The State of Automated Data Logging for AAC

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Acknowledgements

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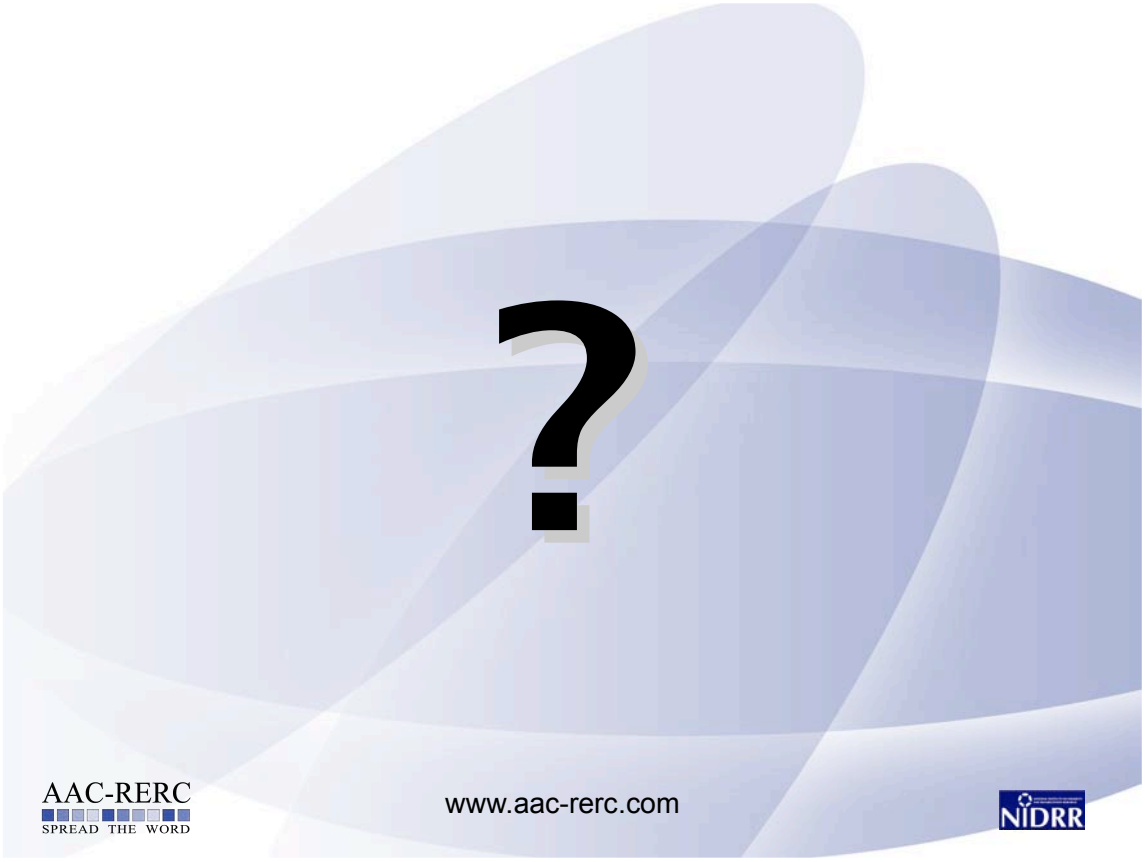
HOW DO WE DEAL WITH NEW TECHNOLOGY?

HOW DO WE EVALUATE NEW TECHNOLOGY?



Focus of Our Presentation

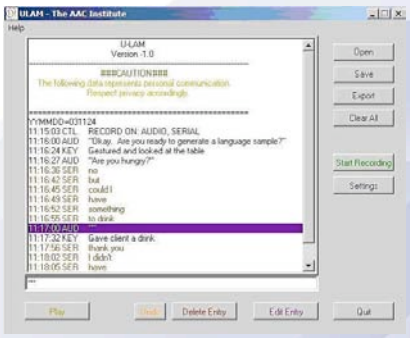
(Focus is on Practitioner Use)

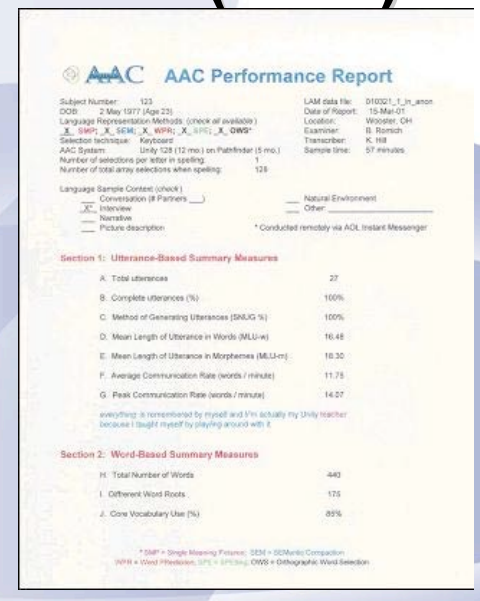
- Look at the Current State of Automated Data Logging (ADL)
- Discuss Use and Usability Specifications for practitioner use of ADL (Focus Group).
- Examine issues related to Validity related to practitioner use of ADL
- Discuss the Cost Effectiveness of ADL
- Discuss Privacy and Legal Issues Related to practitioner use of ADL

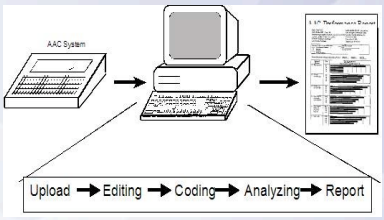
What Is ADL?

- Automated Data Logging (ADL) involves the automated collection and analysis of AAC device input / output.
- What is typically recorded:
  - time
  - selection input
  - message output
  - page
  - context
  - action
  - list of vocabulary alternates (e.g., word prediction list)

Language A Monitor (LAM)







(Lesher, Moulton, Rinkus, Higginbotham, 1998 – 2006). Universal Logfile Format, Augmentative Communication Quantitative Analysis (ACQUA) program

Logfile Name	window	Timestamp	DS_DURATION	DS_WORDS_PER_MINUTE	Net Text
S-C4. log	-1	08:08:12:46:41.3	1792.5	1.94142	No. It is more easy. Yes. No.
S-C4. log	0	08:08:12:46:41.3	0	-1	
S-C4. log	1	08:08:12:46:42.5	1.2	50	No.
S-C4. log	2	08:08:12:47:01.5	19	3.15789	It
S-C4. log	3	08:08:12:47:04.5	3	20	
S-C4. log	4	08:08:12:47:09.0	4.5	0	
S-C4. log	5	08:08:12:47:13.1	4.1	0	
S-C4. log	6	08:08:12:47:14.9	1.8	33.3333	
S-C4. log	7	08:08:12:47:16.7	1.8	33.3333	
S-C4. log	8	08:08:12:47:20.4	3.7	16.2162	
S-C4. log	9	08:08:12:47:23.6	3.2	18.75	
S-C4. log	10	08:08:12:47:27.6	4	15	
S-C4. log	11	08:08:12:47:30.7	3.1	19.3548	
S-C4. log	12	08:08:12:47:33.5	2.8	0	
S-C4. log	13	08:08:12:47:56.6	23.1	0	
S-C4. log	14	08:08:12:47:58.8	2.2	27.2727	
S-C4. log	15	08:08:12:48:07.5	8.7	0	
S-C4. log	16	08:08:12:48:09.2	1.7	35.2941	

Figure 4: An output from an ACQUA analysis.

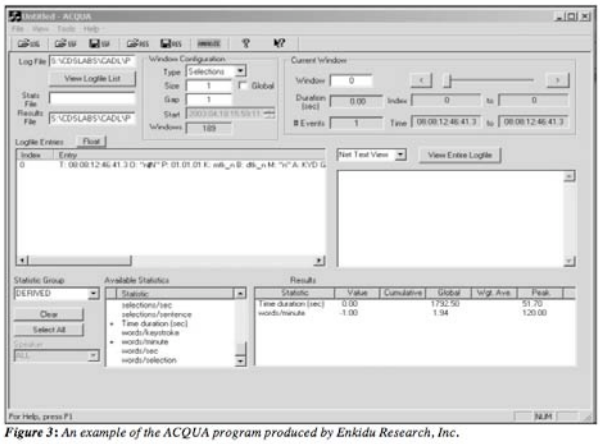


Figure 3: An example of the ACQUA program produced by Enkidu Research, Inc.

Historical Perspective

- Higginbotham used ADL (1985) to track communication device performance for his dissertation work.
- Swiffen, Arnott, Pickering, Newell (1987) used logs to track word prediction system performance.
- Koester and Levine (e.g., 1997, 1998) employed computer-assisted logging and analysis to study users' performance on word prediction and AAC access.
- Romski & Sevcik experimented with automated data collection techniques for language intervention research (Romski, 2001).
- Higginbotham and colleagues used computer-assisted logging and analysis to study the effect of augmentative technologies on interactive communication (Higginbotham, 1989; Scally, 1994; Higginbotham, Kim, Scally, Huang, submitted).
- Lesher, Moulton and Higginbotham's (1998) simulation research employed a logfile formant and automated analyses to evaluate the efficiency of a variety of augmentative selection methods.
- Katya Hill's (2001) dissertation research focused on the efficacy of using automated data logging for the collection and analysis of language samples.

Lesher, Moulton & Higginbotham (1998). Techniques for Augmenting Scanning Communication, *AAC*, *14*, 81 - 101.

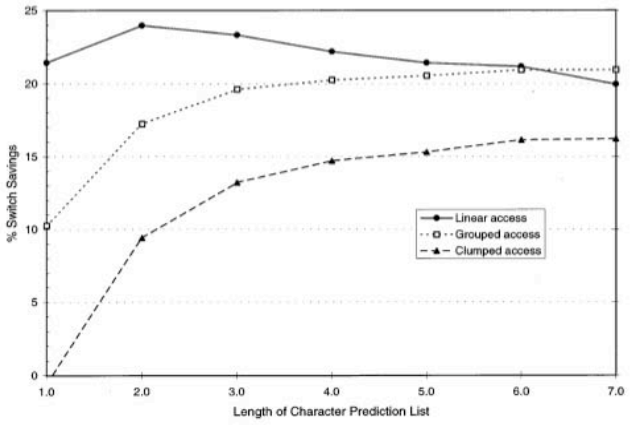
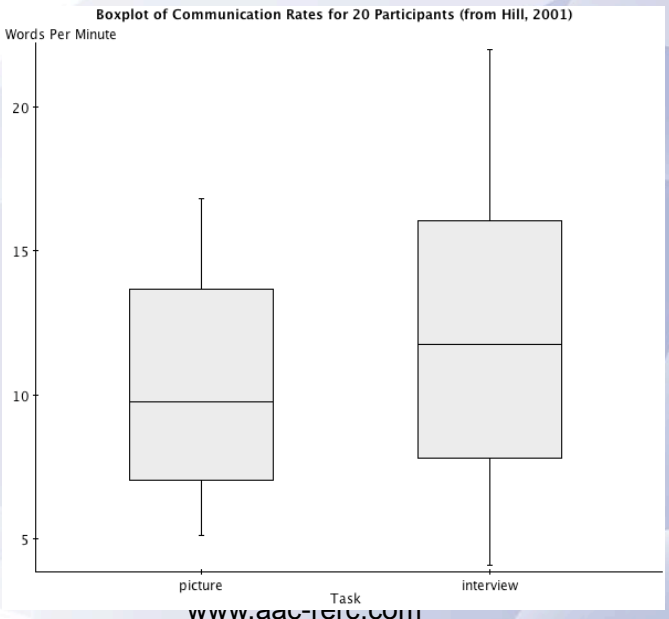


Figure 5. Switch savings as a function of character list size for the three different access methods using kgram character prediction. Data are averaged across the seven testing texts. Trends for individual testing texts are very similar to the trends of the averaged data.

Hill (2001)



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***Assistive Technology, 18*, 107 - 121.**

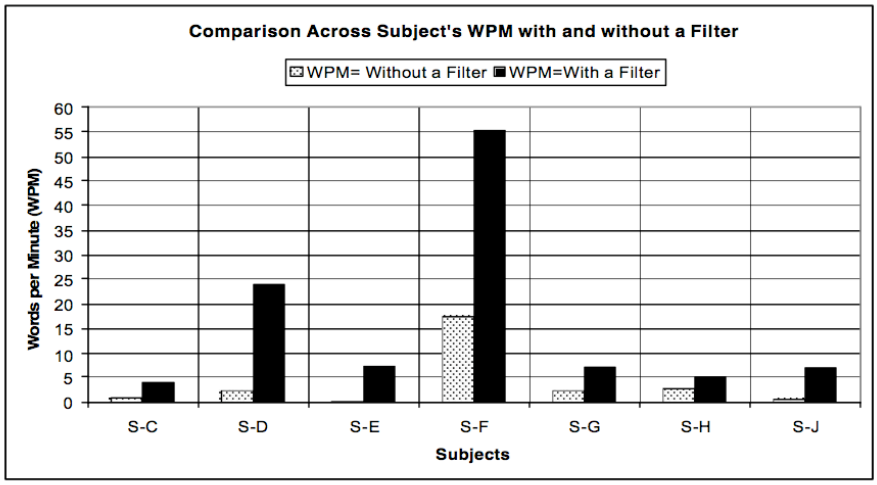


***Figure 16:** Subject comparison of WPM with and without filtering.*

Higginbotham, Kim & Scally (2007). The Effect of the Communication Output Method on Augmented Interaction, *AAC, 23*, 140 - 153.

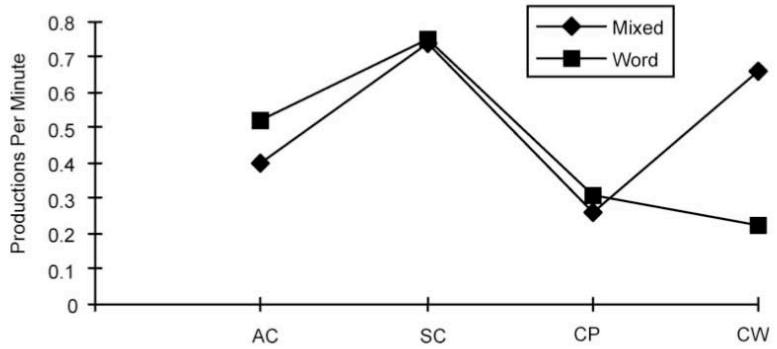
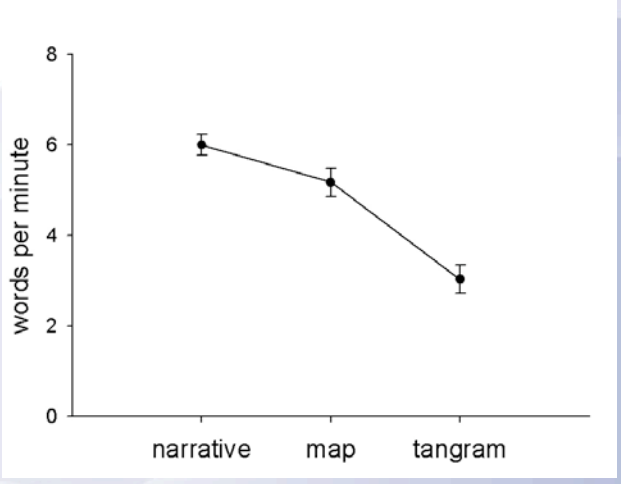


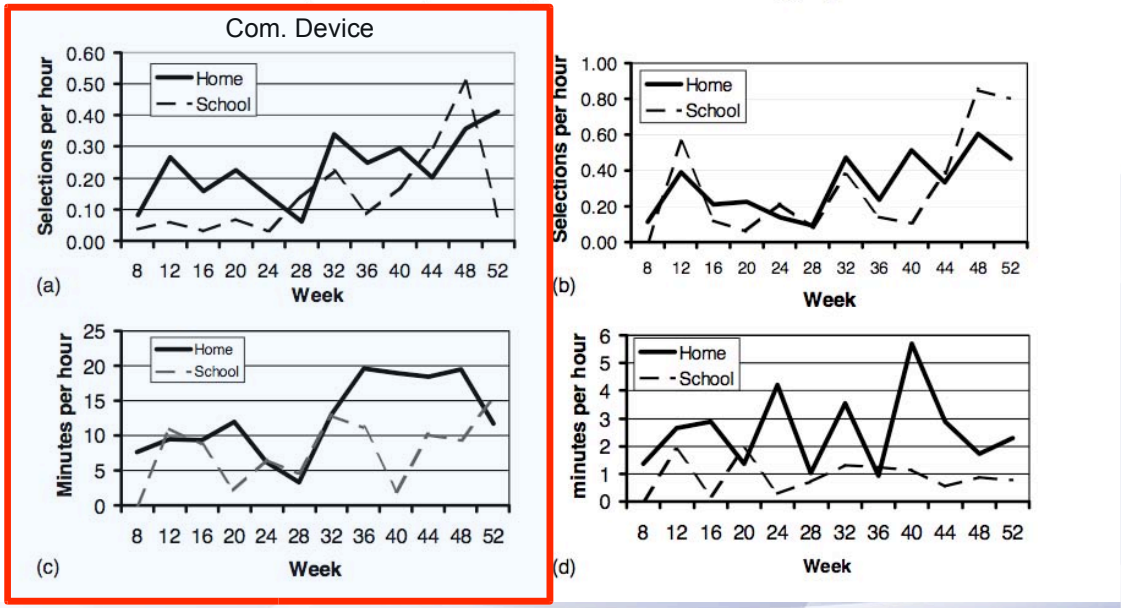
Figure 4. Mean scores of number of words per minute of the first mention of referring expressions across output methods. AC, independently produced by the augmented communicator; SC, independently produced by the speech communicator; CP, collaboratively produced phrase; CW, collaboratively produced word.

Higginbotham, Bisantz, Sumn, Adams & Yik (in press). The Effect of Context Priming and Task Type on Augmentative Communication Performance, *AAC*



Mean Number of Words Per Minute Across 3 Tasks

M.S. Hawley et al. / A provision framework and data logging tool



Final Report, Grant #R41 HD047 038-01
Automated Data Logging Tool (ADL) for AAC Practitioners
PI: D. Jeffery Higginbotham, Ph.D.

Interface Mockup

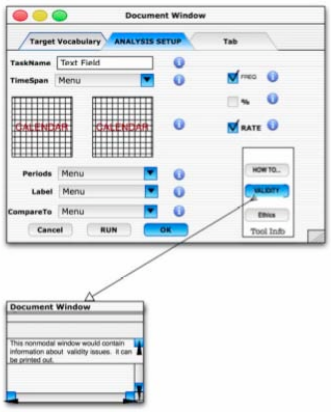


Figure 7: Analysis Setup and Validity Information Pop-Up

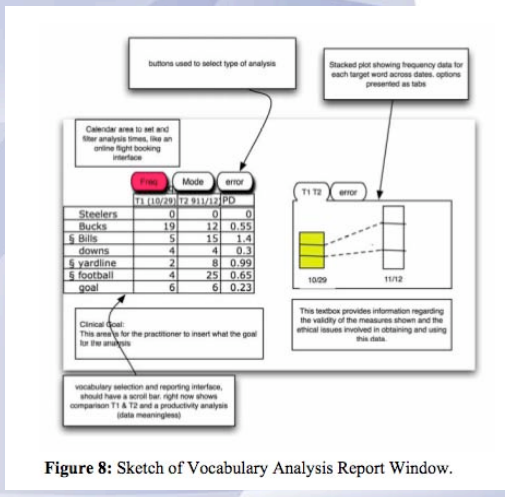


Figure 8: Sketch of Vocabulary Analysis Report Window.

What is the State of ADL?

- What validity issues have been addressed?
- Level of studies (Oxford Hierarchy)
- Dissemination venue (conference, book, internet, *research in a peer reviewed journal*)
- Cost effectiveness, practical implementation
- Potential for harm
- Has ADL fully addressed any of the areas

State of External Evidence

Non-Peer Reviewed

- 3 Book Chapters (descriptive/opinion)
- Conference Proceedings
  - 7 descriptive / opinion
  - 3 case study
  - 2 reviews
- 3 dissertations
- 1 Thesis

Peer Reviewed (vetted)

- 2 descriptive /opinion
- 5 research studies
  - 2 single case, (one with AB design elements)
  - 2 RCTs use ADL to examine device and task performance issues
  - 2 simulation studies (keyboard optimization, scanning)

Purpose of Our Study

- STTR study funded by NIDCD to determine the feasibility of an ADL tool for practitioners
  - Purposes
  - Features
  - Limitations / Caveats
  - Ethical & Privacy Issues
- Inspect measurement validity issues, focus group responses, ethical/legal analysis of existing materials

Methodology

- Face-to-face and email interactions involving 4 focus groups:
  - Practitioner – 4 SLPs, 1 Rehab engineer, 8 – 30 yers experience.
  - Scientists – 5 experts in child language, speech motor control, artificial intelligence, outcomes
  - Engineers – 4 software engineers involved in AAC, 1 rehab engineer.
  - Consumers – 4 life-long AAC users, 1 spouse, 1 individual with an acquired impairment

Methodology

- Each group was asked 3 questions with summaries and followup questions provided by the Research – PI.
  - What should Automated Data Logging Do?
  - What specific features should ADL incorporate?
  - What caveats or concerns do you have?
- Examined responses for themes (NVIVO)

What Should ADL Do?

- The ADL interface should provide a data analysis that:
  - Is meaningful to practitioners
  - Provides ***valid indicators*** of communication performance
  - Presents a guide for making ***valid conclusions***
    - adjust therapy, device content & organization
  - Minimize misinterpretation
  - Facilitates comparisons
  - Protects consumer privacy
  - Easy to use

Specific features for ADL Device

- Measurement
  - In depth word prediction analysis
  - Device use: when device goes to sleep and wakes up
  - User rating scales
  - Page use
  - Vocabulary use by time of day

Specific features for ADL Device

- Analysis
  - Provide automatic (valid) data analysis
  - All measures should have a visual component
  - Compare across contexts, devices, experience
  - Use data to tweak systems (engineers)
  - Look at message production under different speaking conditions.
  - Assess communication in daily living contexts (e.g., outside therapy settings)(practitioners)

Caveats

- Misuse of data due to ignorance. sometimes used to prove a point rather than for knowledge (e.g., proprietary agendas)
- *Tendency to draw conclusions from the data that could have some unfortunate consequences on the user.*
- *I think that the availability of such a tool will create a bit temptation for SLPs and families to jump to conclusions about devices, and a temptation for manufacturers to misuse it, and a temptation for payers to fixate on it. (consumer)*
- Need for structured data analysis the produces results, guides decision making

Caveats – Appropriateness of Measures

- Need to understand the social interaction
- Can't analyze multimodal communication
- Best used for narrative production
- Can't measure communicative intent
- Compatibility of existing data analysis tools

Ethical Concerns

- Need straightforward solutions to ensure privacy
  - password, encryption, suspend logging,
  - data stays on user's machine, doesn't become part of a medical record
- Protocols for securing informed consent
- Limiting use of logfiles by 3rd parties
- Using ADL to track practitioner performance

Privacy Concerns

- Who should have access to your data logs?
- Use of password or biometric screen
- Need for a kill switch
- Recording communication is a violation of a social contract between two people

Should ADL Have a Role in SGD Assessment?

- Discussion about ADL not limited to SLP role as *treatment provider.* Also discussed in context of SGD assessment
  - ADL discussion should be clear: it should have NO role related to SGD assessment
  - ADL should not be a replacement for any existing SGD assessment element
  - ADL should not be an additional SGD assessment element
  - No SGD funding program cares about or should care about ADL

ADL Is *NOT* Evidence Based Practice

- Evidence Based Practice is a methodology for decision making that is based on current and best research evidence; clinical judgement; and client input.
- ADL is a technique to use evidence of SGD use in clinical practice.
- Evidence based practice is used by a highway department to set the speed limit for a stretch of road; a driver watching his speech as he drives along that road is using evidence in practice

Privacy Issues

- Does the Client Own the SGD?
  - If the client owns the SGD, the client can negotiate with the SLP (or other person) every aspect of access to stored data, including no access at all
  - This includes who may access the data; with whom it can be shared; the purposes for which it can be used; whether it can be copied from the device; if copied, how long it may be maintained
- Does a School or Other Party Own the SGD?
  - If another party owns the SGD, the client has less control over who, when, and for what purpose access will be made to stored data

Proposed ADL Access Controls

- If a school or other party owns the device, a written agreement should be entered between the device use and anyone with control over access to stored data.
  - Identify the specific information that can be accessed
  - Identify the person(s) who will be authorized to review the data
  - Identify the specific purposes for which the data can be reviewed
  - Identify whether the data can be copied and stored, or must be deleted following review
  - Identify specific limitations on re-disclosure, if permitted at all

State of ADL

Validity Type	ADL Questions	Current Status	Todo
Measurement Validity	Are ADL measurements accurate? Across different devices and software?	1 study on rate measurement	Demonstrate accuracy of proposed measures (mlu, # words, etc) across platforms and software
Internal Validity	performance? How are other nuisance variables handled? How do people make us of ADL data?	no studies	Show that ADL doesn't impact on performance, account for other nuisance variables. Build ADL software to structure interpretations (based on empirical evidence).
Construct Validity	What do the measures mean?	No theory of language produced by AAC devices. All based on child language, etc., assumptions, role of multimodality in language use. *Evidence limited to descriptions*	Correlate ADL measures with other measures of language & communication ability. Deal directly with issue of single com. mode.
External Validity	Use in what contexts? For what individuals? For what tasks?	Evidence limited to single case descriptions.	
Cost Effectiveness	Is ADL more cost &/or time effective than current techniques?	Studies limited to feasibility, no demonstration of ADL's advantage over non-automated measures.	Demonstrate how ADL is more efficient and effective than current techniques.
Implementation	How can ADL be *practically* implemented? Can valid decisions be made?	Articles discussing best practice issues.	Must demonstrate how to make it work in real-world clinical settings.
Ethical Concerns	How can ADL ethical and privacy considerations be remedied?	Issues brought up, few verified, some privacy remedies developed	Privacy issues must conform to HIPPA, legal precedence.

Future Use of ADL

- Research Tool – must pass IRB for privacy and ethical concerns, peer review for validity concerns.
- Clinician tool – some evidence is suggestive, *BUT*, no peer reviewed studies indicating its validity, application to real-world situations, cost-effectiveness, practicality, or ethical acceptance.
- Need to successfully address these issues before it can be promoted as a valid and ethical approach.
- *Publish in Peer Reviewed Journals*

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This work is funded by a Small Business Technology Transfer program funded by the National Institute on Deafnedss and Other Communication Disorders (#R41 HD047 038-01) and the National Institute on Disability and Rehabilitation Research of the U.S. Department of Education, under grant number H133E030018. The opinions contained in this presentation are those of the grantee and do not necessarily reflect those of the U.S. Department of Education.

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Automated Data Logging Bibliography Categorized by Levels of Evidence and Dissemination Venue

Jeff Higginbotham, University at Buffalo

March 11, 2008

Book - Descriptive

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