International Society for Augmentative and Alternative Communication (ISAAC)

AUGMENTATIVE AND ALTERNATIVE COMMUNICATION RESEARCH ISSUES AND NEEDS

PROCEEDINGS OF THE 2012 ISAAC RESEARCH SYMPOSIUM

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The notation in this publication follows the only established standard in the field of augmentative and alternative communication, introduced by Stephen von Tetzchner and Mogens Hygum Jensen in 1996. In accordance with this, *Naturally spoken utterances* are italicized, while *"Words and sentences in machine-produced digitized or synthesized speech"* are italicized and in quotation marks. In written presentations of sign language, every sign has a *gloss,* that is, a name or translation. Such glosses are written in capital letters, for example, SHOP. The gloss of *GRAPHIC SIGNS* and *PICTURES* are in capital letters and italicized. The same notation is used for *TANGIBLE SIGNS.* When the gloss of a single manual or graphic signs needs more than one word in translation, these will be hyphenated, for example, YOU-AND-ME or *YOU-AND-ME.* Indications of Whole words and Written ready-made sentences are underlined. Also S-p-e-l-l-e-d words are underlined. Quotation signs are used for "interpretations or translations of meaning" of manual or graphic sign utterances. They are also used for the meaning of facial expressions, gestures, pointing, etc., for example, "yes" (nodding) and "no" (shaking the head). Parentheses {...} indicate simultaneous expressive forms, for example speech and manual signs, or manual and graphic signs. {HAPPY. *I am happy}* means that the manual sign HAPPY is produced simultaneously with the naturally spoken sentence *I am happy.*

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Preface

The biennial International Society for Augmentative and Alternative Communication (ISAAC) Research Symposium was conceived and discussed at the 1988 ISAAC Conference, Anaheim, California. ISAAC constituents, along with experienced and novice researchers, recognized the need to promote ISAAC's interest in advancing and expanding AAC research globally, and encouraging qualitative and quantitative approaches. The Research Symposium format was designed to facilitate national and international collaboration and interdisciplinary research. The first Symposium was held in Sweden following the 1990 ISAAC Conference, and a Research Symposium has been held following every biennial conference since then.

The Research Symposium differs from the main conference in focus, attendees, fee structure, venue and schedule, role of participants, topic selection and session format.

Focus. The Research Symposium has only one focus: RESEARCH. Conferences typically have many purposes. They include a number of different types of professional sessions, many of which would not be considered as research presentations.

Attendees. The Research Symposium has relatively few participants ranging from approximately 30 to 100 compared to many national and international Conferences that frequently have several hundred to over a thousand participants.

Fee Structure. The Research Symposium operates within a balanced budget with no intention to make a profit to support other endeavours of the larger organization. The registration fee is kept to a minimum to cover the costs of the meals and venue. The seminar organizers and presenters receive neither an honorarium nor compensation for their travel expenses.

Venue and Schedule. It is preferred that the Research Symposium be held in a separate location from the ISAAC Conference in order to provide a different, more intimate experience for participants. In the past, several universities have donated space to keep costs minimal. Participants typically remain with their selected seminar strand for the Symposium with multiple opportunities to interact and collaborate with all participants during the several coffee breaks, lunch and dinner buffets. There is no exhibit hall, nor planned social functions. Conferences typically have an exhibit hall with a variety of commercial and non-commercial exhibitors and social events happening nightly.

Role of Participants. During the Research Symposium, short papers are presented typically allowing considerable time for discussion. Participants may make substantive contributions to the discussion and/or ask presenters for clarification or expansion of a topic. Opportunities are provided for participants to explore research interests. Conferences, on the other hand, are typically structured for passive participation and topics/themes are of short duration with participants changing sessions.

Topic Selection. Research Symposium topics have varied from two to about seven. A call for proposals and/or ideas is circulated well in advance. The Symposium co-chairs are usually instrumental in soliciting information regarding research needs, proposing issues and helping form groups that become responsible for the topics. Publication of the Research Symposium Proceedings promotes ongoing development and networking on the topics. In contrast, the Conference relies primarily on reviewing proposals and selecting those that are relevant. Conference presentations are archived unless they are published in a journal. Subsequent opportunities for follow-up networking are not integral to a Conference.

Session Format. The Symposium consists of carefully selected seminar themes upon which it typically focusses discussion (which may be enhanced with short papers). Conferences typically have a larger number of paper presentations followed by little or no time for discussion.

The ISAAC Research Symposium serves an important function for ISAAC. The Symposium provides an opportunity to develop a cadre of international research leaders promoting AAC research leading to effective, efficient practice. Like the seminar organizers, the Symposium co-chairs donate their time and expertise to the advancement of the Symposium focus: AAC research.

Introduction

It is with great pleasure the co-editors present the submitted manuscripts from the six seminars of the 12th Biennial Research Symposium sponsored by ISAAC.

The symposium was held at the University of Pittsburgh. Professor Lyle Lloyd addressed the total group of participants at the opening of the symposium. The six seminars followed with opportunities for individuals to interact with all the participants during morning and afternoon breaks, the buffet lunch and dinner. At one point, the assessment and iPad seminars combined their sessions to address common issues. Written summaries of the seminars were submitted throughout the following year.

Themes for the six seminars included a. Blissymbol research (extending research on an internationally-relevant symbol system); b. AAC data collection for language research (a requested seminar topic with recommended leaders); c. the conjoining of tele-rehabilitation and AAC (outcomes included coining the term tele-AAC incorporating telecommunication technologies to intersect service delivery and AAC, then developing/publishing a resolution); d. the use of tablets as AAC devices (a requested seminar theme for which leaders were solicited); e. assessment and measurement issues (identifying difficulties to establishing psychometric norms determining and predicting AAC-related behaviors, with recommendation of data collection over time periods and simultaneously, a big data view approach, such as in the Communication Matrix project); and f. AAC and aphasia research (including a core reference list for foundational and advanced research development).

Appendix A identifies the participants and their contact information for each of the seminars. The participant list was compiled to provide opportunity for future collaboration.

Appendix B lists the published proceedings of previous symposia. This library of resources reflects the expanding research base of ISAAC and provides insight for future research contributions and opportunities for participation.

The 2012 Research Symposium boasted the largest attendance in the history of ISAAC. It is our hope that readers catch the enthusiasm generated by the in-depth sharing of research issues, findings and challenges and that the momentum generated from this and past Symposia continue to broaden the knowledge base of the field. Furthermore, the content of these proceedings might enable persons to visualize their role in contributing/participating in future Research Symposia.

– Co-editors: Lyle L. Lloyd, Linda J.S. Koehler, and Stephen von Tetzchner

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The co-editors appreciate the commitment of ISAAC to publish the Proceedings in electronic format facilitating easy access and assuring availability. We also appreciate the incredible organizational skills, professional demeanor and support of Heather Stonehouse, Manager of Communications, ISAAC International. Initial planning of the symposium was greatly facilitated by Filip Loncke. Both Ellen Cohn and Katya Hill assisted with local arrangements and Ellen masterfully handled adjustments prior to and during the symposium. Local arrangements were adeptly accommodated by Malcolm McNeil, Chair, Communication Science and Disorders at Pittsburgh University.

Section 1: AAC AND APHASIA: SCIENCE AND CLINICAL PRACTICE

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Over the last two decades, significant advances have been made in development and implementation of augmentative and alternative communication (AAC) assessment and intervention strategies designed for persons with aphasia (PWA) who have severe communication impairments (Garrett & Lasker, 2013; Hux, Weissling, & Wallace, 2006; Koul; 2011). Available evidence reinforces the use of various AAC strategies including gestures, drawing, low-technology strategies, and speech generating devices (SGDs). These strategies are particularly important for PWA who may experience deficits in multiple linguistic modalities including spoken and written expression, as well as auditory and reading comprehension. AAC strategies are often used to support impairments in both expression and comprehension that may linger despite extensive speech and language therapy. This seminar provided a comprehensive review of advances in AAC for PWA. An additional purpose of the seminar was to identify critical gaps in AAC research and suggest areas of future research needed to enhance clinical practice.

Through presentation and group discussions on the following major themes, the seminar participants discovered ways to help bridge the gap between cognitive science, its application in aphasia rehabilitation, and AAC intervention for PWA. Within each theme, theoretical models, current evidence, clinical implementations, and specific areas of future research were identified. Specifically, the following major themes were reviewed: (1) Cognitive processing of graphic symbols; (2) Allocation of cognitive resources in relation to SGD use; (3) Message selection and enhancement approaches; (4) efficacy of high technology AAC Intervention in PWA: A meta-analytic review; (5) Social validation framework; and (6) Role of communication partners.

Theme 1: Cognitive Processing of Graphic Symbols

Cognitive processing is a multi-stage phenomenon that involves perceptual identification, response selection and response initiation and execution (e.g., Kahneman, 1973). It has been frequently investigated in terms of the rate and efficiency with which information is processed (e.g., Johnson & Proctor, 2004) and in the manner of allocation of limited mental resources (Navon & Gopher, 1979). Complementary systems that support information processing are attention, working memory and executive function (e.g., Baddeley, 1986; Just & Carpenter, 1992). A breakdown in any of these systems adversely affects task performance. Previous research has indicated that in addition to language impairment, PWA demonstrate reduced

working memory capacity and deficits in allocation of attentional resources (e.g., McNeil, Odell, & Tseng, 1991). Most of these studies were conducted using spoken language. In contrast, very little data are available regarding cognitive resources required by PWA to successfully use AAC techniques and strategies to either supplement or replace their natural language. Nonetheless, it is clear that successful use of AAC strategies and techniques may increase the processing demands of PWA during communicative interaction. For example, to use a taxonomic display, PWA rely on declarative and semantic memory stores while maintaining in working memory the commentary of communication partners and the purpose of the response s/he is composing with the AAC system.

Additionally, unlike the production of natural language, production of "sentences" using graphic symbols does not require complex phonetic or articulatory processing (Koul et al., 2005, Koul, 2011). Previous studies have indicated that individuals with left hemisphere lesions tend to identify graphic symbols with greater ease than written words (de Renzi & Lucchelli, 1993; Goldstein, Canavan, & Polkey, 1988; Koul & Lloyd, 1998; Wapner & Gardner, 1981). Koul and Lloyd (1998) suggested that use of graphic symbols by PWA may facilitate communication by way of the undamaged right hemisphere of the brain. Presentation of these data stimulated a discussion on the application of cognitive neuroscience to successful AAC use in PWA.

Theme 2: Allocation of Cognitive Resources in Relation to SGD Use

As described in Theme 1, the use of AAC strategies, techniques, aids and symbols imposes increased cognitive demands on PWA. Cognitive strategies that are critical to the use of AAC methods include perceptual processing, attention, memory, resource allocation and capacity. Previous research has indicated that PWA demonstrate deficits in resource allocation and such deficits may interfere with their ability to use both low-tech and high-tech AAC systems (Petroi, Koul, & Corwin, 2011). During this segment, we discussed and examined to what extent impairments in resource allocation abilities in PWA interferes with their ability to successfully use both high-tech and low-tech AAC systems; in particular the work of Petroi, Koul, and Corwin (2011) was reviewed in detail. They investigated resource allocation abilities in PWA in the presence and absence of competing stimuli across experimental tasks involving identification of single and multiple graphic symbols presented in a taxonomic display. Further, data regarding the impact of number and location of symbols (i.e., top level vs. two levels deep within the navigation system) on symbol identification and response latency was shared.

Theme 3: Message Selection and Enhancement Approaches

This portion of the symposium focused on current knowledge regarding two types of interface integrated into AAC systems for PWA. More specifically, the presenters compared and contrasted the use of taxonomic displays (TD) (e.g., Johnson, Hough, King, Vox, & Jeffs, 2008; Hough & Johnson, 2009; Steele Aftonomos, & Koul, 2010; Van de Sandt-Koenderman, Wiegers, Wielaert, Duivenvoorden, & Ribbres, 2007) and visual scenes displays (VSDs) (Dietz, McKelvey, & Beukelman, 2006; Dietz, Weissling, Griffith, & McKelvey, 2012; McKelvey, Dietz, Hux, Weissling, & Beukelman, 2007; Wallace & Hux, 2012) and discussed the challenges and benefits associated with implementing either interface when working with PWA. In essence, PWA are able to successfully learn both interfaces; however, some preliminary research suggests that VSDs or some components of VSDs may promote faster learning (McKelvey et al., 2007; Wallace & Hux, 2012). In light of these data, it is important to consider that TDs may offer PWA more flexibility in generating novel messages during spontaneous interactions. In conjunction, the presenters also presented theoretical underpinnings related to the cognitive mechanisms required to successfully use each interface. Globally speaking, TDs require heavy reliance on semantic, working, and declarative memory, as well as complex attentional processes. In contrast, personalized VSDs build upon the relative intact visuospatial skills and episodic memory of PWA, thereby reducing the cognitive demands required to successfully use the interface. Following presentation of data supporting successful use of TDs and VSDs, the presenters and attendees discussed the importance of developing multimodal AAC systems for PWA to allow maximum interactive efficiency across a variety of communicative situations.

In addition to the abovementioned topics, the participants dialogued about the dual role of AAC in aphasia rehabilitation. In particular, the discussion focused on how AAC can be used to simultaneously compensate for deficits and restore linguistic function. Data were presented to support the notion that AAC does not prevent PWA from using spoken language to communicate (Dietz et al., 2012) and the group brainstormed how clinicians and researchers alike might successfully achieve the goal of using AAC in a dual role fashion.

NOTE: Several types of VSDs are available. The presenters discussed the VSD Aphasia and TBI User interface offered by DynaVox™. Dietz and Wallace participated in the development of this interface as doctoral students, under the guidance of Dr. David Beukelman; however, the presenters have no financial or other relationship with this vendor.

Theme 4: Efficacy of High Technology AAC Intervention in PWA: A Meta-Analytic Review

We discussed the state of AAC efficacy research in the context of the prevailing theoretical conceptualization of clinical efficacy and outcome research. We reviewed the work of Koul, Petroi, and Schlosser (2009) regarding the efficacy of AAC intervention using SGDs in PWA. The discussion concluded with the agreement that technologically-based AAC intervention options seem to be effective in changing the dependent variables under study such as describing pictures, producing sentences of various grammatical complexity using graphic symbols and identification and recall of symbols. However, the variability of the results within and across studies is indicative of the critical need for additional research using well-controlled experimental designs (Koul, 2011). Further, future research must also examine the role of AAC strategies and techniques in supporting comprehension of PWA.

Theme 5: Social Validation Framework

Social validation is defined as a procedure of evaluating the social significance of goals, methods, and outcomes (Kazdin, 1997; Schlosser, 1999; Wolf, 1987). When attempting to determine if a particular intervention is socially valid, all stakeholders should be involved. In the case of AAC intervention and aphasia, PWA are the direct stakeholders. Indirect stakeholders include persons who are strongly affected by the intervention (e.g., close family members). Immediate community stakeholders include persons who regularly interact on a social or professional level with direct or indirect stakeholders (e.g., extended family members, close friends, facility staff members, hired caregivers). Extended community stakeholders include persons in the community who rarely or never interact with the direct and indirect stakeholders (e.g., civic or retail personnel) or experts in the field of AAC/aphasia (e.g., clinicians, researchers). Materials and methods for evaluating intervention results in terms of their social validity were discussed and examples were provided, including rating scales and structured interview questions and responses. Quantitative as well as qualitative data obtained from multiple stakeholders can provide valuable information, and results from preliminary studies (e.g., Corwin, 2011; Ribitzski, 2003; Zens, 2005) have been promising.

Theme 6: Role of Communication Partners

The "multiple multiples" challenge was discussed in terms of communication barriers for PWA. This challenge refers to the concept that multiple people, topics, and situations are involved in the overall communication process. Aphasia intervention philosophies including restorative, compensatory, combined, and social approaches were reviewed. Within the social approach to aphasia rehabilitation, the Life Participation Approach to Aphasia (LPAA) is a consumer-driven approach that supports PWA and others affected by aphasia in setting and achieving their immediate and long-term life goals (LPAA Project Group, 2005). LPAA focuses on re-engagement in life, beginning immediately after the onset of aphasia and continuing until the PWA (consumer) no longer chooses to have community support. The nine basic principles of a social approach to aphasia management were discussed (Simmons-Mackie, 2005) as well as a communication classification system to determine which strategies (e.g., written choice strategy, tagged yes/no questions, key words) may be most helpful for PWA (Garrett & Lasker, 2005; Garrett & Beukelman, 1995).

Generalization of AAC use to other contexts remains a dilemma (Lasker & Bedrosian, 1999; Simmons-Mackie, 2005; van de Sandt-Koenderman, Wiegers, Wielaert, Duivenvoorden, & Ribbers, 2007), which could be explained by accommodation theory. Communication partners may not typically communicate using gestures, writing, or AAC devices, yet their role is to mediate participation of PWA during communicative interactions (Damico, 1992; Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001; Simmons-Mackie, 2005). Suggestions for scaffolding communication for PWA were discussed, including examples of "good" versus "bad" communication partners and Supported Conversation for Adults with Aphasia involving co-construction of messages by communication partners and PWA. In summary, Supported Conversation for Adults with Aphasia is effective for training communication partners to effectively interact with PWA. Supported conversation instruction for family members and other stakeholders has a positive impact. It is critical to reduce communication barriers for PWA, and communication partners should have a basic skill set to avoid adversely affecting the socio-emotional needs of PWA and the quality of health care they receive.

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Please note: This list also contains references that are not in the text. This is a comprehensive list of references for readers who have a greater interest in this topic.

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Section 2: AAC ASSESSMENT AND MEASUREMENT ISSUES

Filip Loncke

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This seminar's standing issues related to measurement and assessment in AAC. In an introductory discussion, Loncke and Llewellyn presented some of the intrinsic problems of AAC assessment. These are (1) the fact that AAC communication is essentially idiosyncratic (each person has their own selection of multimodal communication configuration) which evades the principle of comparability and norm-determination, and (2) the fact that some form of dynamic assessment will be needed because we want to measure the learnability. The development of a measurement tool for the use of AAC is difficult and tricky for a number of reasons: (1) Communication behavior itself is idiosyncratic and evades comparability, and (2) Responsiveness to AAC solutions is dependent on a multitude of factors, some of which are idiosyncratic and are difficult to grasp in norms. The solution to meet this challenge is an approach that combines (1) building databases that transcend the limitations of small groups, and (2) the development of a methodology that lends validity to individual-case observations and results.

The seminar consisted of six sections. After Loncke and Llewellyn's short introduction, Buzolich addresses these concerns, in the second section, by (1) proposing to use a sampling of actual interactive (and communicative) behavior and (2) systematically analyzing occurring patterns. The Communication Sampling and Analyzing (CSA) tool is an attempt to do exactly that. In the third section, Rowland's proposal and report goes along similar lines. The Communication Matrix is an instrument that puts what is presently known about (a) the development from non-linguistic non-intentional interaction toward linguistic interaction, and (b) the basic functions of communication, into a two-dimensional observational matrix that allows the generation of an individual matrix. The fact that the instrument is available to everyone on-line has a number of advantages – the most important one is, without any doubt, the fact that it now has the potential to create an enormous data-base, for the first time opening the possibility of data mining and potentially finding patterns (hence ideas for intervention) while hitherto the idiosyncrasy of communication had prevented us to do just that. In the fourth section, Gomory and Steele explore this idea of data-mining further and present a model of the cycle of data that will maximize the use and interpretation of this wealth of information. They also link it to the possibility of telepractice. In the fifth section, Stoep discusses the principle of dynamic assessment. This is really a central concept in AAC because the essence of AAC-assessment is not the diagnosis of a condition, but the prediction of adaptability and adoptability of new (i.e., AAC) strategies. It is about learnability, and not only learnability to the AAC-user, but also by the communication partners. Stoep discusses this based on the Dutch Communication Competence Profile. Loncke and associates present and discuss in the sixth, final section the development of a measurement tool from conceptualization (what is it that we intend to measure?) to construct

development (which behaviors will need to be measured?), expert validation (do experts believe it looks good?), and finally clinical-educational validation (does it really measure and predict what we intended it to do?

One separate section of the meeting was held jointly with the participants of research strand on the use of tablet computers in AAC. The joint session focused on the use of tablet computers and feature matching in assessment. This joint session contained presentations by Lindsay Dutton, Julie Scherz, Amy Finch, and Jessica Gosnell Caron. The meeting discussed the results from a survey among AAC-practitioners in 2010 and 2011. This study showed an increased use of tablets in all stages of the assessment process. The group discussed the implications of this development, which was suspected to continue at least in the next few years.

Setting the Scene: "Why is Assessment So Difficult in AAC?"

Filip Loncke and Lee Llewellyn, University of Virginia, USA

Many types of assessment are critical to AAC, including observation, standardized assessment, and dynamic assessment. However, there are many challenges. AAC assessment tends to evade several of the sound principles on which psychological testing is based.

The use of norms and standardization based on a representative sample of peers is difficult because individuals with AAC needs present, almost by definition, with unique and idiosyncratic characteristics. A central issue concerns validity: do we have a clear construct of what it is that is being assessed is often lacking? What exactly is communicative competence? Questions include how predictive our assessments are, and which components should be assigned critical value (e.g., symbol learnability, language representation, etc.)

This seminar addressed the assessment problem in AAC, and discussed several attempts at improving the procedures of evaluations.

One of the key issues in AAC is that one doesn't know with what to compare the test results, because of a lack of standardized instruments. There are problems with most models that are used to assess communicative competence/language abilities: how much of what has more weight in the prediction of AAC success? For example, should we put more weight on symbol recognition, or on symbol combination skills? Is one component a better or stronger predictor

than the other? No one really knows at this moment. At present, clinical experience (and intuition) appears to be the deciding factors.

Developing a Communication Sampling and Analysis Evaluation Tool

Marilyn Buzolich, Augmentative Communication and Technology Services (ACTS)

Communication sampling and analysis is an assessment tool designed for infants, toddlers, and children with multiple physical, sensory, speech, and/or cognitive, linguistic challenges. The purpose of the CSA (see http://csa.acts-at.com/) is to capture and qualify the nature and extent of communication behavior of the communicatively challenged child with partners during interactive settings and contexts. This is important for establishing baseline levels of communicative functioning, setting goals for intervention, and evaluating the effectiveness of treatment.

Methodology. The CSA is based methodologically on communication science, pragmatics, and speech act theory. Pragmatics is best described by Watzlawick, Beavin, and Jackson (1967) as that which deals with the effects communication has on other individuals. Bates (1979) defined pragmatics as "rules governing the use of language in context." Pragmatics, then, is the study of communicative acts (linguistic and nonlinguistic) and the contexts in which these acts are performed (Bates, 1976).

The CSA measures the child's communication behavior (nonverbal, vocal) and the consequences or effects the behavior has on the partner. For these reasons, it is important to sample the interaction, rather than just the individual. The communicator refers to the communicatively challenged child whereas the partner refers to the other person in the dyad.

Collecting a Communication Sample. Communication sampling provides a starting point in the evaluation of a multiply challenged child with limited or no speech. It gives the evaluator an opportunity to observe the child and partner(s) before attempting direct hands on assessment. Sampling can occur after the child and partner adapt to the presence of the observer and are in a natural and relaxed state. There are no structured or unstructured tasks used to "elicit" communication for sampling. The evaluator selects a specific interactive setting to sample the formulated questions. The evaluator can select and compare communication partners, interactive settings, and contexts. It is essential that the evaluators understand that the child's communication will vary as a function of these factors: interactive setting (Light, 1988), partner (Buzolich et al., 2008), and context (Mathy-Laikko & Yoder, 1986). Therefore, it is important not to generalize beyond the sampling conditions. The communicator profile is simply a snapshot of how the communicator interacts with a particular partner, during an interactive setting, in a given context.

The main target of the CSA-tool is to capture and qualify the nature of communication, in order to set goals for intervention. Its objective is to illustrate the variety of communicative means a child uses.

The Observer. The observer samples as much of the interaction as possible during a given observation period.

Observation is only as good as the observer. Direct observation is preferred above videotaped observation. Yet, for proper coding, you will always need a familiar communication partner that can fully interpret the communicative intentions of the child. For evaluation of communication, and capturing the abilities of a child, a familiar cooperative communication partner is the best choice. We have to take into account both the observable and the unobservable. Non-verbal information covers approximately 70% in regular speech, and even more in interaction with children with little or no speech.

The Challenge of a Lack of Taxonomies. There are no clear taxonomies for analyzing communication with AAC-users; there is no taxonomy present that takes into account partner skills (see also Light, 1998).

What do we observe when we sample:

- The interaction, not the individual
- Context (place)/interactive setting
- Communication partner: relationships, status
- Communication acts (Wetherby & Prizant, 1989)
- Interactive event sequence
- Communicative means
- Categories of communicative functions
- Establishment joint attention

Multimodality is a reality from day one. This is the case for typical as well as for atypical learners. When acquiring language (typical language learners) various communication modes appear early on but some may diminish later on (or fade to the background).

When analyzing, one should not pull the interaction apart in routines. Communication is only meaningful if it is considered within the entire context of the whole effect (i.e., the relevance).

How Much is Needed? Twenty-five events are needed to be able to do an analysis of communicative behavior. Two observers may share only 50% of their comments when taking notes during observation. Sampling while observing does not mean paying attention to all events. Yet, the child's communication profiles they compose are likely to be the same.

Observation and Analysis Issues. We have listed here a few principles and points to heed when conducting an observation:

- When a device is introduced to a child with complex communication needs, changes in the interaction patterns will occur.
- You can't generalize outside the sampling condition.
- For language analysis, which should be done along communication analysis, supplementary methods are needed (for instance Pert, a "Performance Report Tool, developed by the AAC-institute to describe, transcribe and analyze utterances produced with AAC devices, see www.aacinstitute.org).
- What do we do when the opportunities for direct sampling are not available? Instruments like the Communication Matrix are more apparent in that case.

The Communication Matrix

Charity Rowland, Oregon Health and Science University

The Communication Matrix aims at profiling the communication of children aged 0 to 24 months, the earliest stage of communication. Emphasis lies on strengths. The seven levels of communication development, which are incorporated in the matrix, are derived from the pragmatic approach by Bates (1979). In Stage V, insights from 4and Kaplan (re-edition from 1987) on symbols are used. Stage V is a crucial stage because the child starts to show symbolic behavior. This is also an important changing point for potential AAC-users.

Observation issues include the following:

- It is essential to interpret intent correctly.
- Parents and professionals do the assessment separately and then compare; you expect them to see different aspects of communication.
- Cultural differences have not yet been taken into account >> be aware of translation issues.
- Analysis on a single video sample doesn't make good material. What are entered are the impressions that parents/professionals have, who see the child on a day to day basis.
- Instruments to pick up small signals that indicate the emergence of abilities lack. ISCBS is being developed. This instrument will contain elicited tasks and materials.

An efficacy study has been done to find out whether the Communication Matrix can improve the quality of educational goals. And what do these kinds of instruments do in predicting development? The data that are gathered will contain the development of children with and without significant intervention. Yet, it will be possible to identify key behaviors for various groups.

Seven Levels of Communicative Competence. Table 1 represents a stage classification used to describe developmental levels from pre-intentional to linguistic communication.

Table 1: Seven Developmental Levels of Communicative Competence and Salient Behavior

Level	Salient behavior
1. Pre-intentional behavior	Pre-intentional or reflexive behavior that expresses state of subject. State (e.g., hungry, wet) is interpreted by observer
2. Intentional behavior (not intentionally communicative)	Behavior is intentional. But is not intentionally communicative. Behavior functions to affect observer's behavior, since behavior infers intent.
3. Unconventional (pre-symbolic) communication	Non-conventional gestures are used with intent of affecting observer's behavior.
4. Conventional (pre-symbolic) communication	Conventional gestures are used with intent of affecting observer's behavior.
5. Concrete symbols	Limited use of concrete (iconic) symbols to represent environmental entities. 1:1 correspondence between symbol and referent.
6. Abstract symbols	Limited use of abstract symbols to represent environmental entities. Symbols are used singly.
7. Language	Rule-bound use of arbitrary symbol system. Ordered combinations of two or more symbols according to syntactic rules.

Communicative States, Functions and Intents. Within each of the seven levels, people can perform behaviors to (1) refuse, (2) obtain, (3) express a need for socialization, and (4) convey information. This is done by observable behaviors (see Table 2).

Table 2: Communicative States, Functions, and Intents.

Communicative States Functions and Intents

Level	Refuse	Obtain	Social	Information
I	-Expresses discomfort	-Expresses comfort	-Expresses interest in other people	
II	-Protests	-Continues an action -Obtains more of something	-Attracts attention	
III	-Refuses or rejects something	-Requests more of an action -Requests a new action -Requests more of an object -Makes choices -Requests a new object	-Requests attention -Shows affection	
IV				-Answers "Yes" and "No" questions -Asks questions
V		-Requests objects that are absent	-Greets people -Offers things or shares -Directs someone's attention to something -Uses polite social forms	-Names things or people -Makes comments
VI				
VII				

Examples of Specific Behaviors. As indicated, it is important to focus on observable (if possible unambiguous) behaviors. These can include:

- Body movements (postural changes, lunging forward, twisting, turning away, arm and leg movements, head movements, moving toward or moving away from)
- Early sounds (crying, grunting, screaming, whining, fussing, cooing, squealing)
- Facial expressions (smiling, grimacing, frowning)
- Visual (looking at someone or something)
- Simple gestures (pushing away, taking hand, touching, reaching, tapping, hand guiding, activating switch (e.g., calling device)
- Conventionalized gestures (giving, showing, beckoning, hands up (for "up"), shaking, head nodding, shoulder shrugging, specific vocalizations (not a word), alternating gazing, pointing, hugging, kissing, patting)

- Concrete symbols [may be embedded in device] (line drawings, photos, objects, pantomime, sound mimicking)
- Abstract symbols [may be embedded in device] (spoken word, written or Braille word, manual sign, Blissymbolics, abstract 3-dimensional symbol)
- Language [may be embedded in device] (combinations of 2 or more symbols of any kind)

The Profile. The combination of the developmental seven levels and the four communicative functions (refuse, obtain, socialization, information) is the essence of the communication matrix (see Figure 1, following page).

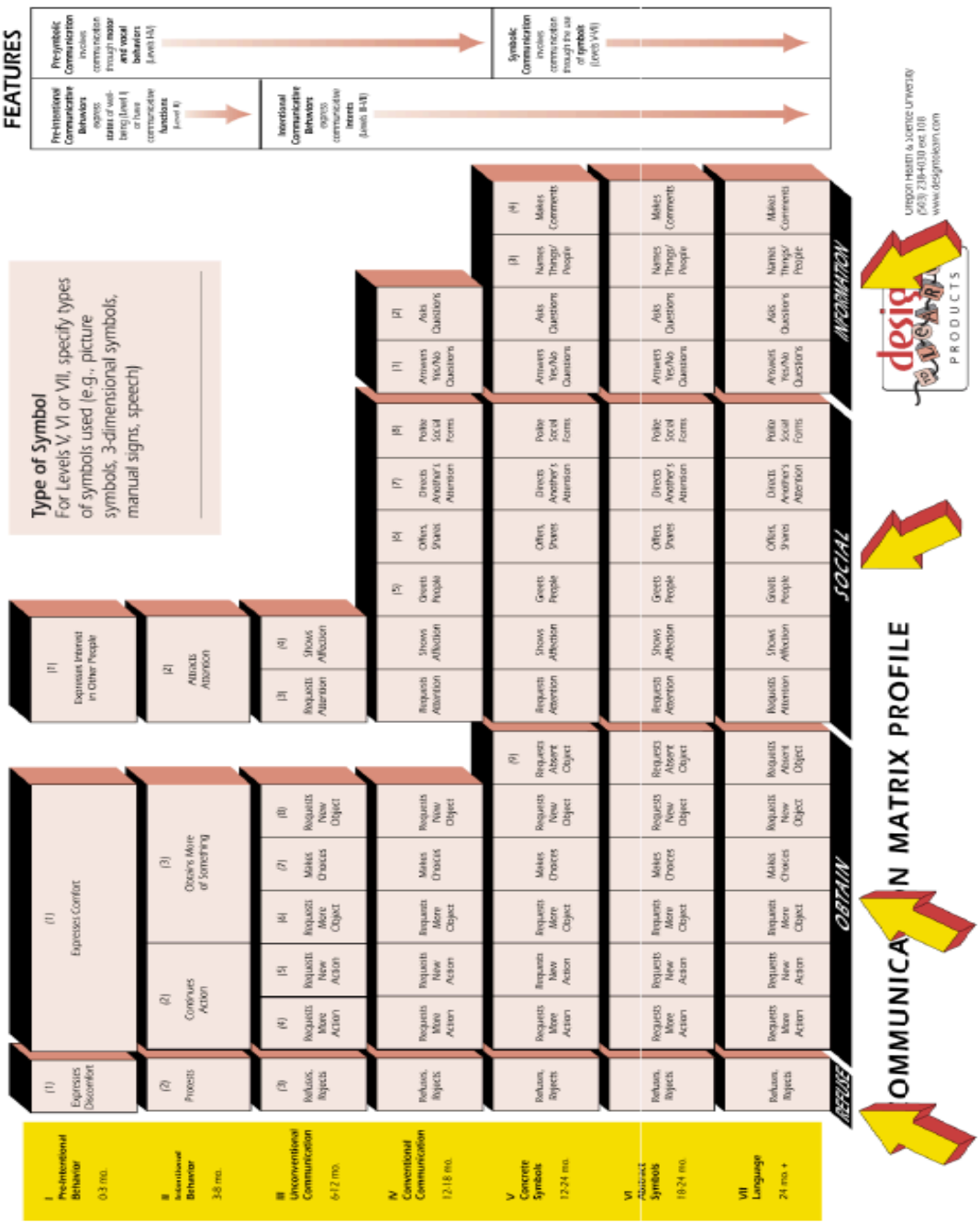

Figure 1: The Communication Matrix. Charity Rowland, PhD, © 1990, 1996, & 2004; printed with permission

Indicators of Communicative Intent. How can we be sure about communicative intent when we cannot ask the person why they perform a specific behavior? Here are a few indicators:

- The behavior is only performed when the person knows that another person is present (except for "distance" behaviors such as vocalizing)
- The behavior is directed toward another person (through gaze, touch, etc.)
- The person waits for a response.
- The person persists if you don't respond, and stops when you do respond.
- The person gets upset if the other responds in the wrong way (e.g., by "sabotaging" the intent).

Indicators that Symbols (e.g., words, signs, photos) are Used with Meaning. A symbol is only a symbol if it corresponds with an internalized representation. How do we know that the person has reached the level that allows the use of symbols "in a symbolic way"?

Here are a few indicators:

- The person uses specific symbols only under appropriate circumstances.
- The person doesn't "run through repertoire" of symbols at every occasion the other responds.
- The person is upset if the other does not respond appropriately to the selected symbol.

Potential. The potential of the Communication Matrix is promising. It represents an easy to grasp conceptualization of developing communication skills, which makes it easy to be used by many caregivers. The fact that it is an online and freely accessible tool creates the possibility to have an enormous database of reports. Until recently, the study of early communicative skills resisted the establishment of norms or even typical developmental sequence. The contribution of many participants may offer a possibility to distinguish patterns out of what we, until now, have considered being idiosyncratic.

Data Mining Through Telepractice

Andrew Gomory and Richard Steele, Lingraphica, USA

Ever since clinicians have started to keep electronic data on clients, there has been an awareness that one should make the most of this information, identifying and developing ways to let meta-data guide clinical and educational decisions. In the past two decades, a gradual development toward the use of electronic distance communication and together with record keeping has taken place toward all medical and intervention disciplines.

In this presentation, we focus on two aspects: (1) the increased possibilities of data mining, and (2) the potential of telepractice.

The Potential of Data Mining. To understand the recent developments in data gathering, it is important to recognize the principle of evidence based intervention. Traditionally evidence can be generated from several sources and form a body of information that informs and directs the person who does the actual intervention.

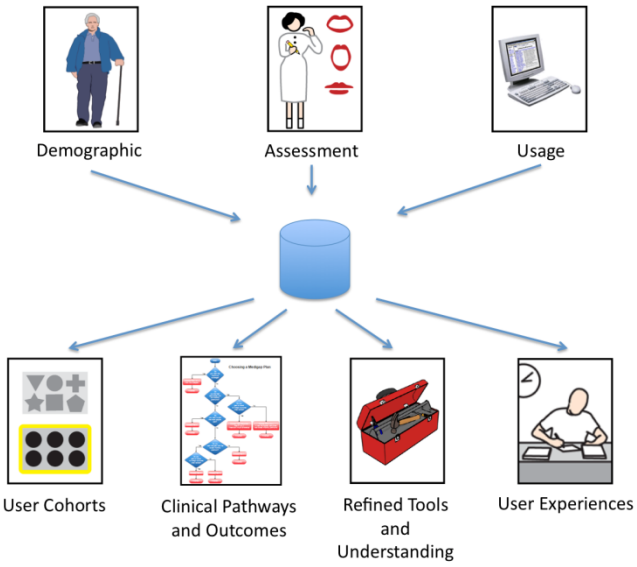

Figure 2: One-directional Flow of Clinical Data

In this model (see Figure 2) information essentially goes in one direction. Research on groups (e.g., demographic information about behaviors, risks, recovery patterns), and individual

assessment (i.e., measurement of individual behaviors from which we deduce intervention) lead to better practices. Intervention must be based on what we know or what we believe is likely. At the same time, what we (believe we) know needs to be controllable (partially by using it as a to-be-tested hypothesis in further intervention). For that reason, the intervention itself generates data. Therefore, we need a model that depicts the circular action in which intervention creates data (see Figure 3).

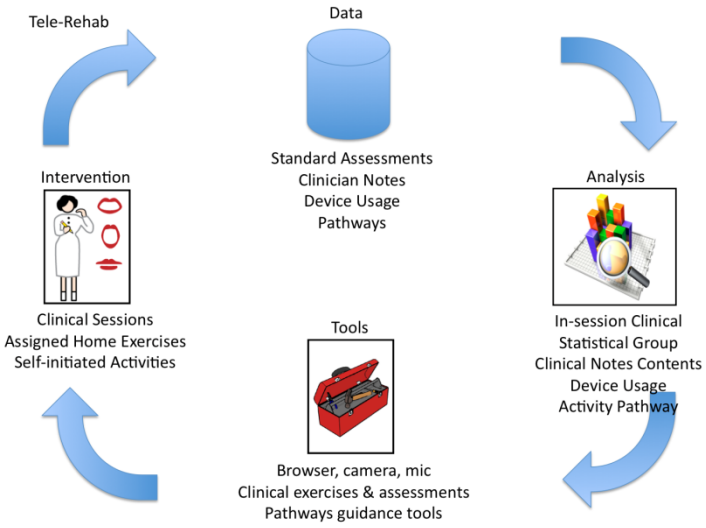

Figure 3. Circular Flow of Clinical and Other Informative Data

Telepractice. The development toward telepractice is reinforcing the possibilities of building data-sets that are part of a feedback loop, i.e., the intervention creates data which inform intervention (which creates data, etc.).

Is a telemedicine version of AAC evaluation possible? At present, it is probably only possible on specific areas, as parts of a comprehensive evaluation, and if there is a skilled team that guides a learning team. A multidisciplinary team is needed, doing hands on assessment, but the degree to which this is necessary depends on the complexity of the client.

Dynamic Assessment

Judith Stoep, Fontys University College and Radboud University, the Netherlands

Stoep, Van Balkom, and the Dutch team around Radboud University in Nijmegen (the Netherlands) (Stoep, Deckers, Van Zaalen, Van Balkom, & Verhoeven, 2012) have developed a measurement tool that tries to grasp the different components of communication in a "Communication Competence Profile: (CCP). It operationalizes the principle that communicative competence must be a multi-dimensional construct to which different sub-skills (linguistic, cognitive, social, and perceptual) contribute. The instrument records information in a number of domains. The domains are Perception, Cognition, Memory, Language Comprehension and Production, Sensori-motor level, Social-emotional functioning, Communication, and characteristics of partners and environment. The scores of the different sections provide a profile that help teams to decide on the content and the priorities for an intervention plan (see Figure 4).

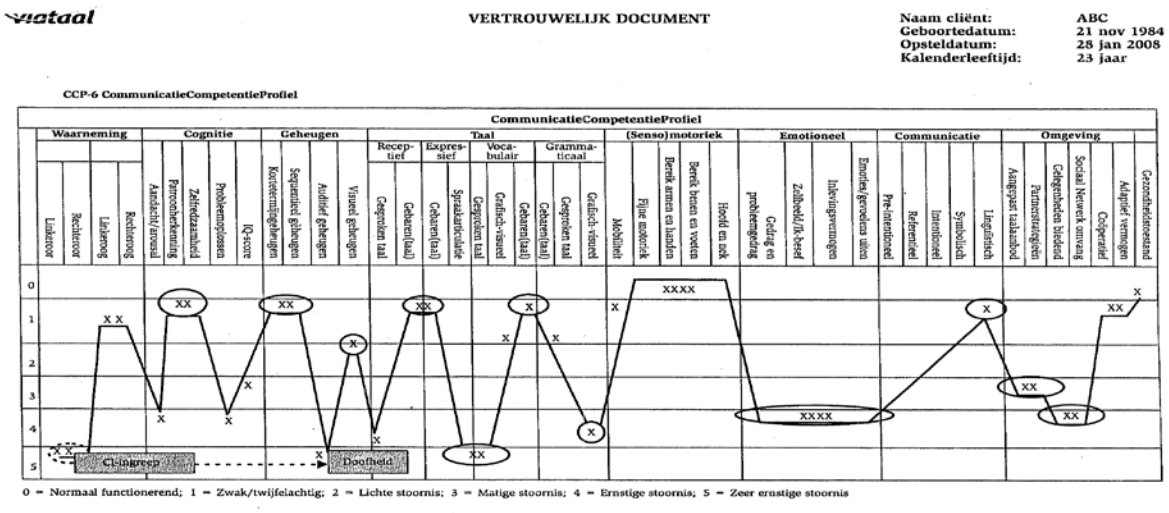

Figure 4. A Dutch Communication Competence Profile Shows Patterns From: Stoep J., Deckers, S., Van Zaalen, Y., Van Balkom, H., & Verhoeven, L. (2012). Profiling communicative competence: A neurosociocognitive reasoning model for AAC assessment. Lecture at the 2012 ISAAC biennial conference, Pittsburgh, PA.

The profile allows inspection of strengths and potential threats to growth (SWOT: Strengths, Weaknesses, Opportunities, and Threats, (United States, 2008)). The system also encourages the formulation of SMART (Specific, Measurable, Acceptable, Realistic, and Time (SMART) goals (O'Neill, Conzemius, Commodore, & Pulsfus, 2006). CCP is obviously a powerful instrument for measurement as a dynamic continuously adjusting process performed jointly by the client, the client's communication partners, and the surrounding team. The instrument certainly has the potential of a framework that will help build data, that will allow data mining, which in turn will help to determine construct validity (e.g., which components within the concept of communication competence weigh more, etc.).

Graphic Symbol Assessment

Filip Loncke, Brittany Davis, and Samantha Hutchinson; University of Virginia, USA

At the University of Virginia, Loncke and colleagues work with clinicians in the ten different countries to develop a graphic symbol assessment tool. This tool was constructed through a series of expert evaluations of four consecutive versions of the instrument. In its final edition, the test consists of the following subtests: Symbol Identification, Symbol Preference, Symbol Memory, Functional Recognition, Classification and Association, Phrase Repetition with Graphic Symbols, Symbol Combination, and Literacy (Loncke, Davis, & Poppalardo, 2011)

The development of a measurement tool for the use of AAC is difficult and tricky for a number of reasons: (1) Communication behavior itself is idiosyncratic and evades comparability, and (2) Responsiveness to AAC solutions is dependent on a multitude of factors, some of which are idiosyncratic and are difficult to grasp in norms.

The solution to meet this challenge is an approach that combines (1) building databases that transcend the limitations of small groups, and (2) the development of a methodology that lends validity to individual-case observations and results.

Here are the steps that are followed in the development of this graphic symbol AAC use tool:

(1) In an initial stage of the development, we need to describe the skill (or set of skills and abilities) that we intend to measure. Why do we believe graphic symbol "competence" is something that would be relevant to assess? How does it fit into the wider picture of skills that will determine a person's ability to use AAC?

(2) Once this initial conceptualization is made, one needs to focus on how it can be made measurable. This further step in the conceptualization involves an analysis into sub-components or sub-skills. In our case these are: Basic recognition, Symbol preference, Symbol matching, Symbol memory, Functional recognition, Classification and association, Symbol combination, Literacy-based communication.

(3) Tasks are selected to measure the sub-skills. We need a sufficient number of probes to make sure that the participant is able (or not) of a behavior at a specific level of difficulty.

(4) The start of a dynamic exchange between a panel of experts leads to a gradual extension and reworking of the tool. Before the tool is actually used by a significant number of clinicians, several rounds of discussions are built in to establish strengths and weaknesses in the test concept and test elaboration (and make the adjustments)

(5) Clinical validation techniques. The tool needs to be matched with multiple observations and, if possible, with correlation evidence using other measuring tools. Essentially, this is information that will need to be provided by clinicians. As stated in other presentations and discussions, more participants will lend more power to (predictive) patterns that may be described.

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Section 3: AAC MEETS TELE-REHABILITATION: ENVISIONING TRANSFORMATIVE TELE-AAC RESEARCH

Tele-AAC Resolution

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Abstract

Approximately 1.3% of all people, or about 4 million Americans, cannot rely on their natural speech to meet their daily communication needs. Telepractice offers a potentially cost-effective service delivery mechanism to provide clinical AAC services at a distance to the benefit of underserved populations in the United States and worldwide. Tele-AAC is a unique cross-disciplinary clinical service delivery model that requires expertise in both telepractice and augmentative and alternative communication (AAC) systems. The Tele-AAC Working Group of the 2012 ISAAC Research Symposium therefore drafted a resolution underscoring the importance of identifying and characterizing the unique opportunities and constraints of Tele-AAC in all aspects of service delivery. These include, but are not limited to: needs assessments; implementation planning; device/system procurement, set-up and training; quality assurance, client progress monitoring, and follow-up service delivery. Tele-AAC, like other telepractice applications, requires adherence to the ASHA Code of Ethics and other policy documents, and state, federal, and international laws, as well as a competent technological infrastructure. The Working Group recommends that institutions of higher education and professional organizations provide training in Tele-AAC service provision. In addition, research and development are needed to create validity measures across Tele-AAC practices (i.e., assessment, implementation, and consultation); determine the communication competence levels achieved by Tele-AAC users; discern stakeholders' perceptions of Tele-AAC services (e.g., acceptability and viability); maximize Tele-AAC's capacity to engage multiple team members in AAC assessment and ongoing service; identify the limitations and barriers of Tele-AAC provision; and develop potential solutions.

Key words: Tele-AAC, Augmentative and Alternative Communication (AAC), telepractice

Resolution

Whereas:

People with complex communication needs may benefit from the use of Augmentative and Alternative Communication (AAC). Examples of AAC include manual signing, letter boards, communication books and high-tech speech generating devices. Beukelman and Mirenda (2012) reported that approximately 1.3% of all people, or about 4 million Americans, cannot rely on

their natural speech to meet their daily communication needs. For adults, the prevalence of complex communication needs (CCN) increases with age, and is significantly higher amongst those living in residential care facilities (Hirdes, Ellis-Hale & Pearson Hirdes, 1993). Prevalence rates of 0.6% have been reported for school-aged children (Matas, Mathy-Laikko, Beukelman & Legresley, 1985), while Binger and Light (2006) report that for preschoolers receiving special education, the prevalence of CCN may be as high as 12%.

Whereas:

Research suggests that the supports available to individuals who use AAC and their families fall short of their needs. Families of children who use AAC interviewed in the US, UK, and Australia have reported a shortage of technical support, intervention, advocacy, and training around their child's AAC device, and feel that they often have to carry these responsibilities alone (Goldbart & Marshall, 2004; Marshall & Goldbart, 2008; McNaughton et al., 2008). Factors contributing to this shortfall are varied, and include: limitations in staffing, funding, and resources; geographical and logistical barriers to service access; and shortage of professionals trained and experienced in AAC service provision (Iacono & Cameron, 2009; McNaughton, et.al, 2008).

Whereas:

Telepractice offers a potentially cost-effective service delivery mechanism to provide clinical AAC services at a distance to the benefit of underserved populations in the United States and worldwide. Telepractice has been reported to improve patient access to services, increase cost-effectiveness and efficiency of service provision, and facilitate access to specialist consultation when required (Mashima & Doarn, 2008). Telepractice has been used with success in many areas of speech-language pathology practice, including fluency and voice disorders, child speech and language delay, acquired communication disorders (Mashima & Doarn, 2008), and the team management of developmental disabilities such as Autism Spectrum Disorder (Boisvert, Lang, Andrianopoulos & Boscardin, 2010).

Whereas:

Tele-AAC is a unique cross-disciplinary clinical service delivery model that requires expertise in both telepractice and augmentative and alternative communication (AAC) systems.

Whereas:

Tele-AAC, like other telepractice applications, requires adherence to the ASHA Code of Ethics and other policy documents, and state, federal, and international laws.

Whereas:

Competent implementation of Tele-AAC is contingent upon an appropriate and adequate technological infrastructure. This includes, but is not limited to hardware/software, Internet, telecommunications, and trained personnel.

Whereas:

As identified by the person who uses Augmentative and Alternative Communication (PWUAAC), Tele-AAC should address the needs of the PWUAAC's circle of communication partners.

Whereas:

Tele-AAC offers the ability to coordinate care across multiple essential direct and indirect service providers. According to the World Health Organization's World Report on Disability (WHO, 2011), services for people with disability often require input across multiple service providers and health care sectors. In reality, services to people with a disability, including those with CCN, are often fragmented or unnecessarily duplicated (WHO, 2011). Tele-AAC can facilitate the coordinated participation of clinical team members; service delivery recipients and their caregivers; and medical personnel. Tele-AAC team-based approaches require adequate technical infrastructure, and a range of clinical methods, strategies, and resources.

Whereas:

Tele-AAC is a valuable clinical service delivery model that includes assessment, therapy, and follow-up services, each of which is deserving of reimbursement. Citing a study by Kairy, Lehoux, and Vincent, (2009), the World Health Organization affirmed that "telepractice leads to similar or even better clinical outcomes when compared to conventional interventions" (WHO, 2011, p. 119), and is a reasonable accommodation to improve service access (WHO, 2011).

Resolved:

The Working Group recommends that Tele-AAC services promote and advance the development of the highest level of communication competence.

Resolved:

The Working Group recommends that Tele-AAC practitioners demonstrate adequate technical competency, maintain appropriate licensure, and employ principles of evidence-based practice.

Resolved:

The Working Group recommends that it is important to identify and characterize the unique opportunities and constraints of Tele-AAC in all aspects of service delivery. These include, but are not limited to: needs assessments; implementation planning; device/system procurement, set-up and training; quality assurance, client progress monitoring, and follow-up service delivery.

Resolved:

The Working Group recommends that institutions of higher education and professional organizations provide training in Tele-AAC service provision. Training should convey the theoretical foundations in combination with hands-on, clinical practicum experience and cover all aspects of service delivery, collaborative teaming, and available technology and resources.

Resolved:

The Working Group recommends that stakeholders such as professional special interest groups and associations encourage the advancement of Tele-AAC. Potential strategies include the conduct of inter-professional continuing education programming; development of Tele-AAC standards and guidelines; identification of new opportunities for the extension of Tele-AAC and infrastructure integration; stimulation of Tele-AAC research; and advocacy for reimbursement and interstate license portability.

Resolved:

The Working Group recommends that research and development in Tele-AAC involve and value the input of PWUAAC. Research and development are needed to create validity measures across Tele-AAC practices (i.e., assessment, implementation, and consultation); determine the communication competence levels achieved by Tele-AAC users; discern stakeholders'

perceptions of Tele-AAC services (e.g., acceptability and viability); maximize Tele-AAC's capacity to engage multiple team members in AAC assessment and ongoing service; identify the limitations and barriers of Tele-AAC provision; and develop potential solutions.

Resolved:

That this Resolution of the August 4, 2012, Tele-AAC Working Group, ISAAC Research Symposium, Pittsburgh, PA, USA be disseminated widely via the ISAAC website, relevant professional listservs and websites, and as a Working Group Report in an open source journal on telerehabilitation.

Approved:

August 4, 2012, Tele-AAC Working Group, ISAAC Research Symposium, Pittsburgh, PA, USA.

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Section 4: BLISSYMBOL RESEARCH AND PRACTICE ISSUES

Stephen von Tetzchner

Department of Psychology, University of Oslo, Norway

Blissymbol Research and Practice Issues: Introduction

Stephen von Tetzchner, University of Oslo, Norway, and Judith Oxley, University of Louisiana at Lafayette, USA

The developmental or learning path of one or more first languages is influenced by a broad range of factors (de Houwer, 2009; Tomasello, 2003, 2008). The individual's abilities and the language environment are important determinants in this process, but also the language mode and the characteristics of the language form(s) available. Some individuals use alternative means of communication and language, and the development of comprehension and use of different communication systems may provide important information about both the nature of the individuals' underlying abilities and the structural and functional characteristics of the various communication and language systems.

Issues in aided language development are related to contemporary concepts of communication going beyond the earlier engineer metaphors with three discrete components: a sender, a receiver, and a message. "Messages" are considered dynamic and actively developed in the process of co-construction and are not necessarily sent or received as unambiguous packages (von Tetzchner et al, 1996). The symbolic system necessarily inhabits a broader context that affects the transaction of meaning and how communication partners negotiate the task of communicating via both linguistic and non-linguistic means. One important issue is how communication, and, more specifically, linguistic communication, develops, and how this development is best supported and promoted by more competent users of natural spoken and signed language (see Nelson, 2007; Tomasello, 2003, 2005).

This question is even more pressing when children are learning language in atypical situations arising from their physical or sensory differences. Children who develop aided language constitute a heterogeneous group with complex blends of abilities and disabilities that influence the transactional processes involved in language development, and the ways and means of scaffolding (Oxley & von Tetzchner, 1999; von Tetzchner, 2009; von Tetzchner and Grove, 2003). It is therefore important that there are different graphic communication systems available for promoting language and communication in ways that support the individual child – sometimes different systems are used in different phases of development (Smith-Lewis, 1994; von Tetzcner & Martinsen, 2000).

The Role of Blissymbolics in Graphic Communication Development. Blissymbolics, the system of Blissymbols, is a form of logographic or ideographic writing, that is, a writing not based on letters (see Downing, 1973). Blissymbolics was originally designed as an international written language with the Chinese writing system as a model (Bliss, 1965), and was first used in Canada with motor-impaired children who were unable to speak and had difficulties in learning to read and write (McNaughton, 2003, this volume). The scientific foundations of the use of graphic systems for communication is related to the correspondence between spoken and written language (Liberman, 1999; Saussure, 1916) and the fact that children who have severe articulation difficulties or are unable to speak often have significant problems learning to read and construct words from alphabetic letters, while they may be able to learn to read and write with logographic and ideographic characters (Geschwind, 1972).

The main issue underlying the present discussion is the significantly reduced use of Blissymbols since they were introduced in 1971 and what consequences this may have for present and future generations of aided communicators. McNaughton (this volume) cast these issues, and more, into a historical perspective to shed light on the various "tensions" that have operated over the years to influence how and why Blissymbolics has been implemented, and the reasons underlying its growth and decline in some places, and its continued favour in others. The history of Blissymbolics can be framed within wider discussions; for example, its status in terms of learnability, its potential for complexity in meaning and enhancing communication rate, its value as an educational tool and learning tool – whether as a bridge to acquiring written codes for a spoken language for aided communicators, or as a tool for typical peers in the classroom, as suggested by Jennische (this volume). McNaughton distinguishes between the distinct goals of face-to-face communication and language development.

There are several graphic systems (Fuller, Lloyd & Stratton, 1997; von Tetzchner & Jensen, 1996), most of them belonging to the PCS style with black and white or coloured line drawings (Johnson, 1981), and some to the PIC style with a white silhouette on a black background (Marajah, 1980), and PCS is the system that is used most. The limited vocabulary usually available to users of pictographic symbol systems implies that the same fixed form may be used to communicate a broad category of related meanings, sometimes also unrelated meanings. The *metonym* approach (cf., Janda, 2011), depicting one instance of the concept implied in the symbol, may also interfere with interpretations of the communication partners and limit the actual range of use of the symbols. If the communication partner assumes transparency of the message, which is not intended, this may be a hindrance to creative communicative use. When Blissymbols were first introduced, they were considered an alternative to the use of pictures cut from magazines and other printed material (McNaughton, 2003, this volume; von Tetzchner, 1990). The function of graphic systems in electronic communication devices is a little researched and discussed issue.

When there is a non-electronic board, pictographs make reference to a potential meaning projected to the viewer by the pictograph. Pictographs on a speech generating device, by contrast, are construction elements making reference to individual words, phrases or longer chunks of text. In other words, their function is navigational in nature. The consequences of these distinctions are far-reaching. Navigational ability and constructional ability are not the same thing: communicators concatenate a sentence from words but have to build up (construct) meaning from Blissymbols. In Blissymbolics, this constructive process serves to decrease ambiguities inherent in a pictographic system, thereby facilitating specificity of meaning and contextual relevance, while simultaneously reducing confusion arising from "icon" confusion. A communicator constructing a Blissymbol message does not encounter the potentially absurd constructions that can arise when various PCS items are sequenced in an effort build some new meaning. Visual absurdities naturally arise; for example, to construct a simple agent-action sequence like *DOG EAT* with PCS, one may select an image of a dog and another image of a human eating something. Whereas the dog image is to be taken "literally," the person should be ignored and the action of eating extracted from the image. This type of abstraction may not be evident, neither for the young aided communicator or the communication partner.

In a sense, pictographic systems do not live a life of their own and a commonly asked question in vocabulary planning is framed as: "Which *words* need to be represented?" This question takes the premise that "words" are individual items, and this seems also to be the premise on which pictographic systems are based. Blissymbolics is a more constructive system, consisting of a set of basic semantic elements and strategies for combining them into new meanings. This is demonstrated in the teaching studies of Jennische (this volume), as well as in the studies using Blissymbols to investigate perceptual and conceptual processes (Alant, Rajaram & Dada, this volume). The tactile version also implies a wider application than is usually attributed to this system (Isaacson & Lloyd, this volume). In many symbol systems, words are really representations of meanings, not other words; likewise, Blissymbols also reference meanings, not words. This distinction is a fundamental one and should not be overlooked.

This last point also raises the question of the vocabulary structure of the communication aid. With pictographic systems like PCS and PIC, it is built up individually. The developmental process starts with a few items, which must then be organized and reorganized. There is an upper bound on a Blissboard, rendering development of the aid less cumbersome, and more gradual. It should also be noted that it is semantic relations that are the drivers of the syntactic system. A communication system based on the communication of meaning, rather than "words," may therefore have the potential to enhance semantic development and set the child on a path that

will naturally prompt the development of greater syntactic elaboration. These two circumstances have driven the many ad hoc attempts over the years to provide children with a productive, generative language system that is can be used as early in development as possible.

Emerging Research Issues. The research agenda raised by the Blissymbol experience includes investigations of the effect of the graphic system on the learner's semantic evolution. Although the strong versions of Whorff's theories have been discarded over the years, the notion that the code itself has potential to influence how we frame concepts is still relevant (Lakoff, 1987; Lakoff & Johnson, 1999). Examples of this can be seen in anecdotal findings from Bliss research.

The main question raised in this discussion is what consequences it may have for individuals developing aided communication if Blissymbols were no longer part of the repertoire of communication systems that professionals consider when they work with a child who starts to develop aided communication. Although PCS and PIC may function well in the very early phases of language development, they may not support an optimal development of language and communication when the child becomes more skilled. The structural and functional characteristics of the Blissymbolics system may support communication and language in people with different abilities and disabilities. The characteristics of Blissymbols and more pictorial systems may become apparent in investigations of the development of aided communicators and shed light on general research issues in language. The functions of Blissymbols may shed light on the underlying abilities and disabilities of people who have different types of disorders.

Another issue is how true scaffolding can take place (von Tetzchner, 2009). The extent to which there is a shared semantic field between the person using the board as an expressive modality, and a communication partner will partially determine successful communication. Also important will be the predisposition and ability of each member of the dyad to negotiate meaning, given the potential for ambiguity. In spite of a 40-year history, many issues related to the development of Blissymbolics communication are still not resolved.

In seeking an understanding of how Bliss might support a child's semantic development, one may consider how various natural languages share features with Blisssymbols, such as classifiers, which facilitate the expression of increasingly refined nuances of meaning (Allan, 1977; Lakoff, 1987). Indeed, the presence of systems of classifiers for nouns and verbs exists in many languages, and classifiers, as a class are learned quite early in development, but there is a developmental trajectory that parallels general cognitive ability. Substantial research supports the presence of definable developmental paths, exists for many languages including Mandarin

Chinese, Cantonese Chinese, and Japanese, and indicates emergence of certain classes around three years of age, and refinement and mature use continue to develop (Erbaugh, 1986; Tse, Li & Leung, 2007; Uchida & Imai, 1999). They are used to indicate a semantic aspect or property of nouns and verb, including notions of count and mass, for which there may be no free forms in the classifier languages. For examples one cannot say one dog, but one body-dog, one herd-dog; similarly with money, round/flat-money and square/flat-money. Nuanced meanings can be communicated when the speaker has adequate cognitive and pragmatic knowledge, such as when there is a need to draw attention to or remove attention from something mentioned. Manual sign language also incorporates classifiers, and developmental pathways are evident (Morgan & Woll, 2007), although sign classifiers tend to be functionally more similar to pronouns (Slobin et al., 2005).

In many aided communicators, the ability to rely increasingly on spelling for expressive communication will often emerge eventually, but there is typically a significant time lag between the use of a graphic system and the capacity to express equivalent ideas through a written modality (pointing to words on a board, using a spelling board, etc.), and some aided communicators remain on a low literacy level in spite of relatively good comprehension of spoken language and non-verbal cognition (Lund & Light, 2006, 2007a,b). Moreover, spelling is arduous and time consuming compared to speaking and signing. Word sets, no matter how well developed, can be lacking in generative power unless grammatical markers and combination strategies are inbuilt. Even when available, the use of these linguistic construction tools demands a degree of metalinguistic capability that may exceed that which is available to a young child. Three-year-olds are typically proficient users of rich morphology and syntax long before they are particularly reflective about the use of these abstractions. Case studies have demonstrated that positive transition from Blissymbols to spelling is possible, even with naturally speaking classmates benefiting from exposure to Blissymbols (Brekke & von Tetzchner, 2003). There is however, a need to understand the underlying processes when literacy acquisition follows an effective path.

The history of graphic communication systems is an important source of information about the consequences of such systems for social participation. Researching the history of Blissymbolics tells about the qualities of Blissymbolics, how it functioned in communication and the way it was used and taught in the last 40 years. This information is too valuable to be lost. Among the first generations of Blissymbol users, in Canada and elsewhere, many are still using Blissymbols and maybe interviewed about their experiences as Blissymbol users across the lifespan. In addition,

experimental studies may give insight into how Blissymbols have influenced the conceptual processes of these aided communicators.

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The Early Years of Graphic Communication Systems – and the Many Issues Still to Be Understood

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In the early years of using graphic communication systems, the professional team that first introduced Blissymbols to young children in Toronto, Canada, did so to provide their students with an alternative to pictures for "talking". They looked to Blissymbols as a substitute for speech. Pictures were rejected as only presenting images of concrete "things," and unable to adequately represent time or abstract concepts. The vocabulary of Blissymbolics offered an expressive language capability with a structure and potential vocabulary to parallel the features of spoken language – in this case English, later French, and eventually 17 languages by the eighties. The team members were dissatisfied with the limited capabilities of pictures to enable children who were unable to speak, to express their thoughts, dreams, opinions, emotions. They knew the children understood language receptively through their attentiveness and their behavioural responses to the speech of others, but the team wanted much more for the children. They wanted them to be able to fully participate in their educational programme.

Initially, in evaluating the accomplishments of the children as they learned Bliss, their communication output was the first behaviour to be formally observed – the number of symbols included in an utterance, the number of grammatical elements in an utterance, the number of turns taken and topics initiated, the range of topics covered, the number of partners, etc. As we all became more experienced in Bliss usage and the teaching of Bliss, however, we noticed other behaviours that were of equal importance. As the children learned and used their Blissymbols, their teachers became aware of and encouraged the children's interest in playing with language, making new symbols, applying the strategies within the system of Blissymbolics.

By the time we undertook our study of 1974–1976 (Silverman, McNaughton & Kates, 1978), we were focussing as well on (1) the communication, academic, social and psychological development of the symbol user, (2) the interrelationship of symbol usage with the family, instructor and setting, (3) the evaluation of symbol displays and teaching programs. We began to consider the unique developmental path of children who were unable to speak and contrast it with the development of speaking children (McNaughton & Lindsay, 1995). This recognition of the parallel yet different role played by graphic communication led to an examination of the capabilities of Blissymbolics relating to language development and literacy acquisition

(McNaughton, 2002). Considered of special importance in the evaluation of Blissymbolics was the notion of *Duality* (Bjorn Lindblom, 1990. ISAAC Biennial Conference, Stockholm, Opening Address). Bliss contains language components at two levels (word and sentence) and this feature could be applied to the teaching of Bliss as preparation for learning to read print. It became evident in the early days of Bliss usage that some children were developing a sight vocabulary through r*ecognizing* (in a holistic way) the words paired with their symbols. This insight, and the recognition of the duality of Blissymbolics (although we didn't have a term for it in the eighties), led to the description of Type One symbols (holistic processing, as with *pictures, pictorial Blissymbols* and *whole word* acquisition) and Type Two symbols (analytic processing, as with *phonological processing of words* and *visual analytic processing of compound Blissymbols*) (McNaughton, 1993; McNaughton & Lindsay, 1995. The analytical visual processing that can be fostered in the learning of Bliss and its relevance within the acquisition of literacy is yet to be explored.

> *"As individuals 'write' or compose sentences with Blissymbols, they learn rules to enable the sequenced symbols to form statements or questions or commands, and to denote plurals, possessives, pronouns and verb tenses and negation. The combinatorial capability of Blissymbolics is so powerful that there is no limit to the number of symbols and sentences that can be produced. As learners read and write with Blissymbols, they gain experience with symbol elements and with syntax and they acquire the underpinning for the rules of their native language. They learn how to analyze symbols and sentences and apply this knowledge to creating new symbols and constructing original sentences. These experiences provide critical preparation for progressing to literacy fluency. For the speaking child this language foundation comes from their many years of talking and listening. For the AAC user, this language foundation must be acquired through the mastery and control of their expressive AAC communication being added to and refining their listening. This can be achieved through experiences with the dual structure of Blissymbolics. Duality provides the valuable additional learning opportunities at the second rung of the ladder."* (*McNaughton, 1998a, p. 305)*

McNaughton's research (1998a,b) showed print analysis to be more difficult than Blissymbol analysis for early readers. Because the analysis of a Blissymbol into its meaning parts is more easily learned at an earlier developmental level than the analysis of words into their sound parts, the early use of Blissymbolics offers a time for enjoying and learning about written language before encountering the greater demands of reading print.

Many Issues Still to Be Understood. The knowledge we have gained through the accomplishments of Bliss users, from research studies and from clinical and classroom experience offers us insights as to the issues requiring study and the questions requiring answers if we are to reach a better understanding of the role of and value to be derived from graphic systems in the development of AAC users.

First, we need to better understand the unique developmental path of AAC users and within it, the development of the skills inherent in literacy acquisition.

Second, we need to better understand the features and "affordances" of various graphic systems and the differing role each can play in the communication, cognition, language, and literacy development of AAC users.

Third, we need to better understand the importance of the teaching methodology and the role of the instructor in deriving the greatest value for the student from the "affordances" of the various graphic communication systems.

Fourth, we need to better understand, within literacy development, the differences between holistic visual processing and analytic visual processing. We need to examine the potentially beneficial role to be played by visual analytic processing for the individual who is learning Blissymbols, prior to and while learning print and before gaining automaticity in the use of the Blissymbols.

Fifth, we need to apply this greater understanding to the educational programs of AAC users, the vocabulary selection and symbol arrangement/presentation process and the design of technology and software.

To aid us in acquiring this greater understanding, we need to a) include experienced AAC users and instructors in the examination process, b) have high expectations of what students can learn through using the various representational systems, c) expect more of technology and software in making the strengths of the various representational systems available to the student, d) recognize and value the individual's right to communicate and learn at the *highest* level achievable, e) look to the reading acquisition literature for insights to be applied to studies with AAC users (suggested authors are Adams, 1990; Stanovich, 1986, 1991; Ehri, 1991; Share, 1995), f) incorporate Bliss character prediction and Bliss-word prediction. This software would provide valuable experience in analytic "word" production ("spelling" in Bliss) and sentence generation,

c) incorporate Bliss communication along with print acquisition. There is need to provide experiences in which the student's learning of Bliss and print can be integrated and mutually supportive. Important caveat: Teacher must understand the developmental path the AAC user is taking, and h) examine and compare the long term communication, language and literacy outcomes from using synthetic speech derived from (1) technology that provides primarily fully programmed sentences, (2) technology that provides opportunity to construct sentences and words in both Bliss characters and Bliss-words, (3) technology that provides opportunity to construct sentences through encoding techniques (e.g., Minspeak).

Some Afterthoughts. We need to assume that our goal is both communication and literacy development (with the concomitant goals of language and cognitive development). Those with severe physical and speech disabilities should have the opportunity to engage in and enjoy all the attributes of language and areas of language use. They are deprived of many of the experiences enjoyed by those who are able-bodied. Language should not be one of them!

Underlying all we do in research studies, we need to acknowledge the differences between "*able" disabled*, versus "*disabled" disabled* and the challenges of severe disabilities (in conversation with Annalu Waller, 2012). In my thesis, I used the term SCSPI (Severe Congenital Speech and Physical Impairments) Those who up to now have benefited the most from Blissymbolics are those with severe physical and speech disabilities but with moderate to high intellectual capabilities. These AAC users have demonstrated the inherent strengths of Blissymbolics and the promise Bliss offers to others if these strengths are understood and supported by those who teach Bliss.

AAC users could benefit much more by researchers re-directing their focus from the comparison of the various graphic representational systems on such variables as transparency, translucency, complexity, to an in-depth examination of the learning opportunities that can be derived from the exemplary teaching and well supported use of particular graphic representational systems, beginning with such an examination of Blissymbolics. Attention needs to be directed toward the AAC users' development and toward the teaching procedures that support students reaching their highest achievement level.

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Characteristic of Blissymbolics

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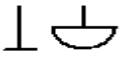
Several studies from early decades have evaluated the translucency or transparency and complexity of the Blissymbols often in comparison with other systems like Rebus, CyberGlyphs, other iconic systems and lexigrams (Alantet al., 2005; Burroughset al., 1990; Huges, 1979; Luftig et al., 1985; Hurlbut et al., 1982; Mirenda et al., 1989). Methods have often been strictly matching symbol - picture, or indicating a picture or symbol after auditory input. Most researchers have concluded that Bliss is the least transparent system, and the most difficult to learn. This reputation has probably been one of the reasons that the use of Blissymbolics decreased in the 80s in favor of pictures for AAC. Concrete pictures may be easy to name and recall but our cognitive and linguistic ability leads far beyond the concrete pictorial level to an abstract level for thinking and expression. When choosing a graphic communication aid these aspects also have to be considered.

In this presentation characteristics of Blissymbolics are presented from three different perspectives: a) the structure of Blissymbolics, b) the generative possibilities of Blissymbolic linked to language development in children, and c) the observed characteristics in the use of Blissymbolics.

The Structure of Blissymbolics. Each Bliss-character has a specific semantic meaning, for example HOUSE  , PLANT  , BOAT  and CHAIR  . Other examples may need more explanations: MEDICINE  is represented by the snake around Aeskulapius' stick. Aeskulapius was the Greek god of medication and the snake around the stick is internationally often used as a symbol for medicine. PERSON represents a person standing on a piece of ground and CONTAINER  is a bowl-shaped character showing that it is something you can put things into and fill up.

Bliss characters can be superimposed or sequenced to represent new meanings:

a car inside a house is *GARAGE*  , a flag on the ground represents *COUNTRY*  . The superimposed characters of liquid, mouth, and a piece of the ground (meaning the surrounding) is a *DRINK*  , as drink is liquid originating from the surrounding one puts into the mouth, a house with plants is a *GREENHOUSE*  , a person with a boat is a *SAILOR*  , drink and fruit is *FRUIT-JUICE*  , and a room for playing is a *PLAYROOM*  . The sequence of characters meaning play is activity (the small volcano shape), feeling and up (= happy) thus *play* is an activity that makes you happy.

In a Bliss word consisting of a sequence of characters, the first character is the *classifier* telling what type of concept it is, like in the examples above: a type of house, a type of person, a type of drink, and a type of room. The following characters are *specifiers,* which specify or narrow the meaning of the classifier.

Bliss characters are symbols. Most of them are pictographic in the way that once you have had them explained to you they are quite easy to remember, but without an explanation most of them are not transparent. They are symbols for a concept and not depicting pictures, e.g., bed, table, car, legs and feet, and animal are represented by  ,  ,  ,  and  .

In spoken languages many concrete concepts also have an abstract meaning. In English, for example, a chair is something to sit on as well as a leader of a meeting, a character is both a letter and a personality, an office is a room and a position. In Blissymbolics, similarly to spoken language, many of the characters have both a concrete and an abstract meaning as well. The most frequent meaning of the shape of a roof of a house is *protection,* referring to the function of roofs  , of the shape of a heart is *feeling*  , of the shape of the skull is *mind*  . Time is always represented by the shape of a mirror. When it is turned backwards it

reflects *the past* , and turned forward *the future* , p*resent time* thus . The shape of a volcano is the symbol for *action* . Charles Bliss meant that the activity of the volcano was the first activity. When the Blissymbols *PAST, FUTURE,* and *ACTION* appear in smaller sizes, they still represent past time, future, and activity, for example, = AGO, = THEN, and = ACTIVITY. When is above a Bliss word it indicates an infinitive verb form. To use the concrete meaning of these Blissymbols, a small square indicator is placed above the Bliss character, like in *HEART* .

The shapes of the pictorial Bliss characters are very general. This makes them less transparent than ordinary pictures. On the other hand they can represent a whole group of something, for example is any four legged animal while pictures of animals always represents specific animals like these pictograms: 

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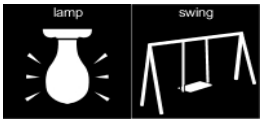
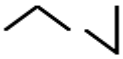
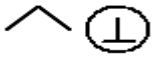
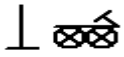
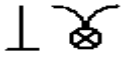
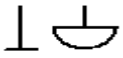
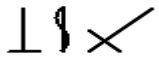
To make specific animals in Blissymbolics, specifiers enhancing distinctive features are added, such as *MONKEY* . A monkey is an animal with four legs (a mammal), ALMOST-THE-SAME-AS (will be described later) a person. An *ELEPHANT* is an animal with a long nose. Another example of the importance of emphasizing the distinctive features of a concept in a graphic symbol is when you want to use the words in an unusual context. In Blissymbolics the (electric) *LAMP SWINGS* is , while in pictograms 

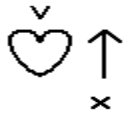
should give the same meaning. This exemplifies some of the difficulties in using pictures in graphic communication.

When I visited South-Africa a few years ago and gave a short lecture about Blissymbolics, one of the teachers pointed out, that one advantage with the Blissymbols is that they are easy to draw. It is a true advantage in educational situations in classrooms for teachers of all countries, and also a special advantage in less technical countries. So although technical solutions are available for all persons using Blissymbols for communication, it can still be useful to be able to draw the Blissymbols when teaching them, discussing their meanings and writing text with Blissymbols.

The logic structure of the system is related to the translucency of the system. Blissymbolics may seem difficult at first glance, but when one discovers the logic one usually becomes very fascinated. The logic structure is visually supported and therefore very useful in teaching situations about concepts and how concepts are linked. The meaning of  is *PROTECTION*. A protection for the foot,  , is a *SHOE*. The meaning of protection for hand (in hand see the thumb and the index finger)  and for head,  are easily generated.

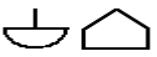
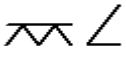
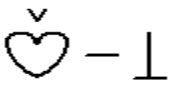
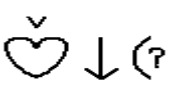
Another example: A person specified as medical is a *DOCTOR*  , and the meanings of  ,  and  would be *DRIVER*, *PILOT* and *SAILOR*. When one has understood the logic way of retrieving meaning of Bliss words, even long Bliss words become comprehensible, for example the combination *PERSON, MEDICAL and KNIFE*  is a *SURGEON*, while *PERSON, MEDICAL, KNIFE* and *HEART*  constitute a *HEART SURGEON*.

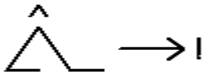
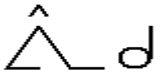
In the grammar of Blissymbolics indicators mark the difference and the relation between noun, verbs, and descriptors (adjectives, adverbs), like *MIND*  , *BRAIN*  , *(TO)THINK*  , *SCISSORS*  , *(TO)CUT*  with scissors, *HAPPINESS*  and *HAPPY*

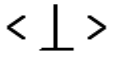
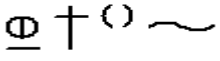
 . Other indicators mark time, e.g., past tense , present and future , plural , possession , etc.

Blissymbolics has a simple syntax and a grammar of its own. However, when Blissymbolics is used as alternative means of communication it is usually adapted to the syntax and grammar of the surrounding language. In publications with Blissymbols and in educational situations a large set of indicators are often used to adjust and visualize the syntax and the grammar of the surrounding language. (For more information regarding the structure and grammar of Blissymbolics, see the fundamental rules at www.blissymbolics.org).

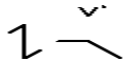
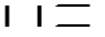
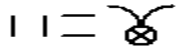
The role of classifiers and specifiers as part of the logic and translucency of Blissymbolics has already been mentioned. In a Bliss-word including a sequence of characters, the first character is the classifier telling what type of concept one is looking for and the following characters in the Bliss-word are specifiers that specify or narrow the meaning of the classifier. Specifiers can be descriptive and indicate the function, the material or something typically associated with the concept. In the authorized Blissymbolics vocabulary (AV), the characters and sequences of characters in the Bliss-words is the result of international consent on these being the best representations of the intended concepts.

The classifier, which may best be translated as "a type of", indicates the hierarchical grouping of concepts, for example, a type of animal, a type of feeling, a type of activity (see the examples below). How children organize and group concepts vary through childhood. The hierarchical concept structure of Bliss-words is based on an adult organization of concepts, and is thus the organization that is usually focused on in language teaching. Children have to be taught this structure of Blissymbolics (the classifiers and specifiers). However, the Blissymbolics vocabulary becomes a useful tool in teaching concept formation, as indicated in these examples: A *BOATHOUSE* is a type of house  , a *HOUSEBOAT* is a type of boat  , an *ELEPHANT* is a type of animal  with a long nose. *LONELY* is a type of feeling  (the feeling without a person). *AFRAID* is also a type of feeling  (a sad or bad feeling of something uncertain in the future). *(TO)RUN*, is a verb, a type of moving

legs and feet forward with intensity  , while *(TO)DANCE* is moving them to music  .

Blissymbolics has a vocabulary to grow with. With age, children acquire a more abstract and advanced vocabulary. Within the same logic structure also complex concepts are included, such as *LEADER*  i.e., a person with the function to think forward*), PERSONALITY*  , i.e., the emanation from a person, *HOLY*  which is an adjective, in the shape of a gloria, *BAPTISM*  is a type of event, *CHRISTIAN* and *HOLY* (= a sacrament), here the sacrament of water, *BAPTISM*. The systematic presentation of complex concepts make them understandable and comparable, such as *ENERGY*  , which is a combination of sun and electromagnetic radiation. The different types of energy are thus *SOLAR ENERGY*  , *HYDRO ENERGY*  , *WAVE ENERGY*  , *WIND ENERGY*  , *GEOTHERMAL ENERGY*  and *BIOENERGY*  .

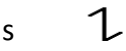
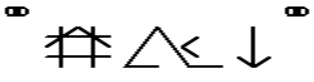
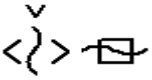
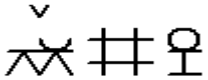
The Generative Possibilities of Blissymbolics. The most important aspect of a language is that it allows persons to express their thoughts, opinions and ideas. In a spoken language this is possible through the endless ways of varying expressions, choosing other words or even making new words. An interesting phase during language development is when children about the age of four invent new words to suit their communicative purpose when talking. Parents usually enjoy the linguistic creativity when they hear their child make up a new word (Mellenius, 2004). The following examples are produced by young speaking children: an unflower (a weed), the goes+down + trouser-s (the trousers that always slip down), to needle (to sew), ice hot (cf., ice cold), lamby (something nice and soft).

Blissymbolics has various ways of modifying existing Bliss-words or make up new words to meet the need of the communicator. Some characters placed in front of the classifier modify or augment the meaning, or make the meaning more intense, like in the following examples. *OPPOSITE MEANING*  (arrows in opposite directions) together with *BROKEN* is *INTACT*  . *MUCH* in *MUCH, MUCH, MUCH , MUCH WIND* becomes *VERY HEAVY STORM*. *ALMOST THE SAME AS*  together with *AIRPLANE*  could mean *HELICOPTER*. One child spontaneously used *OPPOSITE MEANING* and *BREAD*  to say *CAKE*.

If a Bliss-word is missing or not available, one can choose an appropriate classifier and add specifiers according to the intended meaning. In order to indicate to the communication partner that a Bliss-word is not part of the authorized Blissymbolics vocabulary, that it is a personally made up Bliss-word, the person using Blissymbols starts and ends the word with a *COMBINE INDICATOR* . The communication partner then knows that all the characters between the two combine indicators should be interpreted as one concept, one Bliss-word.

To make a Bliss-word more precise, it is also possible to change classifiers or add specifiers e.g., instead of just *BEAR*  express *DADDY BEAR*  . It is common in children's books that a story tells about an animal family or an animal school with the owl as the teacher  (the bird who gives knowledge).

The use of indicators to change parts of words has already been mentioned, for example changing nouns into verbs and adjectives. This way of modifying the meaning to express the function or activity of a thing or describe something seems closely related to children's concept and vocabulary development. A young child may answer *read* when you point at a picture of a book and say *What is this?* or *eat* when you point at food. The thing and the function of the thing are very closely related in concept and word formation.

Within the structure of Blissymbolics, the invented words produced by young children in the examples above could have been expressed as  (*un-flower*),  (the *goes+down + trouser-s*),  (to *needle,* actually the Bliss-word *(TO)SEW),*  (*ice-hot*) and  (*lamby*).

Observed Characteristics in the Use of Blissymbolics. Many children who use Blissymbolics as a means of communication have become linguistically skilled. Some express and show a clear desire for using advanced grammar, comparable to the grammar of the spoken language around them. They may even say that they don't want to express themselves or talk in a childish way. A large number of grammatical indicators have therefore been developed to meet these linguistic needs. Teachers also say that the indicators function well as a visual tool to teach grammar to children in the classroom. Books printed in Blissymbolics are therefore usually adjusted to the grammar of the spoken language. In all Blissymbolics publications, the following phrase should then be included: "This product is written in Blissymbolics adjusted to follow the grammar conventions of xxx language for the purposes of language teaching and learning".

Some children develop linguistic awareness. It is an awareness at different levels where the children may mix letters, Bliss-words and Bliss-word homonyms. To express *SIZE* which in Swedish is *storlek,* one Swedish boy pointed at *STOR*  ("big") and *LEK*  ("play"), thereby creating two homonyms from the Bliss-words *STOR* and *LEK*, which were similar in form but not conceptually. Another example is when the boy wanted to say the name of the Swedish island Gotland. He spelled the first three letters g-o-t and then added  which is the appropriate Bliss-word for *LAND* ("country").

Some fluent Blissymbolics communicators reduce their active vocabulary. They don't use their books, which contain thousands of Bliss-words. They prefer the standard chart (500 Bliss-words) and become smart users of this chart and utilize all the generative possibilities of Blissymbolics, often adding letters and sometimes use homonyms. Some young Blissymbolics communicators

become very fast and efficient communicators. Many love to make up new Bliss-words with combine indicators, challenging the imagination of the communication partner.

Many children who are good Blissymbolics communicators transfer to written language, although some of them keep their old Blissymbol chart for fast communication. There are also aided communicators who never capture the phoneme-grapheme correspondence that alphabetic written language is based on, or who become only partly literate.

In Sweden, some schoolbooks are written with Blissymbols and tests show that children who use these books capture the content and are able to acquire knowledge independently. There are also children who start to learn Blissymbols for communication, who do not use the generative possibilities and never reach the stage of linguistic analytic processing. Some children using Blissymbols are given pictorial communication sets after some years. The reasons for this change is not clear, whether it is based on assumptions about the ability of the child, the teaching methods, the knowledge or interest in the surrounding, including the professionals, or a change of school.

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Semiotic Aspects of Graphic Signs in General and Blissymbolics Specifically

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When augmentative and alternative communication (AAC) emerged in the early 1980s, Blissymbolics (Bliss, 1965) played an important role and it was implements throughout the world. In the middle of the 1990s it reached its peak, for then to decline and seems to have vanished in many countries. If Blissymbols were replaced by better systems this would be a progress to welcome. However, this is not evident, so a closer look might shed some light on this issue.

Peirce and de Saussure: Sign, Index, Icon and Symbol. Being that Blissymbolics is a system of graphic signs and semiotics is the science of signs a semiotic perspective can give some insights to this questions. Charles Sanders Peirce (1998a,b) and Ferdinand de Saussure (1986) were the founders of semiotics. Semiotics are based on the definition of sign as referring to something else. The sign integrates the form of a sign ("significant," signifier) with the meaning ("signifié." signified) to a unit that constitutes the sign.

Pierce defined classes of signs by means of the kind of relationship between signifier and signified. A cause-effect relationship constitutes an *index*. Smoke is caused by fire, so it can be an index for fire. Yawning can be caused by tiredness, so yawning can be an index for tiredness. *Icons* are characterized by a resemblance between signifier and signified. A picture of a tree resembles the tree and hence is an example of an icon. The signifier-signified relationship of symbols is determined by rule, the the relationship is arbitrary (cf. Soto & Olmstead, 1993). In de Saussure's theoretical model an arbitrary relationship is a characteristic of linguistic structures and language.

According to Peirce there is no insight without a sign, and therefore he called the processes that involve signs for 'semiosis' in the sense of interaction between sign, object and interpreter. This fits well with bio-psycho system theories (Maturana & Varela, 1987), proclaiming that there has to be information construction at the boundaries of systems. Saussure on the other hand emphasizes that along with the relationship between word and the things they represent there are also the relationship between the elements of a semiotic structure – a structuralism of linguistics.

Semiotics in Augmentative and Alternative Communication: The Terminology Discourse. From a semiotic perspective on Blissymbolics and alternative communication in general it is important to note the major difference between those fields. The usage of the terms sign and symbol is a first major difference in the terminology in the AAC field on the one side and the semiotic and linguistic field on the other, as Lloyd (1985) points out. A second difference is that in the AAC field iconicity is considered worth striving for, while semiotics prefer arbitrarity. A third

difference is that the distinction between unaided and aided communication is only mentioned in the field of AAC but not in semiotics or linguistics.

Lloyd (1985) points to the necessity of a taxonomy in the AAC field and started a discourse which resulted in the development of a terminology committee within the International Society for Augmentative and Alternative Communication (ISAAC). The main focus was a terminological system for alternative communication means (Lloyd, 1985; Lloyd & Fuller, 1986; Blau, 1987; Lloyd & Kangas, 1988, 1990; Lloyd & Blischak, 1992; Fuller, Lloyd & Schlosser, 1992, 1997; Zangari, Lloyd & Vicker, 1994; Lloyd, Loncke & Arvidson, 1999; Loncke & Lloyd, 1999). The dimensions included in the taxonomy were logical structure, sociolinguistic implications, compatibility with common definitions and usage, clinical and educational relevance and reduction of dual-classification ambiguity (Lloyd & Fuller, 1986; Fuller, Lloyd & Schlosser 1992), There was a focus on symbols (Fuller, Lloyd & Schlosser, 1992), validation by a theoretical framework (Soto & Olmstead, 1993), functionality (Lloyd & Fuller, 1986), transmission techniques and the communication process (Lloyd & Fuller, 1986).

The terms “non-speech,” “non-oral,” “non-vocal,” “non-verbal,” “non-speaking,” “augmentative communication,” “assistive communication” and “alternative communication” are all critically discussed and partly rejected by Lloyd (1985) and Zangari, Lloyd and Vicker (1994). Von Tetzchner and Jensen (1996) consider the terms “non-speaking” and “non-verbal” as useful and define “non-speaking” as a lack of speech and “non-verbal” as the absence of comprehension and use of any spoken, manual or graphic language. Lloyd (1985) defines speech as “the spoken – voiced – and articulated output of the communication system” and language as: “a conventional set of arbitrary symbols, and a set of rules for combining these symbols, to represent ideas about the world for the purposes of communication” (p. 96) or as a “system of symbols (e.g., manual signs, words) and rules for combining them that can be used for a communicative function (e.g., expressing feelings, transferring information)” (Lloyd et al., 1999, p. 165). A stricter definition would be: “A natural human language is a conventional system of arbitrary symbols and grammatical rules to combine these symbols into larger units (i.e., phrases, clauses and sentences) in order to convey meaning. A natural language is one that has evolved naturally from social interaction between human beings and is typically acquired by children as their first language” (Lloyd et al., 1999, p. 96). Lloyd, Loncke and Arvidson (1999) present these definitions with their consequences regarding the state of different alternative communication means as language without giving preference to any of the definitions.

Soto and Olmstead (1993) argue on the basis of Pettersson and Forlack (1988) for a broad understanding of language and suggest that "any system used as a means of communication between people can be regarded as a language" (Soto & Olmstead, 1993, p. 135), including spoken, written, visual languages, but also languages "based on smell, taste, and touch".

Very different and partly contradictory definitions are proposed for the terms "sign," "symbol," "gesture" and "manual sign." Lloyd (1985) defines symbols as "spoken, graphic or manual representations of objects, actions, relationships, etc. While spoken symbols are temporal and are conveyed through the auditory-vocal modality, graphic and manual symbols are spatial or spatial/temporal and are conveyed through the visual modality" (p. 96). In a later definition, a symbol is "(1) Something used to stand for or represent another thing or concept (e.g., real object, picture, line drawing, word); (2) In communication, it is anything used to represent thought (e.g., acoustic symbols via speech, letters of the alphabet via writing). AAC symbols can be acoustic, graphic, manual, and/or tactile" (Lloyd et al., 1999, p. 166). Two types of symbols are distinguished: "In Type One symbols, each symbol's representation relates to the visual appearance of its referent. It is a picture which is derived from the spatial positioning of the components relative to each other within the whole. A Type One symbol matches its referent's salient visual features. Type Two symbols relate to domains other than visual appearance (e.g., phonological or semantic). They portray meaning by the sequencing of their components and the logic or rules by which these components are ordered both on an intrasymbolic level (e.g., components or letters within words) and on an intersymbolic level (e.g. words within phrases and sentences)" (Lloyd et al., 1999, p. 166).

Further: "Gestures and signs are two related types of manual symbols used in nonspeech communication. Signs and gestures that have been conventionalized and conform to certain rules or are constrained in their formation and usage; gestures have no such linguistic constraints, but do have cultural interpretations. Most signs – the linguistic elements of meaning in sign language – are relatively abstract, while gestures tend to be concrete. The meaning of most gestures can often be guessed while the meaning of most signs cannot" (Lloyd, 1985, p. 96).

It is relatively easy to agree with most of the above operational definitions, but it needs to be recognized that authors in such diverse areas as cognitive and language development, linguistics, pragmatics and speech act theory may use "sign" and "symbol" differently. Some may use "sign" as a general representational term having either three levels (icon, index and symbol), or two levels (signal and symbol). Others use "sign," "signal" and "index" for describing a basic and concrete level of communication where the referent is present, and "symbol" for a higher or representational level of communication. In my operational definition I would use "signal" (or "index") for the basic

(and clearly non-linguistic) level and 'symbol' for the higher representational level. This avoids the confusion of "sign" as a general representational term with "manual sign" as in the sign languages of the deaf and the pedagogical sign systems (Lloyd, 1985). Lloyd and Blischak (1992) point out that the field of augmentative and alternative communication night need to reconsider the use of the terms "sign" and "symbol."

A central aim of the terminology discourse was the development of a classification of communication means used in AAC. Lloyd and Fuller (1986) propose a multilevel symbol taxonomy with aided versus unaided as top level categories, followed by static versus dynamic, iconic versus opaque, and set versus system (as a set of rules for the development of new signs) (Fuller, Lloyd & Schlosser, 1992). With these four dual criteria the taxonomy includes 16 categories (Figure 1).

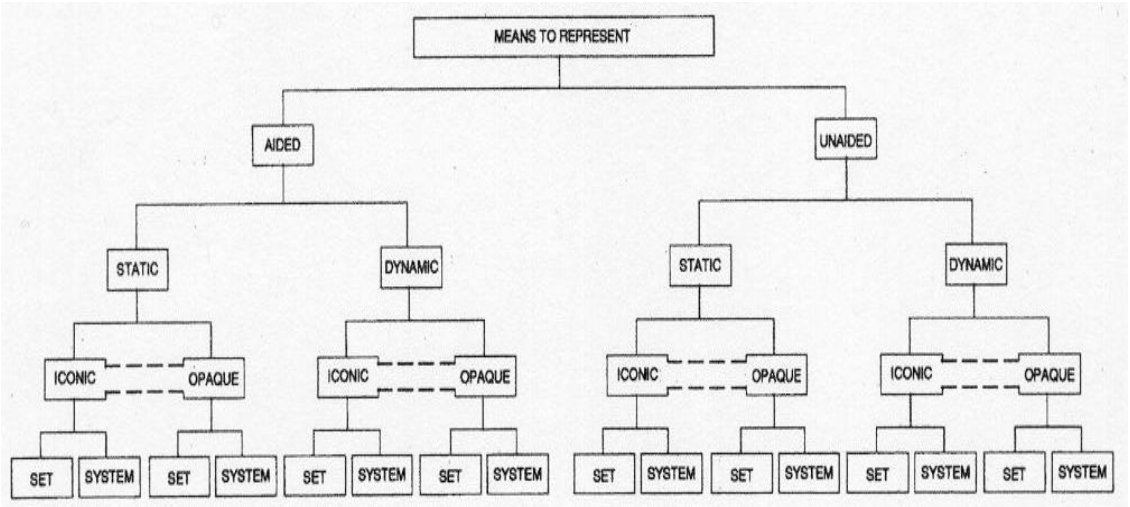

Figure 1. A proposed AAC symbol taxonomy (from Fuller et al., 1992, p. 72).

The claimed duality of the criteria was questioned by Renner (2004). It may work for aided versus unaided, but not for the static versus dynamic dimension, for manual signs, which can be quite static in contrast to communication with graphic signs, which can be quite dynamic (c.f., Blau, 1987; Venkatagiri, 2002). For iconic versus opaque the continuity is stated by the authors themselves. Venkatagiri criticizes the top level aided versus unaided because it focuses on physical characteristics: "however, it fails to account for differences in the complexity and scope of different types of AAC communication" (Venkatagiri, 2002, p. 45). Also the distinction between static and dynamic on level two is rejected with reference to the inconclusive definition of these terms with the consequence that writing is dynamic (in production) and static (in result) at the same time. He also questions the definition of 'symbol' as "all types of message elements that are involved in AAC communication." However, even this loose and expansive use of the term fails to accommodate a vital aspect of AAC, namely, the reflexive and highly conditioned responses of AAC users that represent a range of emotional states (happiness, anger, etc.), comfort states (illness, feeling cold, etc.), physical and psychological needs (toileting, companionship, etc.), and cognitive states (alertness, boredom, etc.). A comprehensive and clinically relevant description of AAC systems should include these highly communicative, albeit unintentional, signs" Venkatagiri, 2002, p. 46). The criticism is especially relevant because Lloyd argues for the inclusion of expressions in persons without recognizable intentions into AAC (Kangas & Lloyd, 1988), making representations of emotional states important for AAC.

Renner (2004) discusses the problematic differentiation between set and system by the criterion that there are rules for a systematic extension of the vocabulary, which is not conclusive since the simple rule to find new signs for new meanings would make a mockery of this criterion. But even a more precise and semiotic oriented definition of system would show a range of rules for extensions from simple to complex. He also criticizes the non-hierarchical structure, where the lower levels are not subcategories of the higher level. Any other arrangement of the levels would lead to the same 16 categories.

Von Tetzchner and Jensen (1996) and von Tetzchner and Martinsen (2000) mainly agree with the former terminology within the AAC field, but disagree with the absence of orientation in semiotics (von Tetzchner & Jensen, 1996). Soto and Olmstead (1993) also plead for a semiotic orientation. In their 'semiotic perspective on AAC' (Soto & Moratinos, 1992; Soto & Olmstead, 1993) they see semiotics "as a methodological and/or theoretical system that can assist AAC researchers and/or professionals in understanding and validating AAC terminology, analyzing sign characteristics, operationalizing sign variables, expanding sign taxonomies, and comprehending sign transmission processes (e.g., production and interpretation)" (Soto & Olmstead, 1993, p. 114).

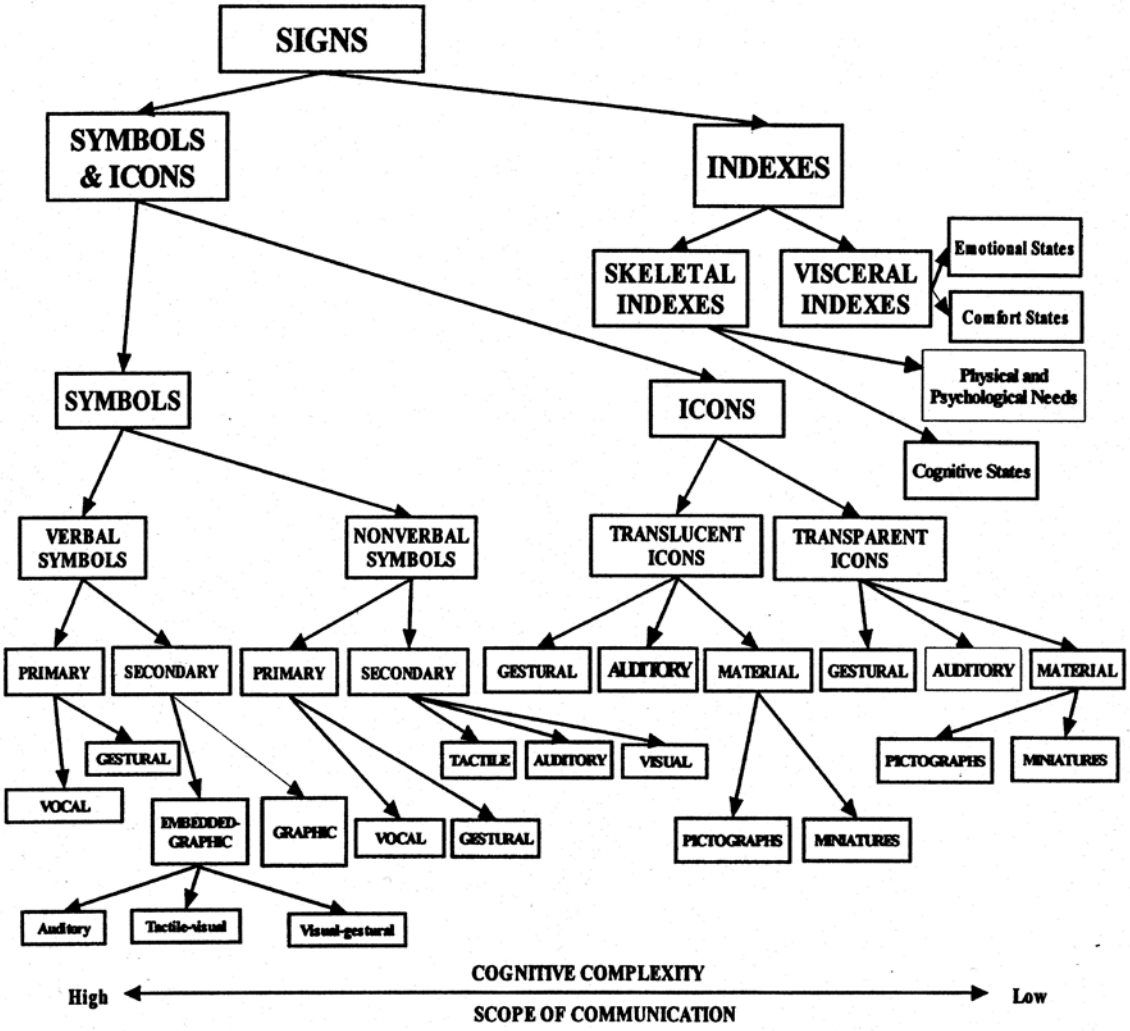

Figure 2. A semiotic taxonomy (from Venkatagiri, 2002, p. 47).

Another semiotic approach for AAC is presented by Venkatagiri (2002). In his classification system "sign" in a semiotic sense is the superordinate term (Figure 2). To avoid confusion with sign language (of the deaf), he uses the term 'gestural language' for sign language. The division into indexes, icons and symbols derives from semiotics. New to the AAC field is the inclusion of communication via indexes which are unintentional. As examples for indexes Venkatagiri (2002) mentions "cries, moans, grunts, and sighs; facial expressions of happiness, sadness, anger, surprise, etc.; and body postures and movements suggestive of various emotions" (p. 46). In his opinion "communication partners must be alert to indexical communication on the part of AAC users, which

often serves as a springboard for the development of intentional communication" (p. 46). In this multilevel taxonomy most Blissymbols are visual symbols, "although a small number of Blissymbols are icons" (p. 49).

This more semiotic oriented approach is a progress in AAC taxonomies. However, communication aids are only mentioned within the categories material, pictogram and miniatures, which do not reflect their importance in AAC. In addition, the permanence of sign is seen as a relevant characteristic of signs in AAC that has to be defined and included (Renner, 2004). Renner also maintains that expression of emotional states should be included, but questions the subcategories "skeletal" and "visceral." The question of which expressions of emotional states are relevant for the transition from unintentional to intentional communication has to be readdressed. He argues for a strict separation of characteristics of communication means from individual aspects, which was not achieved by Venkatagiri (2002) or Lloyd and Fuller (1986). There is no evidence that communication via indexes is always unintentional and via icons and symbols always intentional. Research regarding the intentionality of the usage of communication means requires that these aspects are categorized separately (Renner, 2004). The subdivision of icons into transparent and translucent icons and again into gestural, auditory and material categories are not conclusive, since gestural, auditory and material are not subcategories of transparent or translucent icons, but characteristics of icons in general (c.f., Renner, 2004). The same may be argued for the categories "primary" and "secondary."

There are thus different strong arguments for a semiotic orientation (Soto Moratinos, 1992; Soto & Olmstead, 1993; von Tetzchner & Jensen, 1996; von Tetzchner & Martinsen, 2000; Venkatagiri, 2002) as well as for compatibility to common usage (Lloyd & Fuller, 1986; Fuller et al., 1992). However, for scientific purposes the compatibility with the terminology of the related main scientific field (here semiotics) is more important, also with respect to inner logic and theoretical foundation.

For terminological consistency sign aspects like "graphic" or "acoustic" have to be distinguished from the abilities and characteristics of persons like "visual" or "auditory." There are relationships between the characteristics of sign systems and of individuals which are especially important for AAC. For the investigation of these relationships it is necessary to operationalize them and formulate hypotheses within a theoretical framework.

From a structuralistic perspective like the one presented by de Saussure (1986) it is considered basic to establish a terminological and logical definition of language, since the provision of communication means that the functions of language are one of the main goals in AAC. Soto and

Olmstead (1993) use an extremely wide definition, including all means of interpersonal communication as language. They accept even olfactory and gustatory languages. Lloyd and associates (1999) present several definitions without preference for one. There is still not a consistent definition of language based on semiotics and linguistics. There is a consensus about spoken language and sign language, and as a working definition, any sign system with the function of spoken or signed language may be regarded as language.

Semiotics includes semantics as a study of meaning, syntax as the formal structures of signs and combinations of signs (sentences and text), and pragmatics as the use of sign systems. Renner (2004) proposes an approach to terminology where communication means is the main category and the subdivision is oriented at the division of semiotics and linguistics into content aspects (semantics and grammar), pragmatic and form aspects of communication means (Figure 3). The content aspects are subdivided into indexes, sign sets without grammar, and sign systems with grammar. Subcategories of sign systems are language and non-language sign systems. The index term from semiotics (c.f., Soto & Olmstead, 1993; Venkatagiri 2002) is included as this is the distinction between "set" and "system" (Fuller et al., 1992). However, there is an important difference in the definition of "sign system" as set of sign (vocabulary, lexicon), from which complex meanings can be produced by applying a rule system (grammar). Complex meanings are for example meanings that can only be produced in a sentence. Grammar is primarily seen in from a semantic perspective and not from the perspective of rule conformity (c.f., de Saussure, 1986). The rule system for the production of sentences from words is called "syntax," the rule system for the production of specific word meanings from meaning differentiating elements is called "morphology."

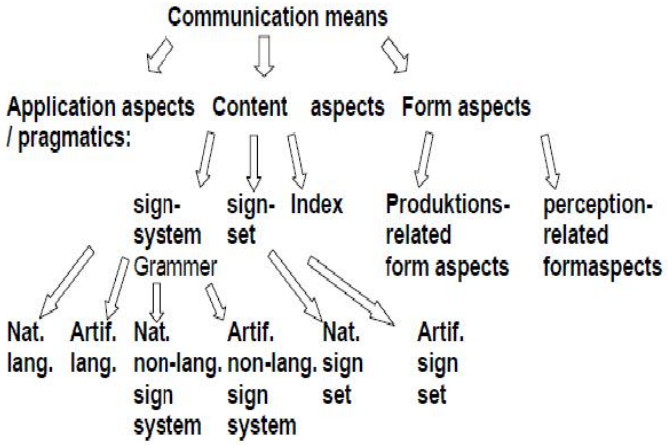

Figure 3. A semiotic taxonomy and category system (from Renner 2004, p. 155, Translation by author).

The distinctions between natural and artificial sign sets, sign systems and languages are not conclusive within the taxonomy, because these are characteristics, not sub-categories as discussed above. However, even if they are not conclusive as taxonomy, they are theoretically important, since artificial communication means may not have the functional scope of natural languages.

Communication means are linked to individual aspects mainly by form aspects and to social aspects mainly by pragmatics in the theoretical frame of Renner (2004). From a theoretical perspective communication means can be seen as included in a broader frame as a means of coordination of collective actions of individuals. There are therefore social functions to be fulfilled by individuals using communication means. Individuals have to be capable to fulfill specific social functions and use communication means.

From de Saussuer's structural perspective, "language" is a system of signs with rules of combination (grammar) to produce meaning. "Linguistics" is the science of languages, while "semiotics" include also non-linguistic sign systems. Explicit criteria for differentiating non-linguistic and linguistic sign systems or languages are not defined, and the question whether or not alternative means of communication like Blissymbolics and other graphic sets or systems are languages remains open for discussion.

Blissymbolics in a Semiotic View. The structuralistic perspective of semiotics shifts the focus from the single sign to entire communication means. In this view Blissymbolics is a communication means with grammatical structures in the sense that regularities allow for the production of complex meanings. Most Blissymbols are truly symbols, while some are icons (Venkatagiri, 2002). Blissymbolics is therefore more powerful than the often used icon sets, but the question is whether it is as powerful as a natural language. A conclusive definition of language based on semiotics and linguistic is an important task that is still not finished. In the meantime, the functions of spoken and signed language can serve as reference. A communication means can be regarded as language if it offers the same functionality. Esperanto is an artificial sign system that may be used to check this working definition, that is, whether Esperanto is a language according to this definition. Esperanto has a comprehensive vocabulary and a grammar that is comparable to natural languages. However, the functional equality is questionable. Since there is a community using Esperanto as their main communication means it may be accepted as an artificial language.

In this respect Blissymbolics is clearly not a language, but due to its grammar it may be considered a sign system. From a semiotic-linguistic perspective, the definition of sign system as a set of rules for the development of new signs is not sufficient (Fuller, Lloyd & Schlosser, 1992). Spoken languages show rule systems on two levels: a) how a large number of spoken words are constructed by a

limited number of phonemes, and b) how sentences are constructed by words. Blissymbolics has this two-level rule system with rules for how words are constructed from a small number of basic visual elements (lines, bows, geometrical shapes) and how sentences are constructed from words. The first consists of a quite elaborated ideographic strategy. A more differentiated semiotic analysis of this ideographic strategy would be an interesting topic of future research. On the other hand, the syntax consists mainly of word order, which is derived from the related spoken language. The consequences of missing other semantic-syntactic grammar features should also be addressed in future research.

The Blissymbolic rules for constructing words (Bliss, 1965) include some basic meanings like "Person" were graphic elements for characteristics (e.g., first, second, third person, and singular and plural) can be added. Also part of this strategy is a comprehensive usage of compound words. Jennische (this volume) uses the semantic field "house" as example, starting with the Bliss icon *HOUSE* and adding specifiers, such as the combination with *BOAT* (also iconic) to construct "boat house." This illustrates how using a limited number of elements with combinatorial rules to create a much larger number of signs is possibly easier to learn.

At this point, semiotic-linguistic interrelations with individual aspects come into scope. The present theoretical framework (Renner, 2004, 2005) includes individual aspects, aspects of communication means and social aspects, and their mutual relationships. The question about the effort needed to learn a specific sign system for different users (with or without cognitive or/and psycholinguistic limitations) concerns the relationship between communication means and individual aspects.

In the language development process children have implicit hypotheses about grammatical regularities, which especially become apparent in mistaken applications of these rules. Search for regularities can be an efficient learning strategy because regularities may save individual learning of a potentially large amount of compound words.

Transparency and translucency research within AAC has mainly addressed single signs. This is adequate only for small vocabularies and single-sign utterances. The structuralistic perspective would broaden the perspective to entire sign systems. For more comprehensive vocabularies like in Blissymbolics, regularities have special importance because they can reduce the learning efforts needed for individuals who can use them. This perspective would suggest research on the teaching and learning processes of sign systems and their functions rather than on single signs. In semiotics, transparency would probably not have the emphasis it has in AAC research, since there is no language that is transparent and no motivation to create a transparent language. De Saussure assumed that only the transition from iconic to arbitrary signs would open the way to language.

Translucency is in contrast of central importance because of its relevance to the learnability of sign systems. Translucency would from this perspective not be limited to single signs but expanded to entire systems, including regularities or rules like in the compound words or the grammar markers in Blissymbolics mentioned above.

As a symbol system Blissymbolics includes a logic of semiotic-linguistic structures that other graphic AAC systems are lacking. These more powerful structures offer learning options to users that they otherwise would not have. Especially important for AAC is the learning efforts needed or the 'learnability' of Blissymbols in comparison to Picture Communication Symbols (PCS), Symbolstix, Minspeak and other graphic communication systems. There are a number of studies about the transparency and iconicity of different AAC tools at the single-sign level. There is a need for research about possible benefits of a grammar for learning new semiotic elements by applying rules.

Beside the learnability of different means of communication the individual characteristics of different user groups are an important area of future research. This may include research about the processes related to learning the meanings of words as well as phrases and sentences, including both teaching and learning processes related to vocabulary items and grammatical structures.

From a sociolinguistic perspective, research should include the question why Blissymbolics was widely used in the early decades of AAC and then decreased significantly in most countries in the last two decades. For example, in Germany Bliss communication boards were common in the early 1980s. In the 1990s, speech output devices became more and more important. Blissymbolics did not offer a speech morphology but there were efforts to develop a Bliss-based speech output device with automatic grammar correction but these attempts failed and devices with user-controlled grammatical features applying a different graphic coding system – an iconic one – took over the market. In order to understand this phenomenon, it is important to realize that the decision makers were often not the users, but their parents. Some users were able ability to use the grammatical features, but many were not. Whether they would have benefited more from Blissymbolics is an empirical question that apparently has been forgotten. From a sociolinguistic perspective an important question might be whether the historic development against Blissymbolics was not or only indirectly due to user-related criteria. From the parents' perspective, speech output devices were preferable compared to communication boards. Speech output devices with incorrect grammar were not convincing at all, even for users with a mean length of utterance (MLU) of one (single sign). Icons on the devices were from the start more convincing than arbitrary graphic signs which might be translucent but not clearly transparent. It was the acceptance by the

parents that defined the success but this acceptance seemed to be based on other factors than the semiotic power of the users' communication means.

The distinction between natural and artificial communication means was part of the classification system. A sociolinguistic question could also address the question if or how an artificial sign system can develop into language. In parallel to Esperanto, this would imply a community using the sign system as their main means of communication. In addition it would be necessary to add generative power in the sense that the community itself will expand the sign system when needed and through this promote its further development.

To sum up: semiotics and linguistics are scientific fields that have a lot to offer for the field of augmentative and alternative communication. Although there have been some contributions evaluating AAC from a semiotic perspective, they have been limited to basic questions of terminology. This is also true for this paper. There are many other and more current semiotic theories that are worth applying to AAC, for example the generative grammar of Noam Chomsky (1968, 2000, 2005), to mention only one. More semiotic-linguistic instruments could help to making in-depth analysis of the communication means used in AAC intervention. From a psycholinguistic perspective, research on second language might give valuable input to AAC.

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Cross-Cultural, Cross-Linguistic Perception of Blissymbols by Korean and English Speakers

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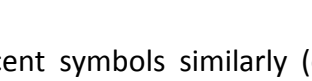
For the purpose of seminar discussion this short paper provides an extended abstract of the methods and an initial report of some of the results from our paper titled "Cross-Cultural, Cross-Linguistic Perception of Blissymbols by Korean and English Speakers" (Chae & Lloyd, under review) submitted for refereed journal publication.

Blissymbolics, a symbol system for augmentative and alternative communication (AAC), is designed to enhance international communication. These symbols are classified into the four categories of "pictographs," "ideographs," "arbitrary" and "international" (Lloyd, Fuller, & Arvidson, 1997). The perception of graphic symbols is a complicated cognitive process resulting in the interpretation of the relationship between the symbol and its referent (Downs & Stea, 1973; Parmentier, 1994). It occurs when the three components, a symbol, its referent, and interpretant which is the comprehension or understanding of someone who perceives a symbol, are dynamically linked. Fristoe and Lloyd (1977, 1979) hypothesized the representation feature of many AAC symbols is a reason why the use of AAC has resulted in improved communication when the traditional methods have failed. Brown (1977, 1978) hypnotized that the iconicity of symbols was culture bound. According to Nisbett and Miyamoto (2005), experience with different social contexts and cultures such as East Asia and North America, leads to both temporary and chronic shifts in perception. It cannot be regarded as consisting of processes that are universal across all people at all times. Also more people become acculturated because of globalization and cultural exchange. Acculturated people are familiar with a new culture yet mostly retain their original culture. For example, in the acculturated home, the native language is preferred, and religious, philosophical, and medical beliefs are kept, although services and networks of individuals from the larger culture and language are explored. At the same time, acculturated families try to adopt the language and values of the larger society.

The purpose of this study is to investigate whether or not there are differences in perceiving 90 randomly selected Blissymbols by students with different cultural backgrounds. The three participant groups included 37 Korean students in Korea (KK), 31 Korean students with more than two years of cultural and English language experience in the United States (KA), and 30 Caucasian-American students in the U.S. (CA). The criteria for the participants in all groups followed those modified from Huer's study (Huer, 2000). All participants were 1) over 20 years

old; 2) free of uncorrected problem, visual or language disorders, or other disabilities; and 3) not familiar with AAC symbol sets. The participants for the KK and CA group had no experience with learning a foreign language in a foreign country for more than six months during grades K-12, and no more than one year of experience living abroad. Additionally, they graduated from high school in Korea or the States, were not bilingual or trilingual, and had parents/caregivers who spoke Korean or English only. The participants for the KA group met the same criteria except for their experience abroad. Materials are made in Korean and English versions through translation and back-translation with Korean and English language professionals. After data collection, several statistical procedures were used to analyze the data according to each research question: proportion, Chi-square (χ^2) test, and ANOVA.

The inter-rater reliability ranged 80-87% and test-retest reliability ranged .24- .78 for the three groups. As a result, there were no differences in rating translucency overall among three groups but nine individual symbols were statistically different (see Table 1). In addition, the three groups chose highest translucent symbols similarly (e.g., ), but lowest translucent symbols differently (see Table 2).

The current findings were similar to Nigam's interpretation (Nigam, 2003) of Huer's study (Huer, 2000). As Nigam (2003) pointed out, the participants with different cultures rated the 90 Blissymbols similarly. Also, the findings from this study were similar to the findings between European-American and African-American groups, and between Hispanic and European groups (Brooks et al., 2002; Garrity, 2009). Furthermore, the findings of this study also confirmed those of Foster and Afzalnia (2005), which suggested that whether or not research demonstrates differences across culture groups, it often depends on the cultural specificity of a particular symbol or referent. The example they provided explains how the image of a British police helmet may represent "police" for British respondents but may suggest "firefighter" to those unfamiliar with this form of headwear. It was unlikely that one could establish a general conclusion that symbol interpretation was culturally limited, since it was likely to depend on the particular symbol. This was similar to the findings of Nigam (2006); namely that some symbols need to be meaningful in their specific culture. Although the group data do not support Brown's hypothesis that iconicity was culture bound, the significant differences found for nine symbols raised enough of a question to warrant further study.

Table 1. Comparisons of nine individual symbols among three groups

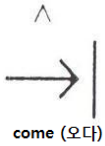
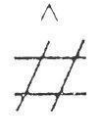
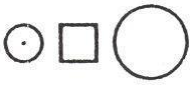
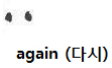
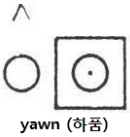
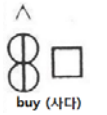
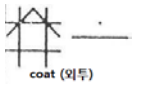
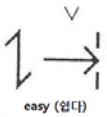
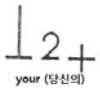
Symbol	*value*	*Df*	*p*
 quit (그만두다)	34.559	12	.001
 basement (지하실)	32.433	12	.001
 ten (열)	24.602	12	.006
 come (오다)	25.456	12	.013
 count (세다)	25.374	12	.013
 circle (동그라미)	24.593	12	.017
 again (다시)	22.804	12	.029
 happy (행복하다)	22.761	12	.030
 yawn (하품)	22.566	12	.032

Table 2. Lowest translucent symbols from the three groups

KK group (n=37)		KA group (n=31)		CA group (n=30)	
Symbol	Proportion (%)	Symbol	Proportion (%)	Symbol	Proportion (%)
	54.1		67.7		65
	51.4		67.7		60
	51.4		64.5		60

The findings from this study could also be discussed in terms of many Blissymbol characteristics. Charles Bliss intended to create the symbol system without a culture bias. In addition, it was a system that operates according to rules (Lloyd et al., 1997). Although Blissymbols were the least iconic of AAC symbols shown in some studies (e.g., Huer, 2000; Mizuko, 1987), no significant differences were found across cultures that examined Blissymbol perception. It implies that the opaque nature of Blissymbols could be generalized regardless of cultural background, disability, or age (Quist et al., 1998). The results shown in this study also might reflect the culture-free or background-free characteristics of many Blissymbols.

Note: This paper is primarily based on a 25-page manuscript under review as of the date of preparation of this paper for a refereed journal titled “Cross-Cultural, Cross Linguistic Perception of Blissymbols by Korean and English Speakers.”

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The Use of Blissymbols as a Tool for Investigating Perceptual and Conceptual Processes

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Blissymbols is a meaning-based symbol system developed by Charles Bliss (1965). It consists of 120 key symbols which are combined to create over 2,000 basic symbols, which have been used by people with communication difficulties over 33 countries. Since 1970s, Blissymbols have been used to aid communication of children with little or no functional speech (McNaughton, 1985). Most of the studies conducted on Blissymbols in the field of AAC have aimed to investigate the nature and usefulness of Blissymbols for intervention with people with severe communication difficulties (Lloyd, Fuller & Arvidson, 1997). Iconicity studies as well as intervention studies have shown the potential as well as challenges in using the system with people with disabilities to facilitate communication and literacy learning (Alant, 2005). The uniqueness of this system in terms of its conceptual basis, generative ability and simplicity has rendered it a topic of interest over multiple decades.

Due to the unique features of Blissymbols, this system also provides researchers with a versatile tool to answer a broader range of research questions that are not primarily related to the use of Blissymbols for communication purposes. These questions could, for example, include investigating perceptual processes by using Blissymbols or investigating the use of specific strategies, for example, the self-generation effect on specific populations. This presentation describes the use of Blissymbols in answering two research questions: A) Whether the self-generation effect enhances the recognition of Blissymbols in people with severe aphasics and B) Whether children's translucency ratings of Blissymbols change over repeated exposures to the same symbols. The extent to which children were able to see more similarities between the Blissymbols and the referents over time was of particular interest. Consequently we will discuss each of these studies in more detail to clarify how Blissymbols were used in each study.

Self-generation Effect and Symbol Recognition in People with Severe Aphasia. This study endeavored to investigate the extent to which the application of the self-generation effect can be viable in facilitating the acquisition and retention of Blissymbols. The self-generated effect refers to the finding of superior retention and recall for stimuli constructed or generated by a healthy adult without disabilities. Although several studies have shown that individuals with severe aphasia can acquire graphic symbol systems, further research is required to identify the best methods to improve acquisition, retention and communicative use of such systems (Koul & Lloyd, 1998).

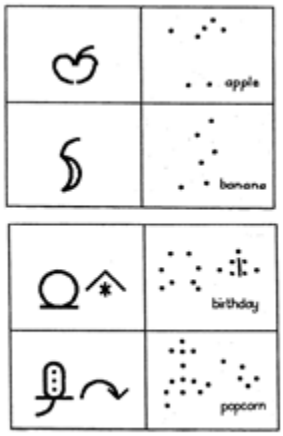

Figure 1. Examples of the self-generation effect

Research has found the self-generation effect to be a robust phenomenon of memory that emerges during free recall and recognition test (Slamecka & Graf, 1978). Different types of generation methods have successfully elicited the self-generation effect such as derivating opposites, synonyms, rhyming words, solving mathematical problems and completing sentences. Other types of stimuli such as pictures, have also elicited the self-generation effect (Kinjo & Snodgras, 2000). In the present study the generation condition involved completing connect-the-dot illustrations. The to-be-recognized Blissymbols were converted into connect-the dot illustrations as used by Peynirciogly (1989). Two sets of Blissymbols were presented to the individuals during three training days; the first set was taught using the self-generation effect (where individuals had to complete the dots in completing the Blissymbol (see Figure 1) and the second set was taught by using paired association between the word and the symbol. Please

refer to Rajaram, Alant and Dada (2012) for more details on the training procedures used as well as the outcomes of the studies.

Children's Translucency Ratings of Blissymbols over Repeated Exposures. Two studies were conducted aimed at the use of Blissymbols in enhancing understanding of how children are able to change their perceptions of Blissymbols over time. The first study (Bornman, Alant & du Preez, 2009) was conducted on typical children, and the second study (Alant, Zheng, Harty & Lloyd, 2013) was made with children with autism spectrum disorders. Here, the focus is on children with autism.

As individuals with autism have been reported to demonstrate superiority in a range of visual search tasks (e.g., see Joseph, Brandon, Connolly, Wolfe & Horowitz, 2009), it might be expected that they would perform particularly well in locating information with a visual display. However, the opposite could also be plausible in that individuals with autism might have more difficulties with visual displays due to their tendency to focus narrowly or in an overly selective fashion on details and not on more global display features (Liss, Saulnier, Fein & Kinsbourne, 2006; Mann & Walker, 2003).

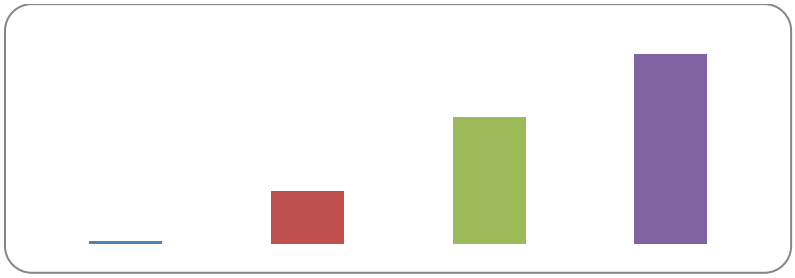

Figure 2. Likert scale used to rate translucency of Blissymbols

Visual cognitive processing may differ in children with autism compared to peers without disabilities. Within this perspective, it might be argued that the use of graphic symbols that are minimalistic in nature (e.g., Blissymbols) rather than more visually complicated or detail-focused (e.g., PCS) could be beneficial in helping children with autism to extract critical features central to the meanings of symbols.

Twenty-two children with autism participated in a Blissymbol translucency task that included 40 symbols. The Blissymbol task was modified from Bornman, Alant, and du Preez (2009) who explored the translucency of Blissymbols with typically developing children. After being trained in the use of the Likert scale, participants were asked to rate the translucency of each Blissymbol by pointing out if the symbol looked, not at all like, a little like, a lot like or exactly like the referent (see Figure 2). This task was presented individually to each participant and repeated over three days. Please see Alant and associates (2013) for more detail on procedures and outcomes of the study.

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Touching Blissymbols

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Charles Bliss developed a symbol system for communication known as Blissymbolics (Bliss, 1949, 1965). His intention for developing Blissymbolics was to produce an easy to learn graphic system that would help unite the world. Blissymbolics did not achieve worldwide popularity and was unsuccessful in uniting the world. However, in 1971, an interdisciplinary team of educators led by Shirley McNaughton working on improving communication in children with severe physical disabilities and little or no functional speech became aware of Blissymbols and successfully used them with their children for communicative purposes (McNaughton & Kate, 1974; Kates & McNaughton, 1975; McNaughton, 1977). Subsequently, the team formed what is now known as Blissymbolics Communication International (BCI) for the purposes of advancing the use of Blissymbolic for individuals with little or no functional speech. Blissymbolics have been used with other disabilities such as aphasia (Koul & Lloyd, 1998; Sawyer-Woods, 1987), intellectual disability (Mizuko & Reichle, 1989; Nail-Chiwetalu, 1992; Song, 1979) and multiple impairments (Elder & Bergman, 1978).

Blissymbolics is a graphic or visually based symbol system. Fuller and Lloyd (1987) used a graphic based measure known as strokes to quantify the complexity of Blissymbols. Isaacson and Lloyd (2009, 2012) used strokes to compare the complexity of Blissymbols to the complexity of Picture Communication Symbols (PCS). Based on the number of strokes, Blissymbols can be classified as minimalistic because they are substantially less complex than PCS. Moreover, the minimalistic quality of Blissymbols is readily apparent in their two dimensional stick-like figures and line renderings. Tactile processing is believed to be a sequential or serial process (Logan, 2002) that is optimized when superfluous information is minimized (Edman, 1992; TAEVIS, 2002). As a result of their minimalism, Blissymbols may have the potential for being readily processed through tactile means and being developed into a tactile communication system.

The first step in determining if Blissymbols have such potential is to test whether the core Blissymbols (a.k.a., simple Blissymbols or elements) can accurately be discriminated from each other, as was done in Isaacson (2012) in which raised-line renderings on paper of core Blissymbols were tested for tactile discrimination. A criterion of at least 90 percent correct tactile discrimination was established as a benchmark for determining whether or not a core symbol had the potential for

being a tactile symbol. Tactile discrimination data shows that a predominant number of core Blissymbols met the benchmark, thereby demonstrating the potential of Blissymbolics for being developed into a tactile communication system. Although a predominant number of Blissymbols were correctly discerned from each other through touch, there were a few core symbols that were statistical outliers. These outliers will need to be more closely examined and modified to improve their tactile discernibility. Future steps for developing a tactile communication system based on Blissymbolics include possible ways to improve the tactile processing of outliers and other symbols, and the use of tactile symbols in communication aids with speech output to facilitate communication with people who are not trained or acquainted with Blissymbolics.

Tangible symbols, such as real and miniature objects, are frequently used tactile communication forms (Mirenda & Locke, 1989; Rowland & Schweigert, 1989, 2000; Vanderheiden & Lloyd, 1986). These types of symbols, however, have many short comings, including being bulky and conspicuousness, qualities which are not conducive to integration into communication aids with speech output. Tactile renderings on paper of Blissymbols are less bulky and conspicuous than real and miniature objects, and have the potential for use in communication devices with speech output. They may be a more beneficial technique for tactile communication than tangible symbols.

Acknowledgement

The above paper summarizes the seminar presentation based on the doctoral dissertation of Isaacson (2012). A manuscript (Isaacson & Lloyd, n.d.) is currently in preparation for publication.

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Language Use with Blissymbolics

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Research has shown that utterances produced by users of graphic systems tend to be short (1–2 words) and grammatically incomplete. They often contain few grammatical markers and have unusual word orders (Binger & Light, 2008). This was only partly true for the participants in this study, who tended to use utterances consisting of 4–6 words and had some grammatical markers, and only rarely unusual word order. The use of telegraphic messages may be considered a way of making communication more efficient, particularly within a context of message co-construction (Smith, 1996). This may apply to some extent to the participants in this study, who despite their relatively long utterances often did not use the grammatical markers available to them.

Sutton, Morford and Gallagher (2004) suggest that utterances produced with a graphic system might depend on what graphic symbols are included and how they are organized in the display. They found that grammatical markers tended to be eliminated to make room for content words when the available space was restricted. The participants in this study all used the software Mind Express in their voice output communication aid (VOCA) and had access to some, if not all, of the grammatical markers available in that system. This provided them with means of using the past and present tense, plural forms of nouns and conjugation of adjectives. Since they had the same graphic symbols in their VOCAs as in their low-tech Bliss boards, they had access to all the prepositions, pronouns, conjunctions and other functions that as a standard are available in Bliss boards. This includes functions like “same as,” “almost same as” and “opposite of” that can be used to expand a limited vocabulary.

Bryen (2008) found that many graphic systems lack the vocabulary to support valued adult roles, such as students, workers, friends, partners, citizens and parents. Research by Todman and Alm (2003) has shown that resources for phrase creation in VOCAs can successfully be complemented with pre-prepared, pragmatically relevant phrases, which can give the users opportunity to maintain the flow of conversations, share in control, stay in touch and provide effective repair. A similar approach was used in the present study, where pre-stored phrases for small talk and for a specific activity were added to the participants’ existing systems.

Features that were lacking in the participants’ Bliss vocabularies, but which were included among the pre-stored phrases that they got as supplements, were words and expressions that could be used for starting and ending conversations, for turn taking, and as evaluation and

feedback. These items were only rarely used by the participants. The pre-stored expressions that they did use functioned as greetings, acknowledgements and answers to *yes/no* questions, functions they could already express with their Bliss vocabularies.

The present study describes three young adults with cerebral palsy who used VOCAs with Blissymbolics took part in a study where their use of VOCAs in different activities were video-recorded and analysed (Rydeman, 2010). The activities included semi-structured interviews, conversations with friends, shopping and role-play shopping.

Participants. The participants in this study all had severe speech and motor impairments due to cerebral palsy. Lisa was 18 years old at the start of the study, John was 22 and Peter was 19 years old. Lisa used her hands to access a VOCA with touch screen, while John and Peter both used a head mouse.

As most users of Blissymbolics, the three young adults had started with low-tech communication boards where they relied on communication partners to formulate the messages they were constructing (Falkman, Sandberg & Hjelmquist, 2002). When the Bliss boards were moved to VOCAs, they were given a taxonomic organization (Light & Drager, 2007) which was based on the layout of the low-tech Bliss boards. All three participants used their low-tech Bliss boards as well.

Expressions Constructed with VOCA. The three participants were interviewed about their shopping habits on two occasions – at the beginning and end of the study, 1½ years apart. They were asked the same open-ended questions, which they had to answer using their VOCAs. Analyses of the expressions they constructed revealed that the participants used longer utterances and more advanced grammar during the second interview, despite the fact that these skills were not targeted during the study. There was a striking difference in utterance length, as can be seen in Figure 1. The number of utterances with seven words or more that were expressed by John, Peter and Lisa, had increased from 2, 4 and 2 in the first interview to 8, 14 and 14 in the second. There was also an increase in the use of utterances with 4–6 words, as well as a decrease in the use of utterances with 1–3 words for all participants.

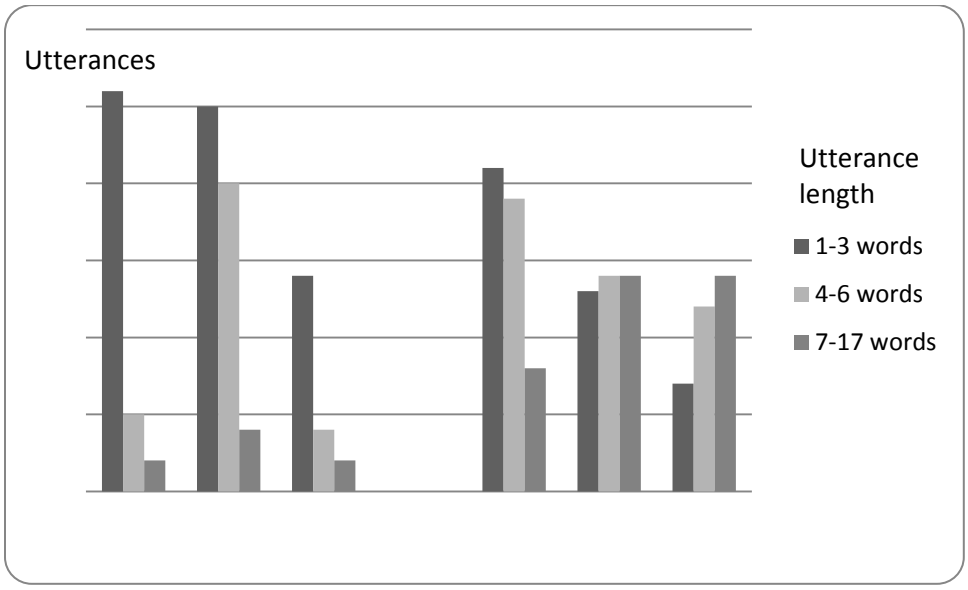

Figure 1. Number of utterances with different utterance length, used during the first and second interviews about shopping habits by three young adults who used VOCAs with Blissymbolics. The mean number of words per utterance had increased for all three participants, from 2.6 to 4.4 for John, from 3.7 to 5 for Peter and from 3.6 to 6.2 for Lisa.

In addition to increases in utterance length, there were also changes in use of grammar. During the first interview, John used a personal pronoun 11 times, predominately *jag* (I), *du* (you) and *mig* (me). During the second interview he used personal pronouns 35 times. In the first interview, John used the prepositions *till* (to), *från* (from) and *på* (on) one time each. In the second interview, he also used the prepositions *i* (in), *med* (with) and *efter* (after), and all in all he used a preposition 15 times. Another change was that John had started to use the past tense, interchangeably with the present tense, but it was not used at all before. During the first interview John used the phrase *Jag inte tycker om går kläder affär* (I not like go clothes shop), with the negation in the wrong position (Swedish). During the second interview he said the same thing, but more correctly: *Jag tycker inte om går kläder affär* (I like not go clothes shop). He also used another negated phrase where the negation was placed correctly.

Peter's and Lisa's language use showed similar developments as John's. Peter increased his use of pronouns from 8 to 28, Lisa from 8 to 31. Peter increased his use of prepositions from 9 to 17, Lisa from 5 to 17. Peter increased his use of the word *som* (as) from 1 to 6, and Lisa increased

her use of the word *att* (to or that) from one to ten times. John and Lisa also showed an increase in total number of utterances, which may account for part of the increase in the number of pronouns and prepositions, but not all of them. John produced 33 utterances in the first interview and 48 in the second. Lisa increased from 20 to 37 utterances, while Peter produced fewer utterances in the second interview, a reduction from 49 to 41. However, the mean length of utterance (in words) increased for all three participants, from 2.6 to 4.4 for John, from 3.7 to 5.0 for Peter and from 3.6 to 6.2 for Lisa.

The pre-stored phrases that the participants were given in the study were not used to the extent that had been expected. They had phrases for shop talk, as well as for small talk, that could be used in many activities. When the participants did use the new pre-stored phrases, they tended to use them only for functions they already had the necessary means for in their Blissymbolics vocabularies.

Discussion. There are several reasons why the participants used more advanced language in the interview at the end of the study, 1½ years after the first. One reason might be that interviewer and the participants knew each other better. A more plausible reason is that the participants had started to use their VOCAs more, and also taken an increased responsibility for their language production. With the low-tech Bliss boards it is the communication partner who says the words, often adding inflections that are not present in the Blissymbol utterance. A VOCA says what the user has selected or written, and with the software Mind Express that all three participants used, it was possible to construct grammatically correct sentences through the specification of grammatical markers, such as past tense or plural.

Some features in Mind Express can be set to work automatically, for example so that a verb selected after an auxiliary always takes on a specific verb form, or the selection of a plural marker before a noun makes the gloss on the Blissymbol appear in plural. It may not only have been the way the participants used the software that had changed from the first to the second interview, because the prerequisites for constructing grammatically correct sentences with Blissymbols had to be in the software, and during the first interview Peter and John still lacked a number of grammatical functions that were included later.

When Lisa took part in the first interview, her communication software had recently been modified and she did not yet know how to get around in it and did not use it very often. She had for a long time been keen to express herself grammatically correct, even if that meant that it took longer time for her to construct her utterances. With increased use of her VOCA, she had become both better and faster at it. John regularly met with a speech-language therapist, and

presumably they worked on his language skills. It is also possible that by taking part in the study, the participants became more aware of the way they expressed themselves, even if the construction of sentences word by word had not been focused on.

The three young adults in this study had all developed grown up with Blissymbolics and were used to construct utterances one Blissymbol after the other with their low-tech communication boards. On these boards all the content was visible at the same time, a feature that facilitates the creation of sequences. This, in combination with the specific features of Blissymbolics, might be an important reason why the three participants used longer expressions and more grammatical features than reported in most other studies of individuals who use VOCAs with graphic systems.

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Access to Blissymbolics with Information and Communication Technology – State of the Art and Visions

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Blissymbolics is, unlike most other graphic communication systems, well suited for use on all technology levels, from no-tech, over low-tech, to current high-tech information and communication technology (ICT) platforms. Blissymbols may be drawn by hand, in the sand, with paper and pen, or on a blackboard or whiteboard. In current practice one is however, as one is for all other graphic symbol resources, heavily dependent on ICT support for practically managing and using Blissymbolics. It may be for setting up and printing symbol charts for low-tech use, or for writing documents or communicating remotely via email and on computers and mobile devices. This presentation gives an overview of the availability of Blissymbolics on ICT platforms in 2012, and some hints about what one can expect for the near future.

Background. Blissymbolics was probably the first graphic system to be supported on the emerging computer platforms in the early 1980s. Talking BlissApple was one of the first computer programs developed for Apple II computers by Gregg Vanderheiden and his colleagues at Trace R&D Center, Madison Wisconsin, USA. It was a breakthrough and was followed by a large number of Blissymbol programs for different computing platforms over the next decades. However, when the real expansion of AAC technology came, with a number of commercially promoted pictorial systems such as PCS, Blissymbolics in general was not supported on the dominating AAC software and hardware platforms. One contributing reason for this was probably that Blissymbolics Communication International (BCI) was focusing on support for Bliss in font technology, i.e., as character sets for writing with Bliss in standard text environments. Though this was visionary, it was also ahead of its time. The font technology at that time was poorly standardised, and not really suitable to support a semantic writing system such as Blissymbolics. This also resulted in part because the Bliss community, particularly in North America and other English-speaking countries where the dominating development of AAC technology took place, pursued a separate track from the main AAC development that relied on graphic images. It became increasingly difficult to find reasonably good support for Blissymbolics on the major AAC platforms. A large number of locally developed dedicated Blissymbol programs came and disappeared. Only a couple of them survived, largely by widening their scope to other symbol systems, for example, “Bliss for Windows” became “Symbols for Windows” and “Mind Express,” which still support Bliss reasonably well. Since 2007 BCI has worked hard to establish a complete and continuously maintained web-based Blissymbol vocabulary resource. Clear

licensing conditions for both free and proprietary commercial use have also been established. This has so far helped to support Blissymbol users indirectly via more software developers who are now offering a Blissymbol option for an increasing number of AAC products (such as Widgit products, Sensory Software's The Grid 2, TalkingTiles app, BlissOnline, CCF-SymbolWriter for LibreOffice/OpenOffice (see below).

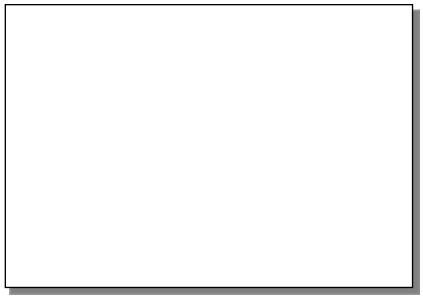
BCI will, in parallel with the graphic Bliss resources, be ready to take up ambitions to establish a Blissymbol font in the Unicode standard, an idea that has been slumbering for many years. This will offer a suitable platform for semantic writing of Bliss-words based on semantically defined and encoded Bliss characters. This may mean a major step forward to making Blissymbolics more widely available and useful, for AAC use but also for language learning and language play for many more.

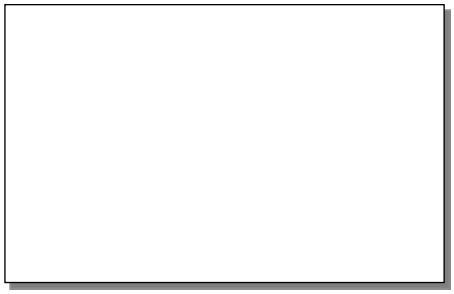
Below follows a rather comprehensive, but definitely not complete, compilation of available Blissymbol resources.

Bliss on the Internet. BCI – Blissymbolics Communication International (www.blissymbolics.org) contains news, information, Blissymbol vocabulary resources, educational resources, an international community network, and more. Related links are:

Vocabulary Resources: (www.symbolnet.org/bliss/blissymbol_resources.html)

Blissymbolics Language Education: Online Nexus (http://blissymbolics.org/moodle/)

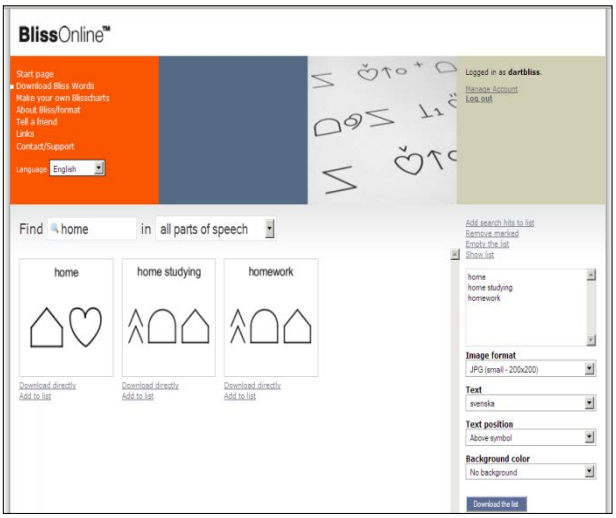




BCIC – Blissymbolics Communication Institute Canada (www.blissymbolics.ca). There is also a temporary site (2012) with interesting material (www.blissymbolics.ca/2012/).

BlissOnline (www.blissonline.se) has an online Blissymbol vocabulary, lexicon and chart resources and services. It is maintained by the national Swedish educational authority SPSM (Specialpedagogiska skolmyndigheten).

Symbols.Net – Blissymbolics Resources (www.symbols.net/blissymbolics/) is not primarily intended for augmentative and alternative communication, but has valuable resources also for this use.

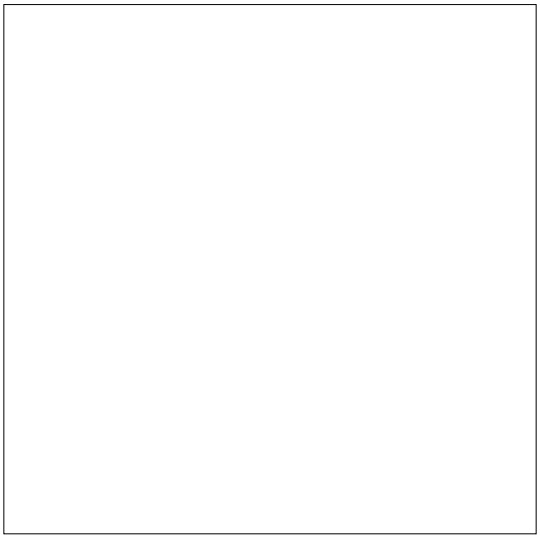


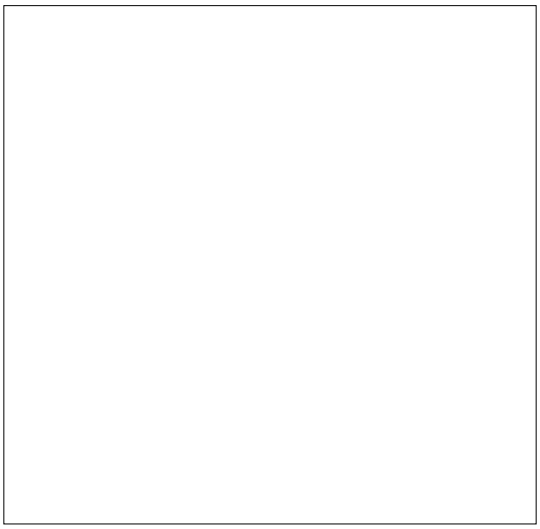
There are several relevant web resources, in English and other languages, which also contain links to other resources.

- Specialpedagogisk skolmyndigheten (www.spsm.se) have material for teaching material in Bliss. It is a general site where one should search for “Bliss” (Swedish).
- Blissbulletinen (www.blissbulletinen.se) is a newsletter about Bliss (Swedish).

  DART (www.dart-gbg.org) contains suggestions and material, including Bliss boards and information about courses (Swedish).
- The Blisspost project (www.blisspost.org) gives information about a project to make Bliss available as electronic mail. The project is finished and the site contains a report that can be downloaded as a pdf (Swedish).
- ISAAC Norge (www.isaac.no/) has information about Blissymbols (Norwegian)
- Papunet (www.papunet.net) contains information about different manual and graphic systems (Finnish, Swedish, and some English information).

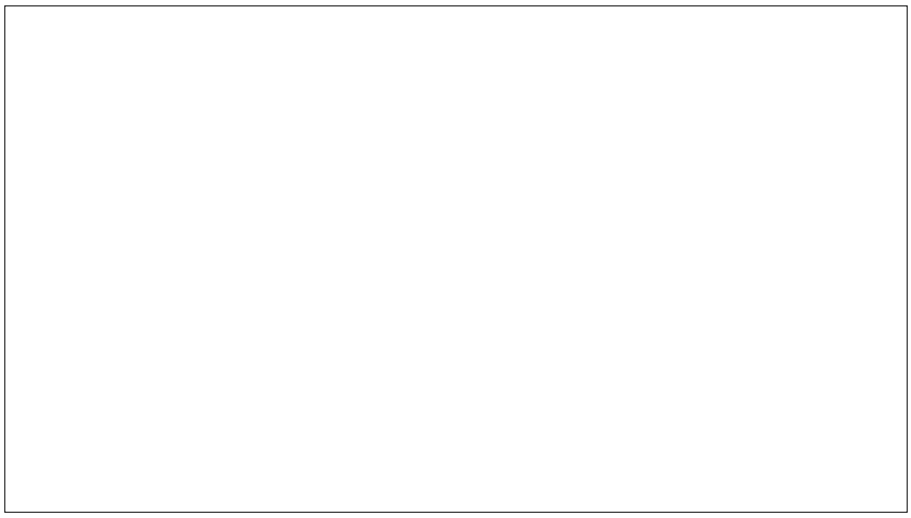
- NavigAbile (www.navigabile.it) contains information about different types of assistive technology (Italian).



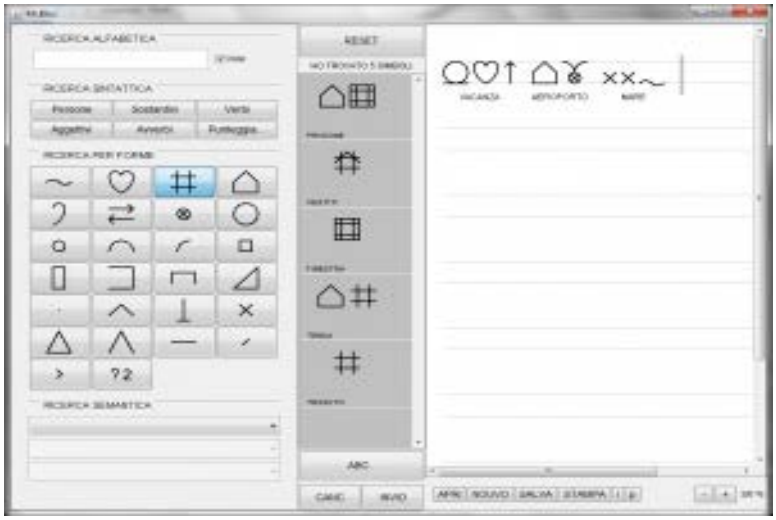


There are Blissymbolics groups on Facebook, such as the Blissymbolics Language support group (www.facebook.com/find-friends/#!/group.php?gid=50871545809) and the Meeting place for Bliss (Mötesplats Bliss) (in Swedish) www.facebook.com/find-friends/#!/group.php?gid=113376055260.

Software. There several computer programs that have specific support for Bliss. The Symbol for Windows series (www.handicom.nl) is a comprehensive AAC package with a fairly well updated Blissymbol vocabulary, and special features for Bliss support.

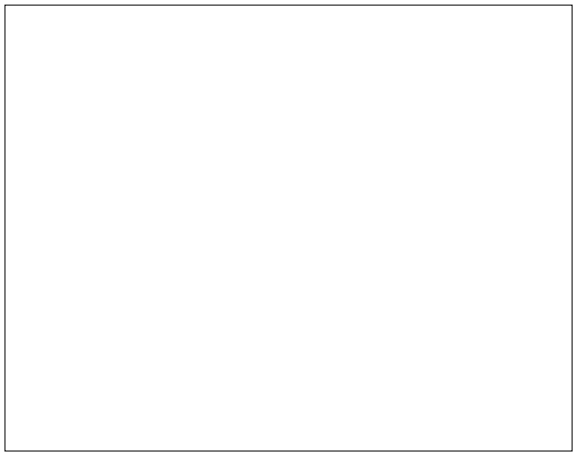


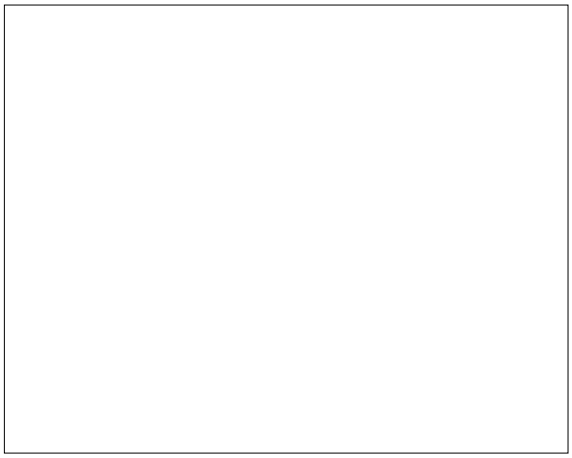
Mind Express (www.jabbla.com) includes Blissymbolics support but with hardly any information provided. The vocabulary is fairly updated, and there is an editor for making new symbols and some other tools. Information about the program may also be found at (www.rehabcenter.se/produktblad/mindexpress.htm).



MisterBLISS (www.misterbliss.it) is a web-based or locally installed cross-platform dedicated Bliss software package (Italian). The Grid 2 (www.sensorysoftware.com) has a well updated Bliss library and Bliss set-ups are available for the GridPlayer iOS app, though Bliss only supported via external Bliss libraries. Blissymbolics may be found at www.sensorysoftware.com/112.html.

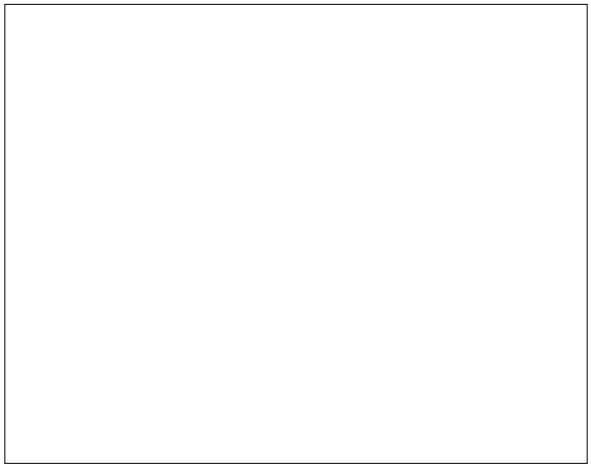
SymWriter which is made by Widgit software (http://www.widgit.com) has recently updated been updated with Blissymbol library support. However, at this time it is mainly available in Swedish (http://www.hargdata.se/p_se_bliss.htm).

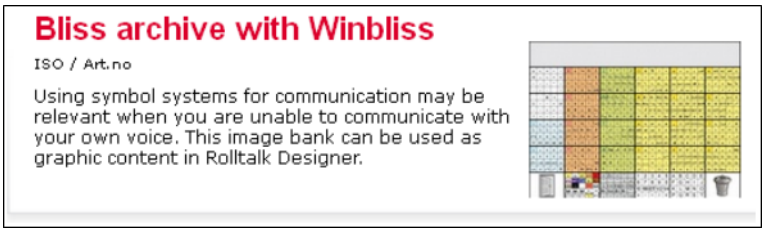




Speaking Dynamically Pro and BoardMaker by Mayer-Johnson (www.mayer-johnson.com/boardmaker-software/) has an older Blissymbol library of 3000 symbols (in English), which may be found at www.mayer-johnson.com/blissymbols.

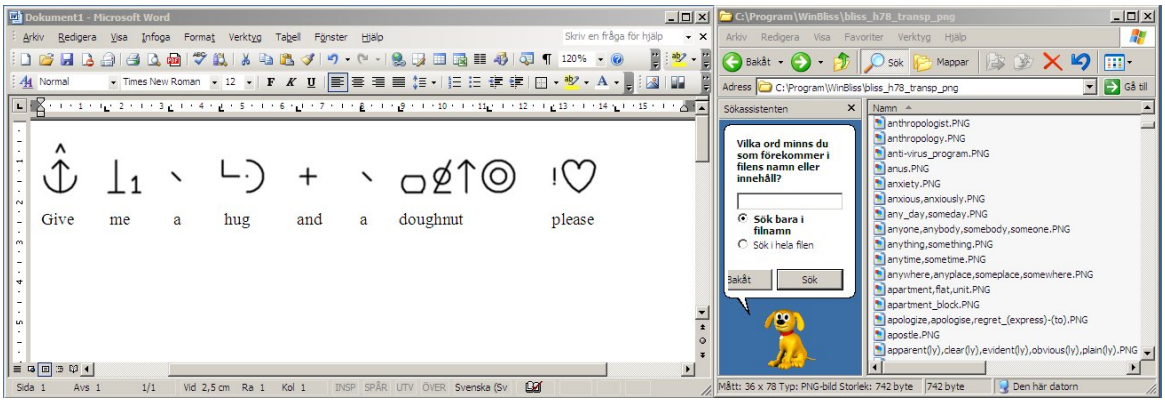
Rolltalk Designer by Abilia (www.abilia.org.uk/ and http://abilia.no/) has a partial Blissymbol library and set-ups (Winbliss), and Blissymbols are commonly used with this program. Search for “Bliss” on the home pages.





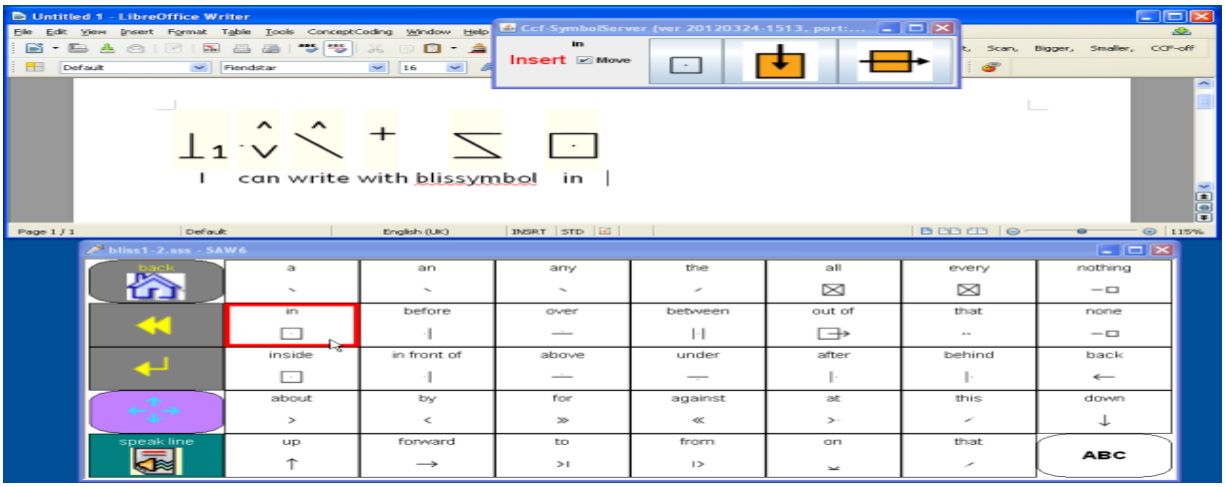
Several companies have announced that they will include complete Blissymbol libraries in their programs, including the Tobii Communicator and Rolltalk Workshop.

Using Blissymbols in Standard Software. Blissymbols can be inserted relatively easily into standard documents formats using office software together with a symbol graphic file library obtained from BCI. This includes MS Word or OO/LO Writer + folder with Blissymbol PNG files, which may drag and drop symbol files from the file folder into documents. One should use the file search to find words included in the file name gloss and use centred tabs in the office document to align symbols and words in a two text lines approach. Word, Writer and others may also be used together with the clipboard export functionalities of WinBliss or Symbol for Windows (see below).

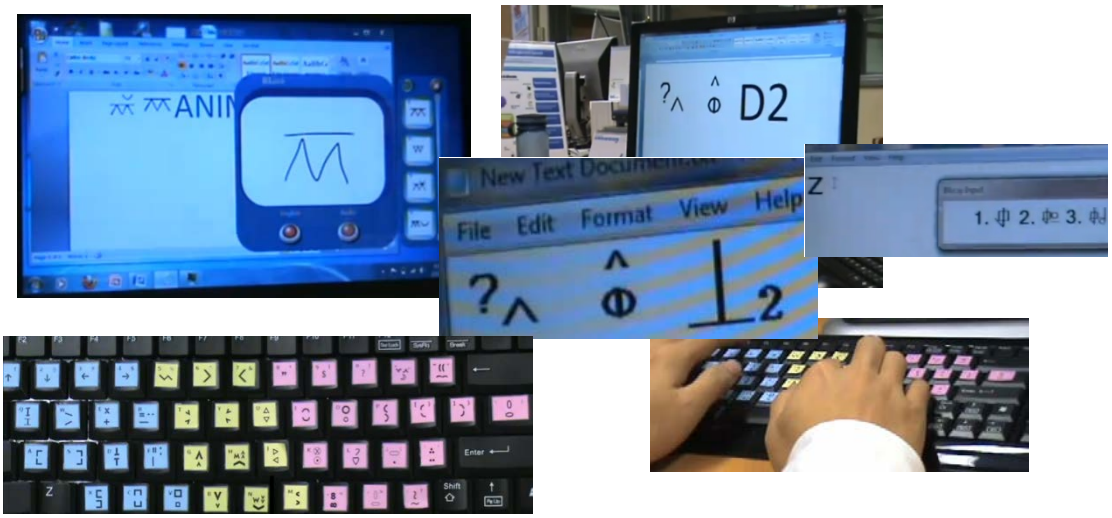


Blissymbol support in LibreOffice and OpenOffice Writer is offered via the CCF Symbol/Writer extensin developed in the European AEGIS (http://www.aegis-project.eu/). The extension communicates with a CCF SymbolServer which matches words to a database of concepts with Blissymbol representations (and currently also ARASAAC symbols). This software is still in development, but can be obtained in a preliminary version via www.conceptcoding.org. The image below shows LibreOffice Writer with the CCF-SymbolWriter extension and the CCF-SymbolServer, together with an on-screen-keyboard Blissymbol input set-up in SAW 6 (Special Access to Windows) – producing text with Blissymbols in the Writer document.

SAW 6 and Blissymbol selection sets in English and Swedish are available from www.oatsoft.org/Software/SpecialAccessToWindows and www.oatsoft.org/Software/saw-resources/downloads.

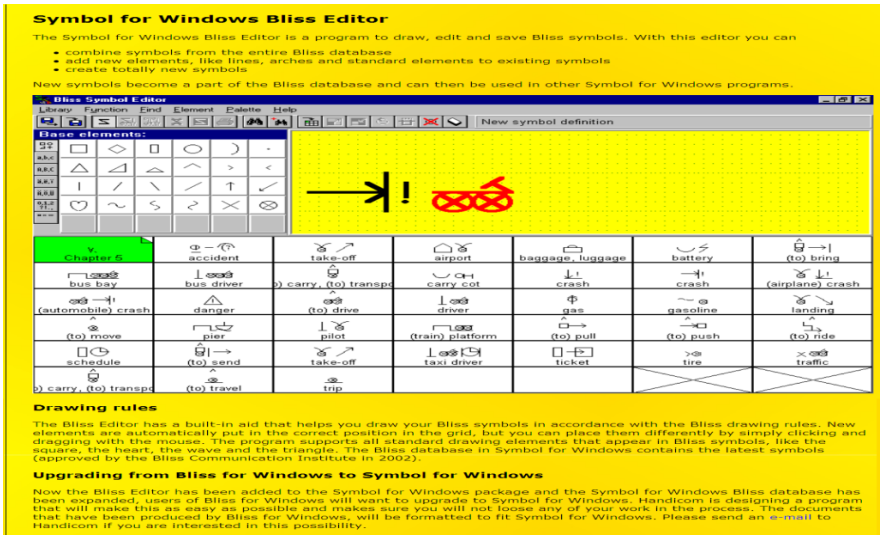


Another project is a student prototype development and has an uncertain future, but represents important evidence for the need and applicability of future Blissymbol font implementations. Blink (BlissInk) is a new Blissymbol software developed at the Nanyang Polytechnic School in Singapore.

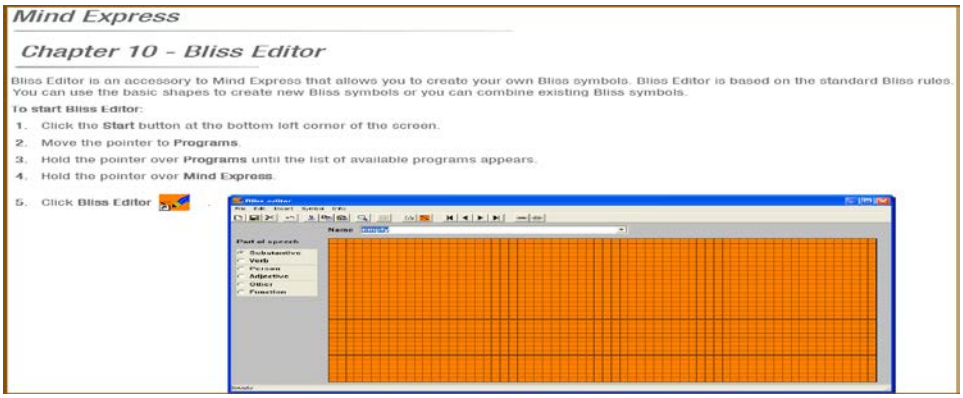


Software for maintaining the Bliss vocabulary is important. WinBliss (www.anycom.se) is currently the main tool for BCI to maintain the BCI Authorized Vocabulary (BCI-AV) resources.

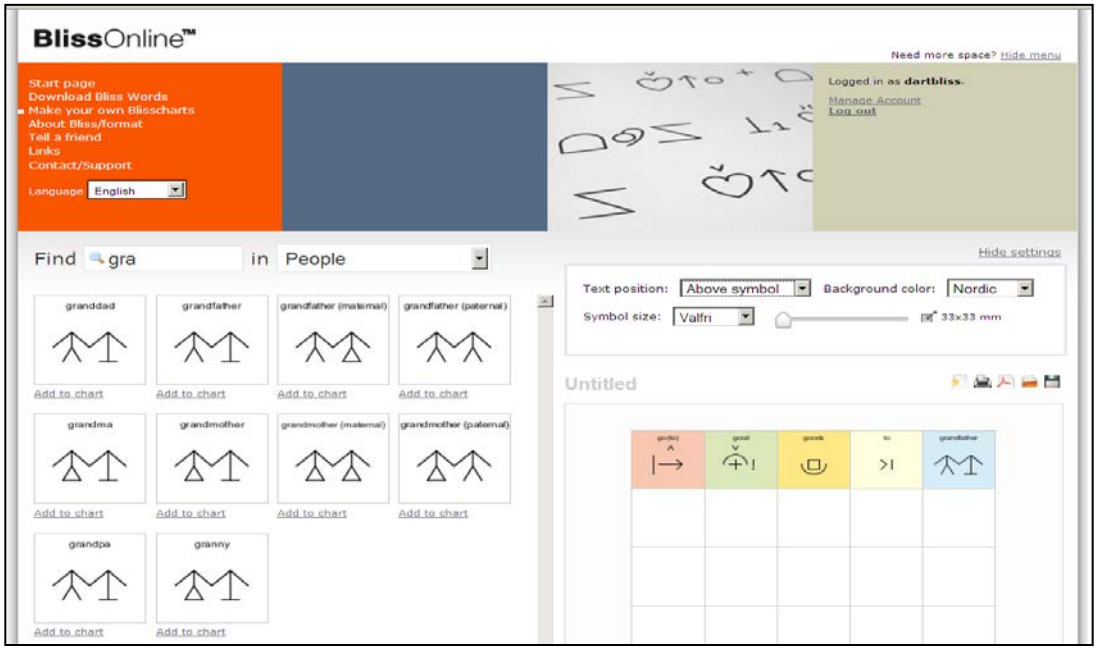
Symbol for Windows (www.handicom.nl) comprises a Bliss editor and an export program, which are suitable for vocabulary maintenance both internally, within the SfW program family, and for external export. Paper Chart Maker is a commonly used tool for maintenance of Blissymbol paper charts.



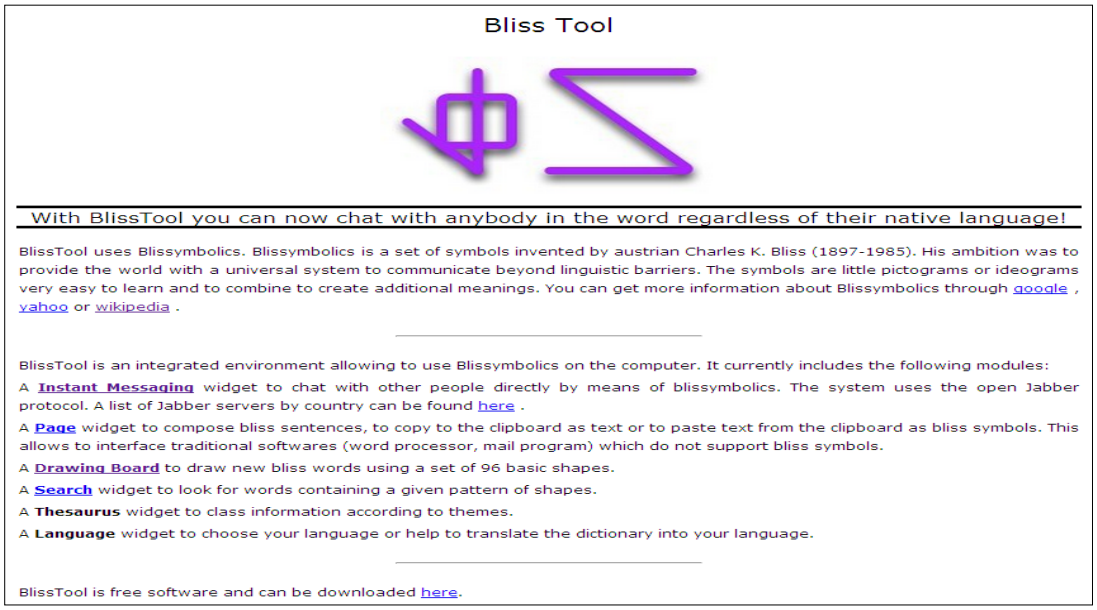
MindExpress (www.jabbla.com and www.rehabcenter.se) has a Bliss Editor.



BlissOnline (www.blissonline.se) is supported by powerful back-office editors and tools used internally by SPSM for maintenance of BlissOnline content, and as production tools for other SPSM Blissymbol products. Unfortunately these are not publicly available at this time.



BlissTool (http://jfbouzereau.free.fr/BLISS/bliss0.html) is a free and open-source Java based non-AAC editing tool for Blissymbols, but unfortunately not quite suited for the main vocabulary maintenance needs of BCI and most AAC Bliss users.



Bliss Tool

With BlissTool you can now chat with anybody in the word regardless of their native language!

BlissTool uses Blissymbolics. Blissymbolics is a set of symbols invented by austrian Charles K. Bliss (1897-1985). His ambition was to provide the world with a universal system to communicate beyond linguistic barriers. The symbols are little pictograms or ideograms very easy to learn and to combine to create additional meanings. You can get more information about Blissymbolics through google , yahoo or wikipedia .

BlissTool is an integrated environment allowing to use Blissymbolics on the computer. It currently includes the following modules:

A **Instant Messaging** widget to chat with other people directly by means of blissymbolics. The system uses the open Jabber protocol. A list of Jabber servers by country can be found here .

A **Page** widget to compose bliss sentences, to copy to the clipboard as text or to paste text from the clipboard as bliss symbols. This allows to interface traditional softwares (word processor, mail program) which do not support bliss symbols.

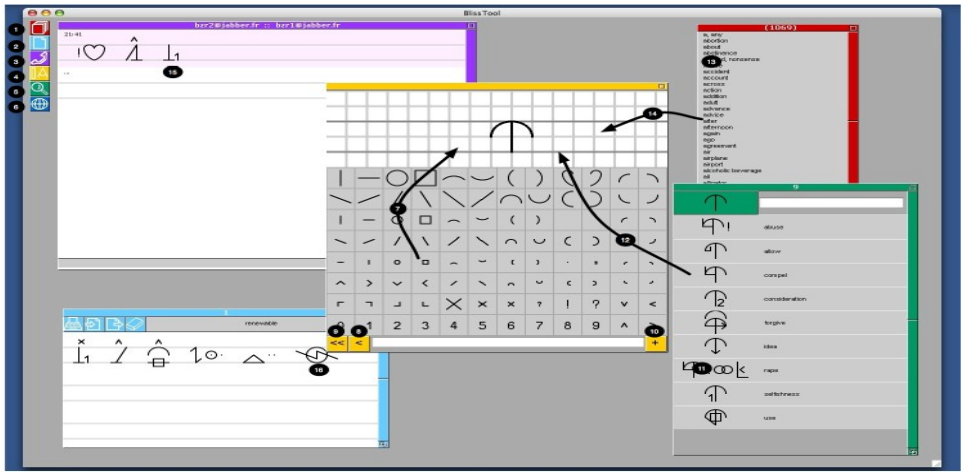
A **Drawing Board** to draw new bliss words using a set of 96 basic shapes.

A **Search** widget to look for words containing a given pattern of shapes.

A **Thesaurus** widget to class information according to themes.

A **Language** widget to choose your language or help to translate the dictionary into your language.

BlissTool is free software and can be downloaded here.



. **Bliss Font Technology.** Several character fonts have been developed for Blissymbolics. The Bliss Template font was developed for BCI documentation and for the (now no longer supported) BlissInternet software developed by BCI.

Other Blissymbol fonts have been, and are still, available via George Sutton's Symbols.net – Blissymbolics resources at www.symbols.net/zips/. One is for example used in the Bliss-Dasher project which is organized by David McKay and Annalu Waller – www.inference.phy.cam.ac.uk/dasher/development/bliss/

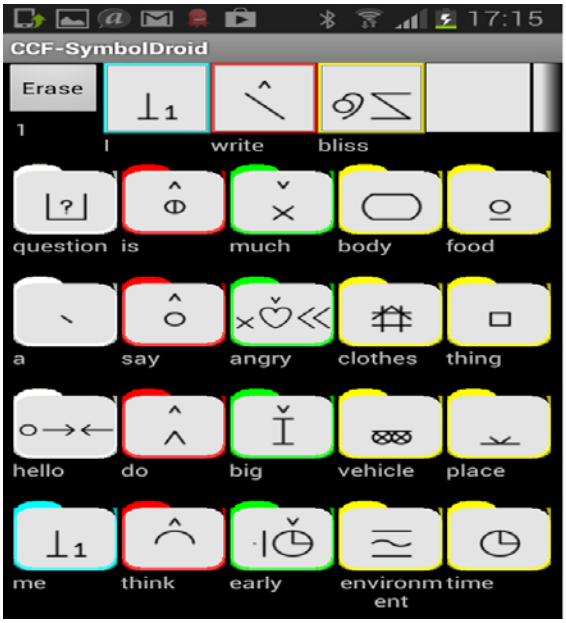
The latest font for Bliss is the one developed in the Unicode private area for the ConceptCoding Framework (CCF) applications in the AEGIS project (see above). This font is a temporary non-standard whole Bliss-word font solution allowing Blissymbols to be displayed in the standard Ruby Annotation format in Open Document Text documents aligned above the words of the written text (available via downloads at www.conceptcoding.org).

Michael Everson's draft proposal for a Bliss character encoding in Unicode since 1998, and which is now again being addressed as a current major task for BCI, can be found at: http://std.dkuug.dk/jtc1/sc2/wg2/docs/n1866.pdf. It is proposed that the encoding for Blissymbolics in the Unicode standard be ideographic, in resemblance to Chinese. Blissymbol characters combine with one another into Bliss-words, with a small set of super-imposed characters which serve to give verbs tense, identify plurals, and to differentiate nouns from verbs and adjectives.

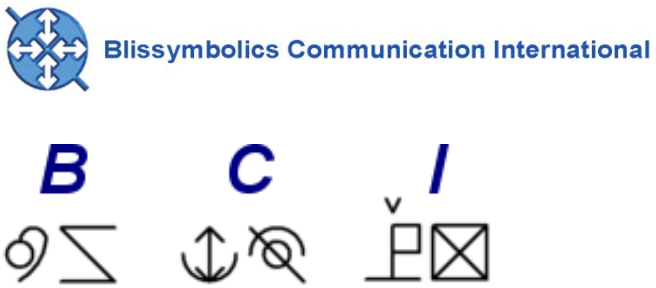
Bliss on the Mobile – Smart Phones, Touch Pads, etc. Blissymbolics is gradually being supported on more mobile apps for both iOS and Android. iBlissymbols for iPhone, iPod Touch, iPad (www.q-s.pl/iblissymbols/) was the first and is still the only dedicated Blissymbol app. It provides a fairly recent Bliss lexicon, which is supported in several languages to different degrees (English, Polish, Swedish, Norwegian, Finnish and Russian). However, many essential preconditions for a fully functional AAC app are lacking.

TalkingTILES (http://mozzaz.com/index.php/products/talkingtiles) is a touch-based AAC application that runs on all major mobile platforms and on any computer. A Blissymbol library is supported, among several other symbol libraries.

The CCF-SymbolDroid app for Android devices is supported by the AEGIS project and provides support for Blissymbolics and ARASAAC pictogram symbols. A preliminary version available via downloads at www.conceptcoding.org.



Conditions for Using Bliss. There are licences and conditions for usage of Blissymbolics. The Blissymbol vocabulary is available and may be used and distributed freely provided it is for personal and personal and local use. It may be downloaded from BCI, used and re-distributed as part of free resources under a free "copyleft" licence – Creative Commons-BY-SA. It may be downloaded from BCI and re-distributed in as part of proprietary non-free products under a traditional license agreement with BCI.



For details see "Licensing Conditions for Blissymbolics" on www.blissymbolics.org.

An Incomplete List of Research and Development about or involving Blissymbolics

Abrahamsson, L. & Ljung, I.-K. (2008). Bliss *i interaktion* (Bliss in interaction)." Masters theses, Uppsala University, Sweden.

Cabello, F. & Leal, M.C. (2010, July). Actualización y traducción de los símbolos del sistema Bliss en español [Updating and translating Blyssymbols in Spanish]. Paper presented at the 2010 AELFA Conference, Valladolid, Spain.

du Preez, A. E. & Bornman, J. (2006). Translucency ratings of Blissymbols. Manuscript, University of Pretoria.

Everson, M. Blissymbols Unicode Font http://www.evertype.com/standards/iso10646/ bmp-roadmap.html and http://www.evertype.com/standards/iso15924.

MacKay, D., Wills, S.& Waller, A. (2007). Bliss-Dasher efficient semantic writing with any muscle http://www.inference.phy.cam.ac.uk/dasher/development/bliss/-abi/Bliss Dasher.pdf.

Olaszi, P. Koutny, I. & Sophia L. Kálmán (2002. From Bliss symbols to grammatically correct voice output: A communication tool for people with disabilities. *Interna-tional Journal of Speech Technology, 5,* 49–56.

Sándor, N., Várady, G., Szalmás, A., Sik-Lányi, C. & Kálmán, S. (2002). Electronic usage of BLISS. *Proceedings of the 4th International Conference of Disability, Virtual Reality and Associated Technology, Veszprém, Hungary.* May be down-loaded from: http://www.icdvrat.rdg.ac.uk/2002/papers/2002_05.pdf.

The AEGIS project (www.aegis-project.eu).

The Concept Coding Framework (www.conceptcoding.org).

The SYMBERED project (www.symbolnet.org).

The WWAAC project (www.wwaac.eu).

von Tetzchner, S., Almeida, M. A., Balandin, S., Basil, C., Batorowicz, B., Clendon, S., Coronas, M., Deliberato, D., Jennische, M., Launonen, K. Mendes, E., Murray, J., Nunes, L., Oxley, J., Peixto, A., Renner, G., Sandberg, A. D. Smith, M., Soro-Camats, E. Soto, G., Stadskleiv, K., Tavares, L., van Balkom, H., van der Schuit, M., Walter, C. C. F., Wriedt, O. & Yang, C.-K. (in preparation). Becoming aided communicators: Communicative development and problem solving in children using communication aids.

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Section 5: iPADS® AND OTHER TABLETS AS AAC DEVICES: RESEARCH, ISSUES AND NEEDS

Lindsay Dutton, Heartspring

Julie Scherz, Wichita State University

Amy Finch, Fort Hays State University

Jessica Caron, Boston Children's Hospital

Through widespread media coverage, mobile technologies have become more widely recognized as potential tools to enhance the educational needs of a variety of learners, including those who may use augmentative and alternative communication (AAC) devices. Families and administrators are clamoring for the purchase of iPads® or other tablets for use as communication devices because they are less expensive than traditional speech generating devices used for AAC and they have the potential to "normalize" the user. In many instances, it appears that professionals are trying to match the user to a mobile technology and set of apps rather than trying to find the right technology for a user based on their unique skills and needs. Many professionals have even encountered families who want to abandon their child's speech generating device (SGD) in favor of an iPad® because it would be more "appropriate" for the family, even though the child was proficient in using the SGD.

Many of the professionals in the field who are experienced at providing AAC evaluations, reports, implementation plans and consultations are frustrated with the way this new technology has gone "viral" with little regard for best practices or professional decision making. With this being a new topic, there has been very little research conducted that supports the use of these devices as AAC or that helps determine the best way to evaluate and implement these systems to decrease the odds of abandonment.

The field of AAC is always changing in light of new technology; however, mobile technology has introduced even faster changes. The smartphone and apps craze started in 2005 with the introduction of a new Motorola phone that allowed users to sync to iTunes for the first time. In 2007, Apple introduced the iPhone and changed the way people function on a daily basis. In 2008, the iPhone 3G became available and allowed people to get information more quickly and to download third-party apps. During the creation and marketing of the new smartphones, the App Store was growing as well. In July 2008, there were 500 apps available. Three months later, 3000 apps were available. Today, the app store carries over 700,000 active apps that range in content from games, to education and lifestyle.

The first AAC-specific app for the iPhone or iPod Touch was introduced in 2009 (Center for Assistive Technology and Environmental Access [CATEA], 2010) with the iPad® being introduced in 2010. The iPad® immediately became a buzzword in the field of AAC. While the primary platform for the iPad® was for audio-visual media and entertainment, professionals in the field of special education and speech-language pathology were considering how it could be utilized with clients as a speech generating device or therapy tool. While there were other tablets

available on the market, the iPad® was definitely getting the most press and had the highest expectations for changing the field and making a difference in education.

The iPad® is a touch screen tablet that is portable and lightweight with an on-screen keyboard for text input, access to email, a web browser for internet interactions, iBooks for purchasing and reading books, and beginning with the iPad2® a camera with video capabilities. In addition, it has opened face-to-face communication using FaceTime. Since its introduction, there has been an explosion of app development with approximately 65 AAC apps in January of 2011, 133 in June 2011 and 150 in June 2012 (Alliano, Herriger, Koutsoftas, & Bartolotta, 2012; McBride, 2012). Although there has been an explosion in the development of AAC apps and changes in the iPad® during this two-year period, York and Fabrikant (2011) remind professionals that the iPad® is a "fragile piece of equipment" (p. 255) that may be easily destroyed.

Controversy and challenges always surround any new technology or idea that enters the world of professionals working in the area of AAC. These issues have been the focus of many discussions on professional listservs such as the American Speech Language Hearing Association Special Interest Group 12 (aka SIG 12) that focuses on AAC, and the Quality Initiative for Assistive Technology (QIAT). The primary topics of these discussions have focused around whether an iPad® used for communication can also be used as a leisure tool or academic support, whether families or school districts/organizations should be handing out iPads® to be used as communication devices without assessing the student's skills, and how to get iPads® funded as a communication device.

Research is a vital part of the decision-making process when professionals determine what intervention methods to use with their clients. The rapid growth and interest of the iPad® and other tablet technology has made it difficult for practitioners to conduct formal scientific research on the use of iPads®, apps, and other tablets as AAC devices. Therefore, most of the information practitioners use to make decisions comes from anecdotal information, family or colleague reports, or experience (Gossnell, Costello, & Shane, 2011; Scherz, Steiner, Trost, & Dutton, 2010).

The tasks of this research strand were to:

1. Discuss and compare communication applications that are available on a tablet versus dedicated communication devices. This comparison looked at vocabulary, language, symbol sets, synthesized or recorded speech and access options.

2. Discuss the persons who are creating apps. Are they consulting with SLPs with language development knowledge? How can professionals standardize the way that the AAC apps are described and reviewed to get more objective information to help decide which app might be a good fit for clients?
3. Discuss language development and apps. What research, if any, is being done on the vocabulary page sets for AAC apps? What research is available for established dedicated devices? How should this influence the evaluation or app purchasing decisions?
4. Discuss AAC evaluations and tablets. How are professionals including tablets in AAC evaluations? What if families do not want a dedicated/traditional device and will only consider a tablet? What kind of data is being collected to support AAC device decisions? Is it consistent across evaluator? How much does or should the parents desire for a specific device weigh on the decision process?

Overview of History of the Development of the iPad®, Other Tablets and Apps for AAC Purposes

A review of the development of AAC apps and other issues related to access to iPads® and other tablets began with Proloquo2Go™ (CATEA, 2010), which was released in 2009 as an application for the iPhone and iPod Touch. This initial AAC app provided the first communication solution with a customizable library of symbols, the ability to import photographs, and built in text-to-speech. Both pre-stored and generative messages could be used and boards could be customized. Although this was considered a good beginning, various features were not available, such as alternative access, rate enhancement techniques, and choices in symbol sets, and the ability to lock other apps so that either they couldn't be changed/deleted or that the Proloquo2Go™ could be locked to make the iPod a dedicated communication system. In addition, funding by health related agencies, such as Medicare/Medicaid was not possible. The other feature that was missing in 2009 was a larger platform. The larger platform was provided when the iPad® became available in January 2010. Rate enhancement was introduced through the Assistive Chat app (Assistive Apps, 2012) in August 2010. This app was the first text-only based app and it had three different voices and word prediction. Three other AAC apps, SoundingBoard, TouchChat™ and TapSpeak Choice, were introduced in fall 2010 and provided additional AAC options. TouchChat™ added the option of abbreviation and expansion for rate enhancement as well as being able to adjust dwell time for direct access. Both SoundingBoard (AbleNet, 2012) and TapSpeak Choice (Conley, 2012) were designed so that either direct or indirect access (i.e., scanning) was available. In addition, the Bluetooth cordless super-switch and

Bluetooth switch interface (Cooper, 2012) were available in December 2010. Both of these devices allowed other wired switches to be used for switch access through Bluetooth. The Blue2™ Bluetooth® switch (AbleNet, 2012) was available in March 2011 by AbleNet, which offered single and dual switch access as well as operating as a switch interface.

Most manufacturers of SGDs provide a list of features on their websites that are easily accessed by professionals during the assessment process when they are searching for devices to best meet the needs of an individual. Although some of the developers of apps provide this detailed information, it is not the common procedure for app developers to list these features in the app store. Since these features are not listed, most professionals have to purchase the app and learn about the features on their own. However, recently there are web sites outside of the App Store, that provide some information on apps for iPads® and other tablets, such as Farrell's list (Farrell, 2012) on Spectronics: Inclusive Learning Technologies website and McBride's AAC Apps Assistant on the AAC Tech Connect website (McBride, 2012). Farrell's site has a list of apps with a description of a few features whereas AAC Assistant allows searching for apps by using a robust or basic search or by different features (e.g., speech output, representation including types of symbols, alternative access, feedback features, page layout features, etc.).

One of the latest developments includes the release of iOS 6, which was scheduled for fall 2012. One of the major features of the new operating system was guided access. One feature of guided access allows the locking of apps at the system level. This allows professionals to decide on the features that are available to users, including disabling hardware buttons such as the home button. Guided access also allows professionals to lock out various areas of the screen or on web sites that aren't relevant to a task (Apple, 2012).

Part of the costs built into dedicated SGDs are supports related to the AAC team, such as multiple trainings on-site or through webinars, repairing of devices, and providing loaner devices. These are areas that are missing for most iPad® apps although a few websites are providing tutorials on the features of the iDevices and apps (McBride, 2012). Overall, the support for the iPad® and other tablets is probably more likely to come from specific agencies, such as educational units, rather than from the manufactures and/or app developers. There are very few AAC apps that were available for professionals as "loans" or "assessment tools" so that they could be used in trials with individuals without having to purchase the app first. However, a few developers recently have developed lite versions of their AAC app, which are less expensive or free so that professionals can download the lite version and use it during assessment trials (McBride, 2012).

Comparison of Features on Dedicated Dynamic Displays and iDevices with AAC Apps

An important aspect of feature matching focuses on individuals who have physical impairments that limit their abilities to use any type of direct access using a part of the body or external pointer (ASHA, 2004**;** Beukelman & Mirenda, 2005; Isaacson & Quist, 2011; Lloyd, Fuller, & Arvidson, 1997; York & Fabrikant, 2011). A review of the apps (Dutton & Scherz, 2013) as of January 2013 (Table 1) was completed to determine whether or not scanning was available for alternative access on the apps in comparison to dynamic display AAC devices. This review was completed using 11 randomly selected dynamic displays from the AAC Tech Connect Device Assistant and 11 AAC robust apps from the AAC Tech Connect App Assistant (McBride, 2012) search engines. The majority of dedicated dynamic display devices (91%) reviewed had the option for scanning whereas only three robust AAC apps (27%) had this option thus limiting the choices for individuals who need some type of alternative access for independently using the AAC app on the iPad®.

Table 1. Brief Comparison of Features of Dedicated Dynamic Display Devices with AAC System Software and iDevices with AAC Applications

Features	Dedicated Dynamic Display Devices	iDevices with AAC Applications
Aided	+	+
Symbols	+	+
Digitized Speech	91% (10)	36% (4)
Synthesized Speech	100% (11)	100% (11)
Text-to-Speech for Creating Novel Utterances	100% (11)	73% (8)
Type of Access Direct Access Indirect Access (Scanning)	 100% (11) 91% (10) Note: Most had options for other alternative access in addition to scanning	 100%(11) 27% (3)

Strategies Word Prediction	91% (10)	67% (7)
Costs-Full Versions	Estimated range $2700-$8295	Estimated iDevices (32 GB) range $224.99 to $599 Apps Range from $89.99-$299.99

Portability was rated as a definite advantage for iPads® and other tablets with weights ranging from 1.4 to 2 pounds. Most dedicated SGDs range from 2.75 to 4.5 pounds, with one hand-held device being 10 ounces and one smaller device weighing 1.44 pounds. Although the iPad® was created to be able to access email, internet, camera, and face-to-face communication for individuals with typical motor skills, there are access issues for individuals with physical disabilities with these apps only being accessed through direct access. Scanning and switch access are available only through individual apps and at this time there is no way to access these other functions through scanning.

There are a variety of tools, charts and matrixes that are available to help professionals choose apps to trial with their clients. Marfilius and Fonner (2012) have a "Feature Match Checklist"; Parker and Zangari (2012) created a "Rubric for Evaluating the Language of Apps for AAC" (RELAAC); and Brady (2012) created the "Quick Feature Matching Checklist". AAC-TechConnect (McBride, 2012) offers an AAC App Assistant that allows users to search by the features for robust apps, basic apps or by individual features alone.

In addition to the above resources, feature matching, the Student Environment Task Tool (SETT) framework (Zabala, 2005) and evidence based practices are also being utilized by professionals to choose apps. Feature matching is process in which an AAC user's strengths and needs (current and future) are evaluated and matched to specific features of AAC symbols, strategies, and devices (Glennen & DeCoste, 1997; Gosnell, 2011; Gosnell, Costello & Shane, 2011; Shane & Costello, 1994). The SETT framework includes a four-part model that is intended to prompt collaborative decision making in all phases of assistive technology and service delivery from consideration through implementation and evaluation of effectiveness. The SETT framework is student centered and is focused on the student's environment, the task that an individual needs

to participate in, and the tools needed to accommodate or modify the environment or task to help the student be successful.

Since many professionals who complete AAC assessments, use a feature matching approach (ASHA, 2001; ASHA, 2004; Gosnell, Costello, & Shane, 2011; Lloyd, Fuller, & Arvidson, 1997; Yorkston & Karlan, 1986) in which the features of AAC systems are matched to the needs and characteristics of the user, a brief comparison of the features of high technology dedicated dynamic display devices with AAC system software (e.g., Dynavox devices, PRC devices, Tobii, Words+, etc.) and iDevices with AAC apps were reviewed (Table 1). This review was based on the 11 robust apps described in McBride's (2012) AAC App Assistant and 11 randomly selected dedicated dynamic display devices found in the AAC Device Assistant (McBride, 2012). The similarities included the fact that both types of devices would be described as aided systems with a variety of symbol options depending on the actual software or apps being selected (Farrell, 2012; McBride, 2012). The majority of dedicated dynamic display devices (91%) had the option for digitized speech whereas only a minority of apps (36%) for the iDevices used digitized speech. All of the dedicated dynamic display and AAC apps had synthesized speech. Although all of the dedicated dynamic display devices had text-to-speech, 73% of the AAC apps had this option (Table 1).

Language Development and AAC Apps

Children and adults who use AAC have the same language needs as individuals with typically developing language. The way children typically develop language should be the foundation for building generative language with individuals using AAC strategies (Beukleman & Mirenda, 2005; Van Tatenhove, 2005).

When an AAC system is implemented, therapists who work with AAC users need to have a vision of where they are going with language development. Van Tatenhove (2005) stated that the development of an AAC system is too often driven by "immediate needs." This usually results in the AAC system being composed primarily of nouns and being void of other grammatical categories of language (e.g., verbs, prepositions, pronouns, etc.). Therefore, requesting typically becomes the most pervasive communicative function in the AAC user's repertoire. "Language develops and expands in an orderly fashion. Our devices and systems must allow for this development from the beginning" (Scherz & Hart, 2002).

Through research, we have a good understanding of different approaches to teach language to AAC users. We also have an understanding of the important factors that play a vital role in successful outcomes for technology such as: appropriate vocabulary selection, appropriate vocabulary arrangement, modeling, and support and attitudes toward technology (Farrell, 2012). However, the introduction of the iPad® and other tablets with apps for communication has made utilizing what is known about language development even more challenging.

Historically, SGDs that were manufactured by vendors had a research and development team comprised of professionals who helped test and create the page sets based on established practices for teaching language. The vendors provided websites and additional manuals to assist with teaching language using AAC, and individual support was provided, as needed. The rapid growth of available communication apps has created a situation in which we have more page sets to trial, but there is minimal research and sometimes no professional support behind the development of the language system of the app.

Some developers of communication apps have begun trying to integrate research into the description of their product. For example, Proloquo2Go™ (AssistiveWare, 2012) stated that the app is based on two research-based vocabulary organizations and lists these organizations as core word and basic communication. The developers of TouchChat™ created three versions and provide a comparison to help professionals make decisions based on their client's skills.

Other app developers have not been as diligent in making sure that their app reflects research. For example, research supports that voice output encourages speech development (Millar, Light, & Schlosser 2006), but some developers do not include speech in their AAC app claiming that speech output would impede speech development. Research also supports that providing an AAC system at all times and modeling use of the system throughout the day in multiple situations leads to maximum language development and best outcomes (Beukelman & Mirenda, 2005; Drager, 2009). However, in the instructions for several AAC apps, users are advised to allow access to the app only a couple times a week until they become more competent (Farrell, 2012).

A variety of people from differing backgrounds have contributed apps for expressive communication. Some mobile technology engineers have partnered with speech language pathologists to build apps. Other app developers have taken a need that they see and built what they felt would fit the need. For example, there are several communication apps that have been created by parents of children with autism to help their child communicate. It is interesting to

note that communication apps that were developed in collaboration with a speech-language pathologist are not always the apps that have the highest ratings by other professionals or users.

Assessment and Data: A Joint Session with the Measurement and Assessment Strand

If 100 different professionals were asked how they conduct AAC evaluations, there would be a variety of different responses. There is no standard method that has been agreed upon by speech-language pathologists. Therefore, the funding parties, such as insurance regulations or the family, typically guide the evaluation process. With no set guidelines for standard AAC evaluations, the addition of iPads® and other tablets for use as AAC devices has made an already challenging process more frustrating for many professionals.

Scherz, Steiner, Trost, and Dutton (2010) conducted a survey to gain insight into how professionals around the country were utilizing iPads® and apps with their clients. ASHA's Special Interest Group 12 and the Quality Indicators for Assistive Technology (QIAT) listservs provided 107 participates for the survey. At that time, over half of the respondents reported that their clients were using an iPod/iPad® as their primary communication system. However, when asked if an AAC evaluation had been completed to determine that the iPod/iPad® was the best system suited for their clients, over half (55.6%) said "no". Dutton and Scherz (2011) conducted a follow up survey one year later. This survey had 78 respondents from ASHA and QIAT listservs. That survey focused primarily on the use of apps with clients. At that time, 78% (60) of the respondents were using iDevices within their practice. The iDevices were primarily being used for reinforcement, language development, cause and effect activities and drills. An overwhelming 93% of the respondents gathered information regarding apps to try based on colleague recommendations. The app store recommendations and reviews were used by 82% of respondents and 65% of people utilized listserv recommendations. When asked how apps were selected for specific clients and skills, "trial and error" was the resounding response. Some responders also commented that they used the Student Environment Task Tool (SETT) framework and some reported reading app reviews. Most responders were not taking any data with respect to the app being used and its effectiveness for meeting client goals.

The most pressing question that professionals face regarding the iPad® and tablets and AAC seems to be whether to implement immediately or assess first. Some passionate discussions have been held on both the QIAT and ASHA listservs with professionals and families debating

whether iPads® or tablets and apps should be trialed as deemed appropriate by the family and professional, or an evaluation should always be conducted to make sure the iPad® or tablet and app meet the unique needs of the client. The question then gets raised, "Are we finding the right technology for the student, or fitting the student to the technology?"

Evaluation Options – Heartspring's Approach. Heartspring, a residential and day school for children with autism and other disabilities in Wichita, KS, has tried to provide options for people on both sides of the discussion, while still meeting the unique needs of each individual student. After conducting comprehensive AAC evaluations for eight years, Heartspring started to get requests from both parents and school districts for students to "just use an iPad®" or "trial an iPad® and let us know how it goes." The comprehensive AAC evaluation typically takes several months to complete and trials 3-6 different communication systems (including iPad®/iPods, etc.) in the classroom and home environments and results in a comprehensive report with recommendations for communication and implementation. When the comprehensive evaluation was offered to parents and school districts interested in iPads®, most were not interested because an iPad® was the only tool being considered. It is cheap (relative to other SGDs), families and professionals feel like they are familiar with the hardware and software due to the popularity of smartphones, and it is normalized in the community.

However, it is not as easy as, "just use the iPad®." There are over 150 different apps in the app store that can be used for expressive communication. With prices ranging from free to $300, they all vary in their symbol sets, page options, voices and other bells and whistles. As a professional trying to find the best communication system for a student, it seemed that if an iPad® was the hardware that had been predetermined, either due to funding, availability or familiarity, then the software used with the hardware should be the most intuitive and effective for the student. Therefore, two years ago Heartspring began offering "iPad® only assessments." These assessments look specifically at the student's ability to utilize the unique hardware features of the iPad®, such as sweeping the "on" arrow and scrolling. These skills are important to ensure that the student is able to turn the device on independently and find the app if needed. Then a variety of apps are assessed based on the student's current communication system and skills. Typically, 3-5 different communication apps are assessed. Performance data is taken on how much support the student needs to access target vocabulary and navigate, and their language use during structured and unstructured activities. The data for each app is then compiled into a report to share with the family and school district. Some students who have been assessed have done well with the iPad®, and the data clearly reflected which app was most intuitive to them. Others have not been successful using the hardware and/or the data taken

during app trials did not indicate that they would be more successful using any of the apps than their current communication system. Either way, the discussions and next steps were determined by the data and student performance.

Evaluation Data - Boston Children's Hospital. The speech-language pathology staff at Boston Children's Hospital designed a project to look at the paradigm shift that has occurred between therapists and families/clients seeking AAC support. Specifically, the project examined how the introduction of iPad® and other tablets has affected the dynamics of the team working with the client in trying to determine the AAC system that is the best fit for the client's skills.

The age of participants ranged from 1 to 80 years old, with most of the data collected from the 3 to 5 years old age group. The diagnoses of the participants varied, but the primary three diagnoses were autism, cerebral palsy and Down syndrome.

During the evaluation process, 78% of families were the first to bring up using an iDevice for communication. Fifty-nine percent of the families did not currently own an iDevice, but 39% brought their own iDevice with them to the evaluation. Thirty three percent of those who brought an iDevice to the evaluation already had apps preloaded on the device. Of the apps that were preloaded, Proloquo2Go™ and TouchChat™ were the two most frequently seen.

Some of the findings of the AAC evaluations in this project include: 30% used the iDevice as their primary communication aid, 36% used the iDevice to focus on foundations for independent communication, and 8% used the iDevice as a back-up or secondary tool to another speech generating device that was owned or available. When an iDevice was not recommended at the end of the evaluation, the decision was attributed to a number of factors: the client having access issues (27%), financial issues (19%), the family already owned a different speech generating device (18%), and no appropriate match was found (17%).

The paradigm shift that has occurred due to the rapid growth and popularity of iDevices and communication apps indicates that speech language pathologists need to ensure that the hype surrounding these consumer applications does not compromise the quality of services and supports that are provided to the clients. The greatest harm in allowing hype, fads and pressure dictate clinical decision making is the time wasted learning or attempting to learn to use an inappropriate communication technology (Gosnell, Costello, & Shane, 2011) as well as wasted funds.

Summaries of Studies Related to iPads® and Other Tablets as AAC Systems

Most practitioners agree that principles of universal design for learning (UDL) are crucial to consider when designing effective systems for assistive technology and AAC. Weed, Wendt, and Lloyd (2011) summarized some of these universal principles:

1. Principle of parsimony: Use the simplest device, system, or intervention approach without compromising benefits.
2. Principle of minimal learning: Interventions requiring knowledge related to known concepts result in greater successes
3. Principle of minimal energy: Successful interventions demand minimal physical effort and performance for long periods of time with little fatigue
4. Principle of minimal interference: Whatever approach is used should not distract the user from an ongoing activity (efficiency is reduced when user must focus on the operation of the device or the retrieval of vocabulary)
5. Principal of best fit: Technology should fit the personality and needs of the individual user
6. Principal of practicality and use: The approach that is most consistent with available resources should be used

From a developer's perspective, the new technologies also provide challenges in providing appropriate apps for appropriate skill development. Hershberger (2011) stated,

> The new mobile technologies and apps have given a sharp rise to a consumer [rather than clinical] model for providing AAC solutions. Due to the low cost of these solutions, third-party funding sources often are not necessary and, in many cases, are not available for these purchases. Eliminating the funding process cuts time and expense, but also often eliminates the clinical component of selecting a device and creating a plan for clinical intervention. Parents who enthusiastically download an app for a son or daughter may find their enthusiasm wane in the absence of clinical and technical support as their child begins to use the device. (p. 30)

He also warned,

> Like all new technologies, iPads® and other mobile devices come with a mixed bag of opportunities and pitfalls. I believe the greatest pitfall is for us to focus too much on the technology. Providing an AAC solution is a complex process. An AAC device is only a tool, one of many components of a solution. The embedded vocabulary and language system are as important as the hardware platforms. Without the appropriate clinical intervention, even the best device may have limited value. Rather than focusing only on the particular technology, we should focus on finding the best solution for the individual who needs speech augmentation. (p. 32)

The AAC-RERC (2011) working group issued a white paper related to mobile devices and communication apps. This group indicated that a set of assumptions about AAC apps and mobile technology needed to be considered and addressed:

1. The advent of these technologies and apps is already affecting the choices that individuals, families and clinicians are making, as well as how the AAC industry is conducting business.
2. In the future, changes in funding policies and service delivery may occur.
3. Persons with complex communication needs have a need for, and right to, the same range of communication options available to everyone else (e.g., multiple technology options).
4. There is an urgent, unmet need for quality research and development. Only limited evidence currently exists that demonstrates the efficacy of mobile technologies and AAC apps on functional communication and quality of life of potential users. (p. 3)

To aid practitioners in making good decisions about the potential use of mobile technologies for AAC evaluations and use, McBride (2011) posed a list of questions to consider. These included:

1. What does the communicator need, want, or desire to communicate? How is that expressed?
2. In order to further evaluate communicative needs, where, when and with whom will the individual communicate?
3. What are the communicator's current skills and abilities?
4. What is the communicator's language/linguistic ability (e.g., vocabulary, symbols, language representation, organization, etc.)?
5. What are the device functions and features required?

6. How does one make the "best choice for the best voice" (i.e., make appropriate decisions for the optimum communication device)?
7. If the device has already been provided, is the communicator currently using the AAC device?

DeLaCruz (2011) reported on data collected from classroom teachers in the Northern Suburban Special Education District (Highland Park, IL) when using both traditional classroom tools (e.g., books, flashcards, timers) and iTechnologies (e.g., book, vocabulary and visual timer apps). The iTechnologies were only used during "discrete skill acquisition" sessions (e.g., teaching specific vocabulary) as opposed to "expand educational opportunities" activities (e.g., identify on a map a site mentioned in a book). DeLaCruz reported that when using the iTechnologies to support instruction, the students engaged in appropriate behavior a greater percentage of time, demonstrated increased accuracy in performing tasks, showed more interest and motivation in the instruction, and demonstrated increased independence with less adult support.

Alliano, Herriger, Koutsoftas, and Bartolotta (2012) reviewed 21 iPad® applications for AAC purposes. Of these, 2 were free and 19 were for purchase. The apps were divided into 3 categories: symbols/picture only, symbols and text-to-speech, and text-to-speech only. The authors selected these 21 apps based on Spectronics ratings and iTunes user ratings. They concluded that

> a pressing issue for SLPs who work with AAC is the proper use of any device to target communication goals. Many families of individuals who require AAC have taken this venture of communication with user-friendly tablets upon themselves. Although this is encouraging…this may come at the cost of creating AAC intervention plans that both augment and promote growth in communication. Given the ease with which individuals and families can obtain an iPad® and associated apps, the purposes of AAC may be compromised. The limitless possibilities and ever advancing technology of PCTs creates a scientific lag behind empirically based treatments that target communicative goals. (pp. 61-62)

Niemeijer, Donnellan, and Robiedo (2012) surveyed 232 individuals about their use of iOS devices. Of these, 17 were AAC users, 98 were family members of individuals who use AAC devices, and 117 were professionals working with AAC users. Nearly all respondents indicated that they now used some sort of iOS device routinely. About one-third of the AAC users indicated that three years ago they used a high-tech dedicated AAC device. Currently, nearly 90% of the AAC users reported that they use an iPad® for communication purposes as well as for non-

AAC activities (e.g., entertainment and learning). A dedicated device was being used concurrently with the iPad® by about 15-20% of the AAC users. The authors concluded that iOS devices have brought AAC within reach of a much larger population than was traditionally served with AAC devices, although their preliminary data suggested that the potential of many AAC users to access a fuller range of communication functions is as yet insufficiently tapped. There may also be a serious shortage of knowledgeable professionals capable of assisting families with effective AAC use on iOS devices.

Hodgdon (2012) issued a special report related to the use of apps for iPads® with individuals with autism spectrum disorders. Her report summarized data from a survey of 3500+ individuals including speech-language pathologists, teachers and parents. Nearly 73% of the respondents reported that they used an iPad® with an individual with ASD. These iPads® were used for a variety of purposes including general educational activities, playing games, making choices, supporting conversations and teaching sign language. Eight-three percent of the respondents indicated that using the iPad® had been useful to meet IEP goals

Flores, et al (2012) compared the iPad® with a picture-based system to meet the needs of 5 students, ages 8-11 who qualified for special education services, to meet their communication needs. This study was conducted during snack time using the two systems to request a preferred snack item. The communication behavior (requesting) was measured in an A-B-A-B-A design over 5 weeks. The picture-based system consisted of three color pictures using BoardMaker® symbols on a Velcro® strip. The app, "Pick a Word" was used on the iPad®, with six colored icons on the screen. There was some increase in requesting behavior for some participants when using the iPad®, but no clear pattern across participants was seen.

Scherz, Steiner, Trost, and Dutton (2010) reported on the use of iPhone apps for communication purposes. Fifty-five respondents indicated they were using apps with clients with autism spectrum disorders, aphasia, Down syndrome, apraxia of speech and cerebral palsy. Five apps were reported as being used most frequently for communication: Proloquo2Go™, Speak It, Tap to Talk, iCommunicate and My Talk. Dutton and Scherz (2011) conducted another survey with 78 respondents. At that time, 78% (43) were using iDevices in their practice, and over half were using an iDevice as the primary communication tool for their clients.

The development of iDevice technology and apps continues to grow at an exponential rate. This creates a great need for professionals to support each other and share information, as well as coordinate research efforts to contribute to the literature and guide the creation of best practices that includes these iDevices and AAC apps. This strand ended the symposium by

developing a list of areas that need more research and creating an action plan. A few of the primary areas of research included more detailed comparisons between iDevices and dedicated SGDs, iDevices, apps and literacy development, the perception of the user and the users perception of themselves when using an iDevice vs. a SGD, and how the iDevices are being purposed (communication or multiple functions). The participants of this strand made plans to create an online forum for professionals to continue discussions initiated during this strand as well as a Facebook group for professional questions, input and collaboration. The creation of an online database that would allow professionals to chart their experience with an iDevice and app, review the system and give a short case study of the client was also discussed.

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Section 6: GATHERING AAC DATA FOR ENHANCEMENT OF LANGUAGE RESEARCH: THE INTERSECTION OF LINGUISTICS AND AAC

Carol Tenny, Google

Katya Hill, University of Pittsburgh

Eric Nyberg, Carnegie Mellon University

Gathering AAC Data for Enhancement of Language Research – The Intersection of Linguistics and AAC: Introduction

Carol Tenny, Google

The purpose of this research symposium was to discuss the creation of a databank for Augmentative and Alternative Communication (AAAC) language data. This is a project that has been launched by the authors, who are based in Pittsburgh, Pennsylvania, USA. The symposium was our first opportunity to engage the wider AAC community in a discussion of this project, and to solicit opinions on the structure, organization, content, format, purpose, and any other aspects of the proposed databank. We continue to solicit ongoing participation by interested members of the AAC community.

Background. The idea for the databank emerged out of a *Thinktank for the Intersection of Linguistic Research and AAC*, held in 2011 in Pittsburgh, PA. The Thinktank was motivated by a desire to bring linguists and linguistic research into the field of AAC. Research in linguistics, including theoretical linguistics, psycholinguistics, child language acquisition, brain language research, and language processing, is quite advanced; yet has not focused to any significant extent on AAC-speakers. Research into the language of AAC-speakers could significantly further our understanding of human language. Conversely, we are not aware of significant contributions from linguists into the field of AAC. Believing that a dialogue between linguistic researchers and AAC researchers and practitioners would be mutually advantageous, we discussed means of bringing linguists and linguistic data from AAC users into the field. An idea of an AAC databank arose out of these discussions.

The Proposed Databank. The AAC databank we are planning is now envisioned to be of sufficient breadth and depth to serve the entire community of persons interested in AAC. We identify four different groups of stakeholders: clinicians, basic researchers, AAC-device designers, and AAC-device users. All four groups will have different needs and requirements for such a database, and all four groups need to have a voice in how it is developed and implemented. For example, clinicians might want access to standardized measures of linguistic or communicative competence. Linguists/scientists might want other types of measures, or access to speech samples for linguistic analysis. Device manufacturers might want to track which of its device features are most commonly used by which type of AAC-user. And AAC-users (or their families) might want resources to track their own progress, or to engage in mentoring others. It should be designed as an open forum for the different stakeholders to interact. For example, it might

provide an interface where clinicians and scientists can interact and learn from each other, helping to bridge the gap between research and practice.

Seminar Sessions. In order to accommodate the needs and interests of these different groups, as well as provide for interaction between users of the database, the database project will require both a novel engineering design for the operating databank; and a novel process design for its workflow processes. In Session 1, Eric Nyberg provided an introduction and overview from the engineering perspective, of the proposed framework for gathering, storing, and analyzing data from AAC users.

In Sessions 2 and 3, we considered what kinds of data and data analysis would be desired, and what kinds of data are currently available. In Session 2, Carol Tenny and Helen Stickney reviewed some recent linguistic research in child language acquisition and psycholinguistics of AAC users, and raised some scientific questions that data from AAC-speakers might address. A lively discussion followed. In session 3, Katya Hill gave an overview of AAC language data and data analysis currently available for clinicians, illustrating the output of a Language Activity Monitor (LAM). The LAM can be used with any device to track the language output and development of the user. Lively debate followed this session as well. Audience members raised and discussed issues relating to this and other kinds of communicative data that could be collected from AAC clients.

Our panel discussion in Session 4 gave some participants an opportunity to express their thoughts about the important issues facing the databank project. Some of the ideas expressed were: the importance of getting concrete data to work with as soon as possible; the importance of including a range of data types; keeping in mind the diversity and individuality of types of AAC users; and not selling AAC-users short in their ability to produce language.

We anticipate modelling the databank after the existing AphasiaBank, which is based at Carnegie Mellon University in Pittsburgh (MacWhinney, Fromm, Forbes, & Holland, 2011; MacWhinney, Fromm, Holland, & Forbes, in press; MacWhinney, Fromm, Holland, Forbes, & Wright, 2010). In Session 5, Brian MacWhinney provided an introduction and overview of the AphasiaBank project, website, data, and data analyses that are currently available (http://talkbank.org/AphasiaBank/).

In our final Session 6, we outlined the next steps to be taken. Participants discussed what kinds of data they would have available that could be shared on the database.

Future Plans. We continue to develop the plans for an open source AAC Databank, to be modeled after AphasiaBank, and to be affiliated with two universities in Pittsburgh. As we discussed in the seminar, we will begin by incorporating samples of the different kinds of data we already have available, using the structures already in place for Brian MacWhinney's well-known databases. For those participants who expressed interest in contributing data: Your data can be contributed using the instructions at http://talkbank.org/share/contrib.html. Whatever data you can send now or soon, will become part of our first pass at creating the AAC database. As we also discussed in the seminar, all forms of data are welcome and encouraged: LAM, video, and transcript.

We continue to solicit participation and contributions of linguistic or communicative data from AAC-users for the open-source databank, where privacy restrictions make that possible. Interested persons are encouraged to contact the authors listed above.

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AAC Data for Linguistic and Scientific Questions

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Although users of AAC devices are well known to the Speech Pathology community, they are not as well known in the linguistic/scientific, community. Persons speaking through Augmentative and Alternative Communication devices (whom we call AAC-speakers), should have a great deal to contribute to the scientific understanding of human language ability. In particular, those AAC-speakers who do not have basic cognitive or linguistic deficits constitute a unique population of language speakers who can provide insight into the relation between grammar and modality. The populations of vocally articulating ("normal") speakers, and of manually articulating deaf speakers of American Sign Language (and other sign languages), have been studied by linguists for many years in their contrasting modalities of language production and comprehension. AAC-speakers have a unique set of language modalities differing from that of these previously studied language populations. However, in contrast to speakers of sign languages such as American (ASL), linguistic research has not focused to any significant extent on AAC-speakers. Linguistic or psycholinguistic investigations with interested AAC-speakers could yield insightful observations about the differences between vocal articulators, manual articulators (ASL speakers), and single-digit articulators (AAC-speakers) that shed light on the general nature of human language, and on the relation between modality and grammar.

Here we outline some scientific questions from five areas of linguistics that research with non-aphasic AAC-speakers could shed light on, and consider what kinds of data could be brought to bear on them.

Psycholinguistics. Psycholinguistics is the general study of the psycho-biological factors at work when the human brain processes and organizes language. As such, it encompasses the more specialized fields in neurolinguistics, grammar, and language acquisition. Language processing includes the comprehension, production, learning, and loss of language. Some types of psycholinguistic research require specialized or invasive technology (such as electroencephalography (EEG)), but other kinds can be completed with minimal technology (such as lexical decision tasks).

One of the simplest sources of psycholinguistic information comes from speech errors, which have been used to supply evidence about how people organize and produce language. Speech errors in both vocal speakers and deaf signers using American Sign Language or other well-studied sign languages, reveal abstract linguistic units as independent and moveable parts in production errors. Words, phrases, morphemes, phonemes, and even features, can be flipped, moved, or operated over in some other way in speech errors. (Fromkin ,1973, wrote the seminal paper on regular speakers in this area; Klima & Bellugi, 1979, and Hohenberger & Waleschkowski, 2005, have written on speech errors in signers.) This shows that these kinds of linguistic units from the grammar must be activated at some point during language production, which shows us not only that these units are psychologically real, but provides a window into how they pattern in the brain. We also have some indication that there is an effect of modality on speech errors (Hohenberger, Happ, & Leuniger, 2002). AAC-speakers, with their alternative modalities of language production, could add greatly to our understanding of language production as it relates to grammar and modality. For example, how do their speech errors reflect the grammar of their native language, and/or the language as it is structured on their device? Tenny and Hill (2012) have produced a preliminary study of speech errors collected from interviews with AAC-speakers in which two different types of speech errors were identified: one type reflecting morphology, like the errors by "normal" speakers recorded by Fromkin (1973); and a second type comparable to errors made by typists. Much more could be learned from speech errors in AAC-speakers, without need for complex or invasive technology. We can imagine experiments devised with finger-twisters, the equivalent of tongue-twisters for AAC-speakers.

Neurolinguistics. Neurolinguistics is the neuroscience of the brain as it relates to language processing. Researchers into human speech perception have taken several different approaches to understanding it. See Diehl, Lotto and Holt (2004) for an overview. Speech perception and speech production seem to be connected in the human brain; but the nature of that connection and the degree of the integration between the brain's functions of perceiving and producing language is not known. The motor theory of speech perception takes the strong view that speech perception depends on recognizing the articulatory gestures made by the mouth and tongue during language production, rather than simply recognizing the acoustic patterns heard (Liberman et al (1967); Liberman and Mattingly (1985); Liberman and Whalen (2000); and Galantucci, Fowler and Turvey (2006)). Hickok and Poeppel (2000) have taken another view of how speech perception and production might be related in the brain, proposing

that neural systems related to the perception and production of speech only partially overlap with each other.

If we could understand the neurological process of speech perception in AAC-speakers, this might contribute to an understanding of these larger questions. What is speech perception like for people who hear but do not speak? Do the brains of AAC-speakers respond to language input differently than the brains of vocal articulators? Answers to these questions might help to shed light on the debates about the motor theory of speech perception and the nature of the interactions between speech production and perception in the brain. Unfortunately, it is not clear at this time what kinds of neurological data would not be too difficult for AAC-speakers to contribute.

Grammar. Anyone who has mastered a language has access to a working grammar of the language "in their head." Whether or not they can explain that grammar to someone else, they rely on this grammar (which we might imagine as a set of subconscious "language rules") to produce and understand language in every moment. Someone in the process of learning a language, whether it be a child learning a first language or an adult learning a second language, has acquired some version of the grammar, perhaps an incomplete one, that they are using for the language they are learning. Linguists studying first language acquisition refer to the child grammar versus the adult grammar. Selinker (1972) coined the term interlanguage for the grammar of a second-language learner (which seems to differ considerably from that of a child learning his first language). Psycholinguists are concerned with how the speaker's grammar is represented in the human brain and how it might change over time during the language acquisition process.

In the present discussion, we are considering AAC-speakers without cognitive or linguistic deficits. From the linguist's point of view, someone with a true linguistic deficit has some form of aphasia or other deficit that affects their *mental* -- not physical -- ability to use and process language. From this point of view, a person with an intact grammar 'in their head,' who cannot produce language by means of speech, has no more linguistic deficit than a deaf person whose native language is American Sign Language. (See Stokoe, 1960, for more on ASL as a natural language.) We would like to be able to ascertain the nature of the *grammar* of the AAC-speaker. Does the mismatch of modality in the input and output systems affect the grammar of the AAC speaker? If so, in what ways? But we cannot even ask these questions without considering the means of representing and accessing language that is available to the speaker on their AAC

device. What an AAC-speaker is able to say with is device may differ, greatly or subtly, from what the grammar is 'in her head.'

A fundamental task for research into the intersection of AAC and Linguistics is to discover, for any particular AAC speaker, how we can differentiate the limits of the AAC system from the limits of his grammar. How would we go about testing for this? Precisely what kind of linguistic data is necessary? This is a basic question that we hope to consider.

Language Acquisition. Language acquisition is the linguistic subfield that (usually) studies first language acquisition (L1 acquisition), or how children learn their first and native language. Children across languages show some similarities in the way that they acquire their first language; within languages, some common patterns have been established for children learning the more well-studied languages. In the linguistics literature there exist very few studies of children acquiring their first language while using an AAC device (although more clinically oriented studies do exist in the AAC literature). Two studies of L1 acquisition by AAC-speakers have recently appeared, one on morphological acquisition in German (Ortloff (2010)) and one on the acquisition of subject-AUX inversion in English (Kovacs and Stickney (2012). Both studies show that language acquisition for these subjects, overall, follows a normal developmental trajectory for the languages being learned.

This is intriguing data, but these studies barely scratch the surface of fundamental questions and issues about language acquisition by AAC-speakers. Do AAC-speaking children learn language like non-AAC children or not, and if they are different, how are they different? How do mismatches in the grammar (syntax, semantics, morphology) of the production system (the AAC device) and the grammar of the target language affect the acquisition process (Stickney (2011))? Does the language acquisition process differ depending on the type of AAC system the child is using? If so, how does it differ?

One question especially pertinent to AAC-speaking children learning their first language is: How much language *production* is necessary in order for children to acquire their language? AAC-speakers may be *passive* native speakers of their language, before they acquire or learn to use an AAC device. They may have native fluency in comprehending their first language, even though they do not speak. But would that translate into native fluency in language production if there were no physical obstacles to speaking? Current theories of language acquisition differ on the relative contributions of innate knowledge versus learning. *Nativists* argue for a significant innate (and human-language-specific) component to language learning (Crain and Pietroski (2002); Chomsky (1975)). Others, including *emergentists* and *connectionists*, argue that language

acquisition depends more on general abilities that humans possess to learn from their environment (Elman et al (1996), MacWhinney (2002), Tomasello (2003), Putnam (1971)). But all agree that the ability of young humans to pick up language is remarkable, and all acknowledge that a certain amount of exposure to language at a certain age is necessary for this to happen. But what kind of exposure that should be, in terms of perception versus production, is unknown. Long-term studies tracking AAC-speaking children from a young age can help to shed light on these important questions. Experimental data from non-AAC-using children learning and exploring an AAC device would be important to have to supplement the longitudinal data from AAC-speaking children. Experimental data from AAC-speaking children would also be extremely useful. We need strategies for how to gather this data in a fun and interactive way.

Pragmatics. Pragmatics is the study of that part of linguistic communication that depends on the context of the utterance, including the time and place of the utterance, the participants and their shared knowledge, and their intent in communicating. Linguists have observed that turn-taking proceeds in conversation in a regular and orderly fashion (Sacks et al (1974)). AAC-speakers generally have a slower rate of speech than vocal articulators, so it may be a challenge to maintain or gain the floor in any conversational exchange. What sort of linguistic strategies do AAC-speakers employ to engage the interlocutor, maintain attention, or announce their turn-taking in a conversation? Video of conversations including AAC-speakers could be collected and analyzed to address this question.

The linguistic/scientific community is interested in understanding how language is developed, how it is encoded in the brain and how it is used by speakers on a day-to-day basis. AAC-speakers, with their unique way of producing language, can provide linguists with unique data. This data is invaluable for providing new perspectives on our understanding of how human language works.

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Principled Research, Engineering, and Clinical Evaluation of Speech-Generating Devices: A Proposal for an AAC Data Repository

Eric H. Nyberg III

Editor's Note: This paper represents the original seminar presentation by Dr. Nyberg, in which he focused specifically on speech-generating-devices. Following the discussions among the participants at the symposium, the database is expanded to include other kinds of AAC communicative data, for which standards will have to be developed.

Overview. This paper describes a project for an AAC language database that will require a standardized protocol for data: i) about the speech generating device, and ii) about the language used by the speaker. The AAC database will have four kinds of stakeholders (Figure 1). It will have a workflow process for the stakeholders to interact with each other, and with the database, in order to further their respective goals.

Prerequisites for the Repository. In order to create a repository that focuses on verbal communication in a natural language (e.g., English) using speech-generating devices (SGDs), it will be necessary to produce common, general ways to:

- Describe and categorize different SGDs
- Measure the characteristics of SGDs
- Exercise and assess the skills of SGD users
- Produce scientifically sound research on hypotheses about SGD and natural language use in different user populations

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*Lloyd, et al. (1990) introduced the notion of *symbol set* vs. *symbol system*. Using the current taxonomy, their symbol *set* corresponds to an SGD design with symbol sequences limited to length 1 (single symbols are used to access speech outputs), and their symbol system corresponds to an SGD design with symbol sequences of length greater than 1 (sequences of symbols are used to access speech outputs).

Stakeholder Community	Concerns	How does Repository help?	Expected Impact
AAC Clinical Community	Help clients be more effective users of AAC	Gather centralized performance data to better select SGDs and training exercises	Reduce time/cost to improve AAC use
AAC User Community	Become a more effective user of AAC	Allow AAC users to monitor their own performance data and select their own training exercises	Measured improvement in AAC communication
Linguistic Research Community	Understand language of AAC users; Create more effective AAC models	Support large-scale experimentation via exercises designed to test hypotheses about AAC communication & how to improve it	Publish new academic results regarding models/predictions made by linguistic theories of AAC communication
AAC Manufacturing Community	Create more effective AAC devices	Supports self-paced training by users of commercial SGDs; provides impartial source of feedback (performance data) from user community	Manufacturing community will be motivated to interoperate with standard data logging protocols, to take advantage of feedback; commercial devices evolve more quickly

Figure 1. Expected Impact for AAC Repository Stakeholder Groups

Describing and Categorizing Different SGDs. We are focusing on a particular type of communication: verbal communication in natural language (e.g. English) by means of speech audio waveforms produced by a speech generating device, or SGD. A speech generating device accepts a sequence of one or more physical actuations (e.g., key presses) which trigger a natural language audio output (e.g. a spoken word, phrase, sentence, paragraph, etc.). Each physical actuator transmits a unique signal or code to the SGD when it is actuated, so that each unique actuation or sequence of actuations can be associated with a distinct speech audio output. For example, consider the keys on a QWERTY keyboard as the set of actuators, each identified uniquely by the ASCII code it transmits. A simple design for an SGD could map sequences of ASCII

codes to unique speech audio outputs in English, just by having each word (speech audio pronunciation of the word) be represented by the sequence of key strokes required to spell it.

At this point we introduce two new terms: symbol and selection set. Let the selection set be the set of glyphs or images S = { s_0, … s_n } that is used to label the actuators. Let a symbol sequence be a unique sequence of one or more symbols which is mapped to a unique speech output by the SGD. Given a selection set of size n, there are n unique symbol sequences of length 1, n^2 unique symbol sequences of length 2, and so on. For example, the 26-character symbols in the English alphabet (selection set) yield 26 unique sequences of length 1, 26 * 26 = 676 unique sequences of length 2, 26 * 26 *26 = 17576 unique sequences of length 3, and so on. Conversely, if we wish to encode a vocabulary (a set of speech audio outputs) of size m, we can do so with m single symbol sequences from a selection set of size m, m two-symbol sequences from a selection set of size m1/2 , or m three-symbol sequences from a selection set of size m1/3 , and so on. This important relationship between the size of the vocabulary, the size of the selection set, and the sequence length required to encode the vocabulary in the SGD has direct implications for: a) the physical realization of the SGD, and b) the resulting effectiveness of the SGD for actual users.

For example, if an SGD is required to encode 1,000 vocabulary items, it may be impractical to design an SGD with 1,000 sequences of length 1, for this would require a selection set (and corresponding array of actuators) with 1000 symbols, which might be difficult for a user to memorize, recall and access quickly enough for effective communication. Consider an alternative design with 1000 sequences of length 2, which requires a selection set of size 100; 100 symbols can be placed on a 10x10 array of actuators, which might be easier (and ultimately effective) for the user to memorize, recall and access quickly when a particular speech output is desired.

Measuring the Characteristics of SGDs. The ease of memorization and recall are related to the mental association or mnemonic which is used to relate the visual representation of a symbol or symbol sequence with the speech output it encodes. To be effective, this mnemonic should be easy to learn and remember. The ease of access is related to the physical mobility and motor planning ability of the user. In order to input a symbol sequence to the SGD, the user must actuate a series of physical actuators. The amount of time required for a given user to actuate a sequence (and therefore produce a speech output) will depend on their motor skills and the location(s) and size(s) of the actuator(s) (Fitt's Law). Two important considerations follow: An SGD which requires fewer and/or simpler mnemonics will be easier to learn and retain; and SGDs which require shorter sequences will allow speech outputs to be accessed more quickly on average.

In (Baker et al., 2010) the concepts of symbol, selection set, symbol sequence, mnemonic and vocabulary were used to group the symbols systems used by existing SGDs into natural classes (Types I, II and III). The systems in each grouping make different assumptions about the design tradeoffs between selection set size, sequence length, and vocabulary size, with a corresponding impact on the simplicity of the mnemonics used to encode symbols and sequences. By describing available SGDs and their symbol systems using these concepts, it becomes possible for the speech-language clinician to more effectively compare different SGDs by taking into account the communication goals (vocabulary needs), cognitive abilities and motor skills possessed by a particular user. Some systems are easier to learn and access, but more difficult to extend to larger vocabularies; while other systems take more time to learn and access, but are much easier to extend to the larger vocabularies required by AAC users with intact cognition who engage in rich variety of verbal communications (at home, at work, at school, etc.) on a daily basis.

Once we have described the symbols, selection sets, mnemonics and vocabularies used by a particular set of SGDs, we can compare those using simple metrics which are user-independent and device-oriented: the size of the selection set, the size of the vocabulary, the average length of the symbol sequences used to encode the vocabulary, etc. These measurements can be made without collecting any data from actual use by real users.

Exercising and assessing the skills of SGD users. We can also measure how well a particular user is able to generate speech output using a particular SGD, by way of metrics that are SGD-independent and user-oriented. If we can log each actuation made by the user, and each speech output, we can measure the time that a particular user requires to access the symbols, symbol sequences, and their corresponding speech outputs (Hill & Romich, 2001). If we

log all of the user's SGD activity while they are engaged in a particular communication task, then a variety of automatic measurements are possible:

Symbol-related metrics. What symbols were accessed, and how frequently? What percentage of the symbols in the selection set was accessed? What was the average time required to access a symbol? What is the variance in the time required to access each symbol?

Sequence-related metrics. What symbol sequences were accessed, and how frequently? What percentage of the symbol sequences (speech outputs) was actually used? What was the average time required to complete each symbol sequence? What is the variance in the time required to access each speech output via its symbol sequence?

These metrics can be used to formulate and standardize a clinical approach for: 1) *comparing SGD designs*, in order to understand how the design choices made by a given SGD correlate with successful communication for a given client population (or not); 2) *assessing clients for potential SGD support*, by providing a statistical correlation between the assessed skill level of the client and the prospects for successful communication using a given SGD; 3) *measuring client communication ability and growth* through periodic assessment using a variety of communication tasks as exercises; and 4) *providing personalized instruction to clients* by selecting communication exercises that will help them to improve their use of their SGD, based on an automatic analysis of their current communication performance.

Producing Scientifically Sound Research. A principled approach to design and engineering of SGDs becomes possible when device-oriented measurements (selection set size, sequence length, mnemonics, vocabulary) can be automatically correlated with user-oriented measurements (throughput over time, per task, etc.) for a statistically meaningful sample of tasks and users. Since the ultimate goal of SGD development is to provide the most effective communication aid for any given user, an effective correlation between SGD design criteria and expected user performance for different user populations is a worthy goal of ongoing research. To empirically determine whether such a correlation exists, it will be necessary to gather a statistically meaningful sample of assessment tasks, with corresponding user logs and performance analyses for different devices, in a centralized repository.

Vision for the AAC Repository. We envision the creation of an AAC Data Repository, a web-based application that would support the gathering and analysis of statistically meaningful samples of SGD user communication. The Repository would store a variety of communication

exercises undertaken by a growing number of SGD users. These exercises will be specifically formulated by clinicians, researchers and device manufacturers to gather SGD performance data to be used in the development of clinical training exercises, academic research on SGD communication, and improved SGD designs. The proposed AAC Repository would address important concerns in four stakeholder groups, with significant potential impact in each community (Figure 1). Figures 2 and 3 illustrate the potential increase and facilitation of interactions between the four stakeholder groups, which the database would support.

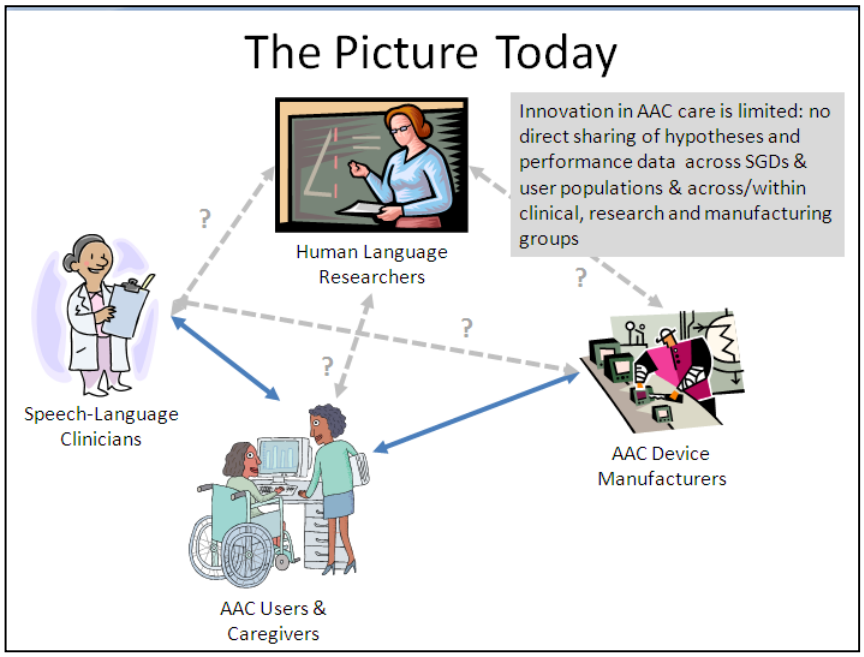

Figure 2. A vision of the situation today of interactions of the four stakeholder groups

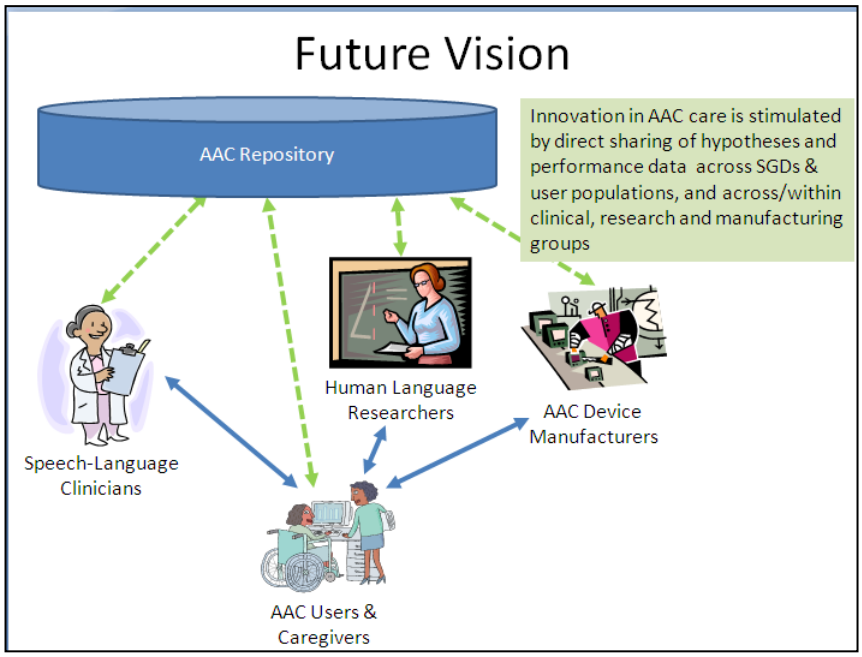

Figure 3. A future vision of the interactions of four stakeholder groups using the AAC Data Repository

Some Clinical and User Scenarios. A typical clinical scenario using the AAC Repository would involve having the user perform an assessment task (e.g., a picture description task) while logging their SGD activity. The SGD log would be uploaded to the repository by the clinician, who could then immediately request an automatically-generated report after selecting the specific measurements of interest. This would allow the tailoring of custom reports to focus on different aspects of communication performance.

The AAC Repository would also allow users to complete on-line practice tasks at home and measure their own performance. If practice tasks were created to focus on different elements of performance, then it would be straightforward to implement an algorithm to automatically suggest potentially useful practice tasks for a user, based on an automatic analysis of their performance on a current assessment task.

Next Steps. Our proposed approach is to develop a workflow and computing infrastructure that will systematize and synergize the relationships between linguistic research and clinical application of linguistic research for AAC users. This approach includes the following main steps:

1. Document the goals and needs of the stakeholder groups, and document use cases which describe how they would participate in the workflow;

2. Develop a workflow to integrate the different use cases into a single process;

3. Design and build a computing system and data repository to support sustained application of the workflow process and long-term dissemination of clinical research results.

We would like to begin with a hypothetical pilot test involving one user, one device (with LAM), and one assessment (working with associated clinician(s), researcher(s), etc.).

In our next steps we should:

- Identify researchers who wish to collaborate on research proposals based on the AACR concept
- Identify clinicians who wish to collaborate on standardized assessments for the AACR
- Identify device manufacturers to collaborate with on assessments for their devices
- Identify users who wish to participate in design and testing of a pilot system

Open Questions. We have some open questions remaining concerning:

- Privacy and data rights
- How to implement standardized logging (this may be simple in principle, but difficult in practice?)
- What user populations or devices are the right ones to start with?
- What assessment and exercises or tasks are the right ones?

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Appendix B: Proceedings from Previous Research Symposia

Brodin, J. & Björck-Åkesson, E. (Eds.) (1991). Understanding the theoretical and methodological bases of augmentative and alternative communication. Proceedings of the First ISAAC Research Symposium (Stockholm 1990). Toronto: International Society for Augmentative and Alternative Communication

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