AN AAC USABILITY TOOLKIT

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Why evaluate device use?

Many AAC devices utilize complex user interfaces, designed to perform a wide variety of communication, programming and computer control functions. While there is no single development approach, AAC device user interface development is usually guided by hardware and software designers, educators and clinicians, then tried out with expert AAC users who provide feedback for developers. Much less frequently is the design process iterative - where the device use is studied as individuals attempt to program and/or communicate with these devices. One of the problems is the lack of appropriate low cost usability tools for AAC design.

Over recent years a variety of cognitive processing models have been developed, each taking a common processing cycle and recasting it into a new task domain: technology use, language production, language comprehension, social interaction (e.g., Clark, 1996; Brennan, 1998; Norman, 1988). These models have been used to describe performance as well as locate sources of performance error. Norman (1988) provides a basic example for the cognitive cycle functioning during our use of everyday objects in our environment: Form a goal-> Form an intention -> Specify an action -> Execute the action - (then) - Perceive -> Interpret -> Evaluate outcome.

The AAC-UT consists of two tools for describing and evaluating the sufficiency of AAC interfaces as they are being used for communication and device programming. The AAC-UT provides a set of evaluation criteria to help the researcher/designer describe device use problems, and to specify the point in the cognitive action cycle that the problem occurred, probable causes, ramifications of the problem and the types of support present or absent during the specific event.

Version 1 of AAC-UT utilizes a Microsoft Access database to catalog information about the potential usability of a particular software interface component or specific goal-directed use of the application (e.g., construct an utterance using the keyboard).

Implemented on an open source video annotation program (ELAN), AAC-UT provides the research/designer the ability to specify events in a audio or video file of interest, code and comment upon that event, search for similar events, and output a record of the transcribed video for further analysis or report writing.

Functional Characteristics of the AAC Usability Toolkit

- Identify and segment specific user-device events from one or multiple video sources.
- Annotate and code events according to a variety of descriptive and evaluative categories dealing with device use and user error. Codes may be added to, or substituted with other codes on the Elan system.
- Results may be exported as a tab-delimited text file consisting of the code categories, notes and time onset, offset and duration information. These data may be opened in a spreadsheet. These results may be shared with device developers providing specific information about the usability of their products.

References

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Elan may be downloaded free of charge at: <u>http://www.lat-mpi.eu/tools/elan/</u>.

The AAC-UT codes and code definitions for Elan may be downloaded from: <u>http://aac-rerc.psu.edu/index.php/projects/show/id</u>

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AAC-UT Version 1

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		mend to be able to thake abbrevs on the sty.						
		The interface and sequence works well						



Version 1 of the usability toolkit was focused on describing and evaluating AAC software features and operations. The evaluator typically inspects the software, and analyzes its potential for producing errors based on his/her own experience. A graphic of a particular user interface feature can be stored in each record. A report can be generated for each software evaluation and sent to the developer.

AAC-UT Version 2

Version 2 of the usability toolkit focuses utilizes ELAN – a free software tool for creating complex video and audio annotations (<u>http://www.lat-mpi.eu/tools/elan/</u>).

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File Edit Annot	ation Tier Type Searc	n View Options Window	Help					
	A CHANGE C				 Error Nr Annotati Software 3 Did not ci 4 Al ceils 1 5 No ceils 1 6 No blank 7 User forg 8 Control co 	Grid Text Subtitles	Audio Recognizer Video Recognizer Metad speech output is not running in conjunction with software. tivate same cell. (e.g., p-o- blank cell- o-1) ds with double letters to be easily entered into the system no delete all key programmed le activation activating between two similar letters (e.g., p-o-o-l)	Itata Controls Begin Time End Time Duration 0:03:16.760 00:03:25.360 00:00:06.600 0:00:32:5.400 00:03:46.400 00:00:06.400 0:06:29.780 00:06:29.200 00:00:14.460 0:06:48.460 00:06:52.920 00:00:15.400 0:07:76.360 00:06:80.860 00:00:16.460 0:07:75.4360 00:00:08:08.680 00:00:16.120 00:11:56.740 00:12:360 00:00:01:2.360
	00:06:31.280	Selection: 00:06:30	0.460 - 00:06:31.560 1100 ← → ↓ ↑ Selection N 00:06:45.000 00:06:50.000	lode Loop Mode	0.000 00:07:05.000	00:07:10.000 00:07:15.0	00 00:07:20.000 00:07:25.000	00:07:30.000 00:07:35.000
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[1] — Recovery [12]	Eas, Easy Ea	sy Easy Easy	Eas Very Dif	ic,				
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France L Baselin	Very likely		Very likely				Very likely	

Error Like	elih Very likely			very likely	Very likely
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- Obvious	yes	yes	yes	yos	??
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Learning	So CMM professiona	CMM professional k	CMM professional knowl	CMM professional k	CMM professional knowledge
L-Note					
1 10					a la la

ELAN provides a means of annotating (transcribing, commenting, coding) user activity recorded from multiple video and audio sources. The length of the event, action, error and learning annotations reflect the amount of time each was observed to occur. The figure above shows the analysis of the errors made by an individual attempting to program a keyboard display on a prototype technology, using the AAC-UT protocol. Any event may contain multiple actions, errors or instances of learning. The figures below display the coding hierarchy (left), which can be collapsed or expanded. Codes appear in a drop down menu which can be selected using a mouse (middle). Once coded, the transcript can be output in a variety of ways, included tab-delimited text, amenable to analysis using a variety of software. The transcript (right) displays the event label, time codes and the content of each annotation.

These data can be used to provide quantitative and qualitative summaries of user performance, or selectively compiled to illustrate a particular user-device problem. Currently we are exploring ways to use the report capabilities of ELAN as subtitle input to illustrate user problems directly on video.

A W			- n		1000 100 100 Web 100	
1			1 Туре	Onset (ss.ms)	Duration	Behavior
P			2 default	17.76	2.53	\$\$\$\$\$
- Funnt	00:06 30:000 00:05:35:000 00:06:40:000 00:06:45:000 00	06:50.000	3 Event	198.76	6.6	event
191	Attempting to type words with double letters, or activate the same cell in sequence multi-	complete/inappro]	4 Error	198.76	6.6	
101						Prompt box pops up to indicate character limit has been exceeded in
₱¬ Action	Cick Cick Cick Cick Cick Cick	pokin Activate cli	5 Event	211.54	14.48	primary software being used.
[30]						Software for composing message and producing speech output is not
E mart Tama	here here here here here here here	ning / setting on	6 Error	211.54	14.48	running in conjunction with software being used to input selections
Event Type	and and and and and a	had a second co.	7 Error Stage	211.54	14.48	Intrepret System State
1-1	and all all all all all all all all all al	transferred inter	8 Error Source	211.54	14.48	Lack of visible guidelines
- Feedback	abs, abse, abser, absers, absers, abs, at	psent immediate	9 Error Cost	211.54	14.48	info loss
[19]			10 Error Likelihood	211.54	14.48	likely
			11 Action	213.94	1.7	Cont. Typing
	and the second se		12 Action	217.7	2.52	User asks to go on
141						Attempting to type words with double letters, or activate the same cell in
Protection	and a second sec		13 Event	389.78	18.68	sequence multiple times (e.g., p-o-o-l)
[1]	Eas, Easy Easy Easy Easy V	ary Dif Very Diffic				Did not click in separate cell before trying to reactivate same cell. (e.g.,
	All and a second a second as second as second as second as a s	Second Construction of	14 Error	389.78	18.68	p-o- blank cell- o-l)
Recovery			15 Error Stage	389.78	18.68	Intrepret System State
[12]			16 Error Source	389.78	18.68	Functions inconsistent with model
A Note	Did not dick in separate cell before twing to reactivate same cell. (e.g., n.g. Mark cell A/	I calls have a fund	17 Error Cost	389.78	18.68	Additional steps
[0]		Contraction of the local division of the loc	18 Error Likelihood	389.78	18.68	Very likely
	Internet Control Control	ant an Intention	19 Action	390.46	1.1	Click #1
HT Error	energies of second	ALL BLI STREET	20 Action	392.58	1.32	Click #2
[0]			21 Action	394.88	1.46	Click #3
Error Stage	Lack of visible guidelines	her	22 Action	397.66	1.86	Click #4
[7]	too many choices (large decision space)		23 Action	401.56	1.64	Click #5
	Functions inconsistent with model	Iditional steps	24 Action	405.9	1.18	Click #6
Error Source	These has no model in match action		25 Action	408.42	0.04	Instruction from observer
1,1	We has no mode to match action	ary likely	26 Event	408.46	4.46	Incomplete/inanorogriate instruction
Error Cost	Operations are unfamiliar a		27 Error	408.46	4.40	All cells have a function/no blank cell
[7]	User forgets information +		211 Error Stane	408.46	4.40	Form an Intention
		100	20 Error Source	408.46	4.40	Other
Error Likelih	It is uncommon to I User moves selector User spends longer amo IH	lidenu fies one cell unabil	20 Error Cost	400.40	4.40	Additional store
111			30 Error Cost	400.40	4,40	Monitorial steps
E Note	Lans Lans Lans Lans		31 Error Likelihood	408.40	4,40	Leokies for unergenerated cell
[1]	Non Non Non Non	*	32 Action	908.52	1.9	Looking for unprogrammed cell
	has block or Back by Back and Back	ink on flank	33 Action	410.5	2.42	Activate clear box
Learning	Some Denk of selan Denk of selan De	rik or sash	24 6	400.40		Accempting to type words with double letters, or activate the same cell in
141			39 Event	437.62	15.4	sequence multiple times (e.g., p-o-o-i)
Obvious	CMM professional K, CMM professional knowl, C	MM professional k	35 5	122 62		No cells have been left for activation to allow words with double letters
[7]			35 Error	437.62	15.4	to be easily entered into the system
			36 Error Stage	437.62	15.4	Percieve System State
- User Guidan			37 Error Source	437.62	15.4	Functions inconsistent with model
[11]			38 Error Cost	437.62	15.4	Additional steps
- Learning So			39 Error Likelihood	437.62	15.4	Very likely
[7]			40 Action	437.66	3.76	User states "here we go again"
			41 Action	441.48	2.38	p-"o" added to sentence; observer instructs to activate blank cell
L-Note			42 Action	445.86	1.92	Activate "blank box"

Describing and Analyzing Device Use / Error ACTION DESCRIPTION

These following are primarily low-inference, descriptive categories, providing contextual information about the type of activity, state of the system in which the error occurred.

<u>Event</u> – A description of the general activity that the device user is currently engaged.

<u>Description of Problem (Version 1 only</u>) – The description of user and device actions are described using a performance grammar developed for the toolkit (See Version 1 figures).

<u>Event Type</u> – The general activity that the user is performing (selection sequence, typing / prediction, programming, setting controls, initiating output, pointing.

<u>Feedback</u> – what types of feedback does the user receive in response to his/her actions (immediate, delayed, absent, appropriate, obtrusive, inconsistent).

<u>Warning</u> – What type of warning did the user receive indicating a significant change to the system (various graphic, auditory signals, changes in system state)

<u>Protection Against Devastating Process</u> – If the user action could result in a loss of data, shutdown, damage to the device, etc., what was the specific warning produced by the device alerting the user to this situation (Single Warning Cancel/No Cancel, Multiple Warnings, lockstep sequence, auditory siren, spoken message, text message, graphic warning, key click, none, other).

Ease of Crash Recovery – The degree to which a system can be restored (easy, difficult, very difficult)

LEARNING

These categories have to do with ways that the user could understand the event. What resources are available to the user, how is it presented. The following categories provide the background upon which the user is expected to use to complete a task. Filling these categories out requires a moderate level of inference / interpretation of the event by the evaluator.

Obviousness - Should the process be obvious to the user (Yes, No, ??, N/A) ?

<u>User Guidance</u> - what types of cues are being used to inform or guide the user when engaged in the task at hand (click, tone or beep, text deletion, color change, change in button outline or thickness, insertion of graphic element, synthesized speech output, thermometer, window appears/disappears, menu appears, disappears)?

<u>Sources for Learning</u> - ways in which the user can or could learn about this system:

- mental model based on common knowledge
 help menu
- mental model based on professional knowledge
- mental model based on software knowledge
- spoken (explicit) prompts

- inferred actions
 - memorization required
- no information provided

ERROR

In this section, the specific error made by the user, or problem that occurred is explained in detail enough that to provide support for the developer to minimize its chances for occurring on a repeated basis.

Error Stage - Based on Don Norman's (1990) task-action cycle. Use these categories to determine what point in someone's cognitive activity can the error / problem be located:

- · Forms goal determines the desired outcome of his/her actions
- Forms intention the user has a plan to accomplish task
- Specifies action the user to accomplish intention
- Executes action the user to accomplish intention
- Perceives state the user perceives response to his/her action.
- Interprets state the user understands meaning of response
- Evaluates outcome the user appraises response in terms of user's goals

<u>Error Source</u> – The specific user-device context contributing to the specific user error.

- Lack of visible guidelines the application provides little visible guidance or constraints that would facilitate decision making
- Too many choices there are too many choices to make an a given time.
- Functions inconsistent with user model the functions of the technology do not conform with the advertised model.
- User has no model upon which to base decisions the user has not model of the system to use to inform decision making
- Operations are unfamiliar the user is unfamiliar with the operations of the technology
- User forgets information

<u>Error Cost</u> - Deals with the consequences of the error made by the user (additional steps, information loss, device shutdown, program crash, damage to device, can't access device, other)

Error Likelihood - the probability in which this error would happen during the operation of this technology.