Development of a Voluntary Standard Format for Augmentative Communication Device Logfiles

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ABSTRACT

The means for evaluating human-machine interaction in Augmentative and Alternative Communication (AAC) has not followed the technical advances in the field. We propose the development of a voluntary standard for AAC device logfiles. An initial approach and set of logfile specifications are proposed.

STATEMENT OF THE PROBLEM

Over the last few years we have witnessed a rapidly increasing technical sophistication in augmentative communication devices. Such achievements include dynamic and animated displays, advanced prediction engines, hybrid selection algorithms, neurophysiological access methods, and many other technical achievements. In contrast, methods for measuring these systems have not progressed at the same pace. One reason for this discrepancy is due to the lack of computerized research tools permitting the real-time analysis of human behavior and computer processes.

To date, most studies of human-computer interaction in augmentative communication are conducted either with experimental systems, or by monitoring standard AAC devices using indirect methods (1,2). Experimental systems provide precise information regarding the human-computer events, but they may not resemble their real-world counterparts in important ways. Conversely, standard AAC devices are real enough, but don't provide the means for monitoring the events required to understand and model how humans relate to and interact with the technology.

Studies that cannot be easily performed with current technologies

Pointing out several studies that currently can't be performed can best convey the current state of augmentative device assessment. Note that such investigations could have considerable impact on bettering the communication lives of our consumers. Moreover, they index a field of research, which in our opinion, is important and grant-fundable.

Development of navigational skill using Dynavox's paging system. This type of study would focus on the acquisition of an augmentative communication system. A longitudinal research methodology would be called for utilizing repeated sampling of user-device interactions in experimental and naturalistic settings over a prolonged period of time. Logging of temporal, action and location events and the indexing of content at each page/level would be required.

Performance differences related to static versus dynamic prediction lists. Different selection algorithms and vocabulary organizations may impact on an individual's performance, especially with considerable practice. This is another longitudinal study involving the collection of precise timing data in various communication contexts. Information is needed, at an event level, focusing on the temporal characteristics of the prediction list display, letter and list selection and the subsequent display of the selected information.

Real-time performance differences in semantic compaction, word prediction and dynamic display paging systems. The evaluation of real-time performance differences across AAC platforms deserves significant attention from researchers in our field. Such studies could be performed in

both the laboratory as well as the field. Here, we need to identify various system events, contextual information and accurate timing data. Further, this information needs to be sampled in a similar manner and formats - *across different manufacturers' AAC systems*.

Because of the relative size of our community and relative lack of research resources, cooperation is essential if we are to make significant advancements. The development of a voluntary standard for log files would allow the researcher, the clinician and the manufacturer to directly assess augmentative devices and user's interactions with devices. Based upon a standard logfile format, we could develop software that would enable manufacturer's to optimize the performance of their technologies, allow researchers to study how communication technologies are used, and enable clinicians to efficiently and validly assess their performance and adjust devices to suit their client's needs. In our own lab, the use of standardized logfile protocols have enabled us to automatically reduce, analyze and graph over 100,000 device-generated events in a matter of minutes.

APPROACH

Plan of Action

The standardization of a logfile protocol should involve a consensus building process involving the research, manufacturing, clinical and consumer communities. We propose that the American National Standards Institute (ANSI) be used to sponsor its development (3). The purpose of ANSI is to administer the U.S. voluntary standardization system, provide a national consensus process and to represent U.S. interests in international standardizing bodies. We have developed a website[1] to facilitate discussion about a logfile standard in order to help set a focused agenda for the ANSI Standards committee.

Content and Structure of the Logfile

It is premature to propose a standard protocol at this time; however, we would like to offer the beginnings of a workable model. There are several kinds of data that need to be included in a logfile: the current state of the system and context in which activity is taking place, the actions of the user with the device, the consequent actions taken by the device as a result of the user's input and derived measures.

State and contextual data would include information about the current system configuration (access method, dictionary employed), the current state of the user interface (e.g., page), and the message context preceding the users current action(s). Contextual data may include prediction word lists functional at the time of the selection as well as the sentence context in which a word is being spelled out. Timing information may also be considered contextual data. For example, the delay times of scanning systems may be updated periodically. Contextual data may appear as heading information or be included in the log file with each update.

User-interactions with the interface constitute another general category of behavior that needs to be recorded. Information to be logged would include the position and content of the display token being accessed. Each user-device interaction should be time-stamped. Due to the precision required to measure many user-device interactions it is recommended that timing information be recorded at a 100th of a second resolution. Temporal data should initially be calculated in terms of absolute time; other temporal measures can be derived from these data.

Device actions constitute a wide range of events generated by the AAC device in response to user input and/or other device or environmental sources (e.g., time of day). Data would include all

[1] http://www.buffalo.edu/~cdsjeff/logfile.html

navigational pointers, mode and content of information displayed, computer control commands, and timing information associated with the actuation of these events.

Derived information would include a set of intermediate calculations that can be easily handled by the device without sacrificing performance. These may include latency and duration information, determination of user errors, whether interface information has been updated, etc.

How should the data files be set up? One basic consideration is to make logfiles accessible across Unix, Windows and Macintosh microcomputer platforms. Further, data should be able to be read in, parsed and analyzed using a variety of general-purpose analysis programs. We recommend that

Software rather than hardware approach

Two approaches may be taken to facilitate data collection. As advocated by Romich (4), a hardware "box" may be attached to an I/O port to intercept output directed to the data collection device. This approach has the potential of being used across a number of different devices and standardizes the downloading of logs to the data analysis system. However, one does incur the additional expense of the data collection device, it is currently limited to 256k memory and requires the developer to develop their system to output information in parallel to its operation. This solution may be problematic depending on the amount of data output. We also recommend a software solution where the manufacturer creates and stores logfiles in the device's memory. Files can be downloaded onto the analysis platform after being collected during a communication activity. This solution overcomes the cost and dependence on an external data collection system and may overcome memory limitations.

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ACKNOWLEDGEMENTS

The authors wish to acknowledge support from the National Institute on Disability and Rehabilitation Research of the United States Department of Education under grant #H133E980026. The opinions expressed are those of the authors and do not necessarily reflect those of the United States Department of Education.

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