severe aphasia were tallied. The results of this study indicated that the participant's number of conversational exchanges per topic and comprehensible responses were higher with written choice support. Likewise, the participant's wife judged his comprehensible responses to be proportionally more accurate when he answered questions with written choices. Although the participant continued to communicate through other channels (e.g., yes/no and gestural responses), his preference was for written choice communication when it was available. Garrett and Beukelman concluded that 'the written choice technique supported the transfer of information between the partner and the aphasic communicator, which in turn allowed conversational exchanges to extend beyond the minimum number mandated by the experimental procedures' (pp. 247). They also suggested that this technique would be useful in non-conversational situations (e.g., rapid exchanges between nurses and patients regarding medical needs). Despite the restriction of choices and dependence on structured rules, Garrett and Beukelman felt that written choice communication might provide increased communicative quality for individuals with limited communication options.

Lasker *et al.*[22] used an alternating treatment design to investigate specific components of Garrett and Beukel-

man's[21] WCS. They examined the relative contributions of two WCS components, written and spoken words, by measuring response accuracy in different presentation modes. The participants in the Lasker *et al*. study (three adults with severe aphasia) responded to questions under three conditions: auditory-only format (choices were spoken); visual-only format (written choices were not read aloud); and, standard WCS (simultaneous auditory and visual format). The results indicated different response accuracy patterns for participants across presentation modes. Two participants responded equally to all modes, although their response accuracies differed. In contrast, the third participant needed both written and auditory cues for optimal performance. Her responses in the standard WCS mode were superior to responses in the other two modes. Based on the finding that all participants answered questions in the standard WCS condition with an average of 87% accuracy, Lasker *et al*. concluded that their results confirm that simultaneous auditory and visual components of WCS evoke mostly accurate responses from individuals with severe aphasia. The authors cautioned, however, that 'specific components of Written Choice may be crucial to the accurate performances of certain users' (pp. 115).

Fox, Sohlberg and Fried-Oken[20] used an alternating treatment single subject design to examine 'the benefit of conversational topic choice for promoting use of communication aids designed to communicate opinions or to describe events' (pp. 193). Fox *et al*. tested whether choice of topic improved use of symbol-based aids with familiar and unfamiliar partners in the clinical environment and with family and friends in the natural environment. Choice was made from topics judged to be of equal value to three participants with severe Broca's aphasia. Quantitative data on selected variables (e.g., number of non-ambiguous symbols used to respond to questions and to comment) were obtained under two conditions: choice and nonchoice topic communication aid training. Generalization to natural environments was assessed by having each participant's primary conversational partner rate their satisfaction with conversations.

Fox *et al*.[20] developed communication aid vocabularies for topics that consisted of personal photos, coloured magazine photos, and/or Boardmaker computer line drawings with key word labels; these pictures were displayed on pages in a binder. Participants received communication aid training designed to teach use of these aids in conversations about choice/nonchoice topics. Conversation partner training, provided to promote generalization, involved watching an instructional video that encouraged pointing to pictures in the binder when conversing with the participant, allowing adequate response time, and confirming understanding of messages. Partners also were encouraged to take the aid into natural environments to model use for less familiar partners.

The results of the Fox *et al*.[20] study indicated that, although all participants showed improved use of nonambiguous symbols in communication aid training, only the youngest one with more recent onset of aphasia benefited most from topic choice in the clinical environment. This benefit did not generalize to natural environments where he used his nonchoice aid more than his choice aid. This participant also showed the greatest potential to use his choice and nonchoice topic aids with partners in multiple natural environments. Conversation partners reported high levels of satisfaction with natural environment conversations. Fox *et al*. concluded that their results 'illustrate some of the difficulties inherent in capturing the effects of a dynamic concept such as choice in a complex and lengthy procedure such as communication aid training' (pp. 187). They further concluded that their study confirmed similar challenges with natural environment generalization reflected in previous research[8, 11, 25, 26] and suggested that other variables (e.g., topic preference) were more relevant to communication aid use than the ability to use nonambiguous symbols and topic choice.

Lyon *et al*.[23] took a different approach to training communication partners. They attempted to enhance communication and well-being in settings where adults with aphasia and their caregivers live and interact. The approach emphasized 'communication with a naïve normal adult while concurrently strengthening a more active, self-determined, and controlled role in daily life' (pp. 695). Treatment involved community volunteers (Communication Partners), rather than caregivers; partners were paired with adults with aphasia and trained to act as their liaisons for bridging clinical and real-life pursuits.

During the initial 6-week period of this study, a clinician suggested a number of communication strategies that the partner could use with the adult with aphasia including letting them try to say the message first, encouraging use of gestures or drawing following unclear spoken messages, and moving from general to specific questions to clarify messages. The partner and the adult with aphasia practiced implementing these and other strategies in the clinical setting as the clinician observed and provided further suggestions. During the subsequent 14 weeks, pairs engaged in weekly activities selected by the adult with aphasia. A session with the clinician in the clinical setting each week during this

phase served as a review of the previous week's activity and planning time for the outside activity the following week. Only the adults with aphasia and the communication partners participated in the outside activities.

A combination of standardized tests of language, communication or well-being, non-standardized investigator-constructed questionnaires, and informal measures (SLPs' subjective ratings of outcomes and tallies of activities) were used to measure the effects of training for 10 treated pairs. As predicted by Lyons *et al.*,[23] results indicated that pre-post treatment differences on standardized tests did not approach statistical significance due to the lack of sensitivity and specificity of standardized measures for revealing treatment gains. SLPs' subjective evaluations of outcomes as having been met, not met, or exceeded, varied across pairs. One-third of the pairs fell into each of the three categories. However, SLPs' tallies of the number of activities initiated during treatment, sustained after treatment ended, and begun following treatment indicated that nine of 10 pairs established activities that were sustained and eight of nine added activities following treatment. The investigator-constructed questionnaires indicated significant gains in well-being and communication for all participants, i.e., adults with aphasia, partners, and caregivers. Lyon *et al.* concluded that, 'This consensus illustrated the potential value of Communication Partners in merging clinical and real-life therapies and, as importantly, fostering reciprocal and simultaneous repair of both communication and self' (pp. 702).

All of the studies reviewed thus far have used unaided or low-tech aided AAC approaches to treatment of adults with aphasia. The studies reviewed in this final section have incorporated high-tech AAC devices into their treatment.[27–35] According to Koul and Harding,[27] 'Computer-based graphic symbol communication systems are one of the most recent additions to the current repertoire of AAC options' (pp. 11), and a number of software programs and/or dedicated devices are currently available for individuals with little or no functional speech.

Murray's[29] longitudinal study of a participant with a 4-year history of non-fluent primary progressive aphasia (PPA) used different treatment approaches over a $2\frac{1}{2}$ year period. At the beginning of this period, Back-to-the-Drawing Board (BDB)[36] was implemented to capitalize on intact right-hemisphere functions. This programme taught the participant to draw a series of uncaptioned cartoons that increased from five single-panel to three triple-panel cartoons. The results of the BDB programme indicated that post-treatment drawings depicted main events more accurately and reflected greater detail and clarity than pre-treatment drawings. Despite positive treatment effect, little spontaneous use of drawing in communication interactions outside the therapy room was observed. Four months post BDB treatment, however, the participant began to augment written messages with drawing.

Murray[29] adopted a dyadic, functional treatment approach subsequent to the BDB program, and introduced an electronic AAC device—a Dyna Vox. Symbols for messages were selected and programmed in the Dyna Vox with preselected functional vocabulary. A variety of role-play activities were used to foster the use of the device, as well as conversations between the participant and familiar and unfamiliar partners. Although the conversations were to encourage use of the Dyna Vox, the participant was also encouraged to use a variety of modalities (e.g., drawing, writing, gesturing). The results of training indicated that the participant adapted to the AAC device quickly and demonstrated improved message accuracy length and response latency. However, the participant and her spouse reported minimal use of the Dyna Vox outside the home or clinic, likely due to portability issues. Based on the results of post-treatment functional communication assessments, Murray concluded that the variety of treatments helped the participant to retain 'relatively effective and independent functional communication, despite the progressive decline in her linguistic abilities' (pp. 668).

Another AAC system (TalksBac) was specifically developed for adults with nonfluent aphasia using a portable computer with a built-in speech synthesizer. TalksBac provides predictive access to a personalized database of sentences and stories. Waller *et al.*[31] trained four participants with nonfluent aphasia and their caregivers to use the TalksBac system over a 9-month period. The participants' pre-post treatment communication skills were assessed with a battery of tests. Conversational abilities with and without the system also were compared to determine whether TalksBac allowed better participation in conversations. The results of the post-treatment assessments indicated little change in underlying comprehension and expression when compared to the pre-treatment assessments. Analysis of the videotaped conversations indicated that abilities improved when using the system for two of three participants (the fourth was not able to carry out conversations using TalksBac independently). Waller *et al.* concluded that the conversational abilities of one participant were not enhanced by the system because he had developed his own nonverbal strategies that were more effective. The authors further concluded that 'TalksBac has the potential to augment the communica-

tion abilities of adults with nonfluent aphasia who have not been able to develop their own compensatory strategies' (pp. 46).

The computer-based visual input communication (C-VIC) software is another iconographic system that was specifically designed as an alternative mode of communication for adults with chronic severe aphasia. Shelton, Weinrich, and colleagues have investigated the efficacy of C-VIC in a number of recent studies[28, 30, 32–35] and found that individuals with severe aphasia can access, manipulate, and combine graphic symbols following rules specific to the C-VIC software system. For example, Weinrich *et al.*[32, 33] trained two participants with severe aphasia to comprehend and produce locative prepositional phrases and reversible subject-verb-object (S-V-O) sentences in English and C-VIC according to a defined treatment protocol (refer to 37 for details). The results indicated that the participants comprehended word order in C-VIC S-V-O sentences better than they were able to assign symbol order during sentence production. Their results also demonstrated improved verbal production, a finding that is consistent with the long-held notion that training graphic symbols improves speech production.[4] In a similar study focused on verb tense morphology, Weinrich *et al.*[34] also found that three participants with severe expressive aphasia demonstrated improvements in comprehension and verbal production of correct verb tense morphology following C-VIC training. In contrast, McCall *et al.*[28] found improvements specific to C-VIC training, but no improvement to natural language. Similarly, Weinrich *et al.*[35] found that single S-V-O sentence production did not generalize to multi-sentence C-VIC or verbal production.

While the C-VIC studies documented encouraging results in terms of the participants' abilities to access, manipulate, and combine graphic symbols, Shelton *et al.*[30] reported little evidence that the individuals trained on C-VIC used the system to interact with family members. This finding is consistent with Garrett and Beukelman's[24] observation that replacing natural language with an AAC device may not enhance functional communication skills and that effective AAC intervention requires involvement of communication partners.

Koul and Harding[27] evaluated whether results obtained with C-VIC could be replicated with a different software program. This programme, referred to as TS, was designed to offer graphic symbols with synthetic voice output, as either a dedicated device or stand-alone software that turns a microcomputer into an electronic communication device. The TS program was used to train five participants with severe or global aphasia.

Koul and Harding[27] employed a single-subject multiple-baseline across behaviours design to assess the effects of training on symbol identification. The second treatment phase was non-experimental, i.e. no baseline data were collected; instead, the percentage of correct sentences produced was documented to assess symbol production. Prior to treatment phase one, participants were taught the mechanics of the computer and TS program. A structured hierarchical protocol followed that progressed from easy to more difficult tasks. The results of symbol identification training indicated that all participants identified noun symbols better than verb symbols and symbol combinations. Results of the symbol production task were comparable to the identification task in that the most frequently observed error on the production task was omission or incorrect verb symbol selection. Koul and Harding concluded their results 'essentially replicate the results obtained in several previous studies with C-VIC' (pp. 19). They further concluded that the evidence from several studies of C-VIC and their study of TS indicated that individuals with chronic severe aphasia demonstrate superior performance on computer-based graphic symbol systems as compared to their spoken or sign-based language abilities. Finally, Koul and Harding pointed out that, although these AAC systems can be effective tools in aphasia intervention, little evidence is available relative to their functional use in everyday communicative interactions.

Where do we stand?

A primary purpose of this article is to draw conclusions specific to the state and effectiveness of AAC treatment for persons with severe aphasia. The preceding review provides a confusing, yet intriguing point for consideration. That is, although positive AAC treatment effects have been reported for this population, they have occurred in controlled environments and, in most cases, failed to generalize to everyday settings.

One can only speculate as to why individuals with aphasia might not be successful AAC users in natural settings post treatment. Could it be that researchers and practitioners have failed to extend and support training in real world contexts? In our review, only the Lyon's *et al.*[23] study provided a structured extension of a treatment protocol into the everyday settings of persons with aphasia. Although their unique use of communication partners as trainers failed to generate traditionally measurable treatment effects, participants reported increased perceptions of success and well being.

Another plausible explanation for limited generalization of treatment effects could be the acceptance of

AAC by users and those around them. In a recent report of AAC intervention with an 'ideal' candidate with aphasia, Lasker and Bedrosian[38] note their subject's reluctance to use AAC post a period of successful training in a clinical setting. These investigators suggest that AAC acceptance and use is a complex factor in treatment success involving myriad factors, including readiness, treatment methods, and outcome measures.

A factor related to AAC acceptance is the conceptualization of socially valid treatment outcomes. For example, is the common therapy goal of simple device or system use meaningful to the user and his or her communicative partners outside of traditional training venues? The earlier review noted a shift away from discrete form related goals to more pragmatically appropriate objectives in the 1970s and 80s. This move reflected an attempt to generate meaningful AAC outcomes for persons with severe aphasia. Since that time, however, one must question how well we have established and measured outcomes that are socially valid.

To conduct socially valid treatment we must discover what is significant to consumers of therapeutic services.[39, 40] Schwartz and Baer[41] noted that 'consumers' can be categorized according to their involvement with intervention efforts. The following four types of consumers have been identified: direct, indirect, immediate community, and extended community.

Direct consumers are the individuals receiving services. In contrast, *indirect consumers* are persons who are significantly affected by changes in direct consumers. For example, an indirect consumer may be a family member or close friend. Consumers in the *immediate community* have regular contact with direct consumers yet may not be strongly affected by changes targeted through treatments. For example, a church or club leader may be an immediate community consumer for many children. Finally, consumers in the *extended community* are persons who have no regular contact with direct consumers. For example, a waiter in a restaurant or a person passing by on the street could serve this role. Extended community consumers, then, may be thought of as unfamiliar interactive partners.

An obvious impediment to socially valid goal setting is the need to assess the consumers mentioned above. Simply stated, this takes time and is difficult. Browder[42] discussed the importance of including family members and others. Schlosser[43] reported a series of means by which several investigators in the field of AAC have assessed one or more consumer groups specific to setting goals. For example, direct, indirect, and immediate community consumers have been evaluated through discussion, problem solving, and other subjective methods. Schlosser proposed that immediate and extended community consumers could also be assessed through social comparisons (e.g., in this case comparing characteristics of successful and unsuccessful AAC users). The same method has also been used by Colton and Sheridan.[39]

Finally, could the lack of treatment gains in natural settings for persons with severe aphasia be related to a failure to adequately control the myriad factors complicating communicative success for all AAC users? For example, the ease of use of a system, its portability and cosmetic appeal, the saliency of vocabulary selected, and countless other factors, all impact users' success with AAC. One can question the degree to which these system variables and other consumer variables (e.g., knowledge of and attitudes toward technology) have been controlled.

Can we go further?

It is our opinion that AAC applications with persons with severe aphasia are at a critical juncture. We must be open to new ideas and changes if there is to be an increased probability of meaningful treatment success in the future. What, then, are recommended avenues of pursuit with this population?

First, training studies must employ careful measures to control for system and user variables that might impact findings. These include, but are not limited to, ease of system/device use, vocabulary selection, and user knowledge. Second, training paradigms must be designed that systematically extend treatment to natural contexts. This appears to be a major shortcoming of studies conducted to date. Obviously, treating outside of controlled environments introduces potentially compromising risks to intervention (e.g., multiple trainers and training contexts). In our opinion, the increased opportunity for treatment success outweighs these risks. Third, investigators must carefully examine their methods, goals, and outcome measures to determine their social validity. The work of Schlosser[43] provides a helpful guideline for using the various participants of AAC to help address this critical need. Finally, subjects must be selected that present a significant 'buy in' to treatment. Participants buy in clearly includes motivation and partner/environmental support. Some effort to measure these variables prior to intervention would make treatment findings more interpretable.

In closing, there continues to be an intuitive fit between AAC and persons with severe aphasia. Validating this fit will largely depend upon the ability of researchers and/or clinicians to discover and make use

of the variables and strategies that affect acquisition, retention, and most importantly, communicative use in naturally occurring environments.

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