

**High Usability Software for Outpatient Data-Collection
and Health Education**

by

Nadeem Abdelmagid Mazen

Submitted to the Department of Mechanical Engineering
in Partial Fulfillment of the Requirements for the Degree of

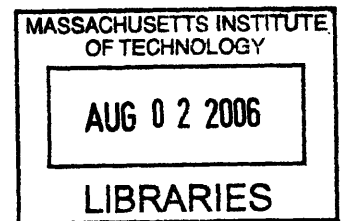
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Abstract

TechThesys is a web-deployable data-collection application intended for outpatient clinics. It was programmed in Flash and integrates visual crispness, video, voice-prompts, and clear user-flow towards high-usability across all user levels of computer-savvy. Informal usability feedback shows that the first version of TechThesys is a success among users new to computer technology and that the application is at least acceptable to more versed computer users. Some glitches and design flaws exist to be corrected in the next version of TechThesys. Users at all experience levels found themselves contributing personal information with TechThesys, motivated by the strong sense of security that it instilled.

Thesis Supervisor: Peter Szolovits
Title: Professor of Computer Science

Dedication

For my Father and Mother who instilled in me the will to succeed and who saw me through every step of the way—who made sure I had everything I needed to excel, most of all their love and support.

For my sister who will make all of this hard work look like a piece of cake when it is her turn.

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TechThesys:

High Usability Software for Outpatient Data-Collection and Health Education

Introduction

Some of the first research into medical informatics came rather early on in the public life of the computer when Slack et. al. published research into computer-based patient-data collection in 1966.¹ Early on, the field was limited by the cost of computing systems and by what is today termed “poor usability” of those early systems.^{2,3,4} Since then, there have been sharp decreases in the cost of hardware and notable increases in the usability of software. Also, with the proliferation of information-technology and with the emergence of the internet, there is now a “critical mass” of public familiarity with standard computer interfaces. Despite the purported benefits of computer based information collection and “the paperless office,” outpatient clinics and other medical environments have been slow adopters of technology. Computers have only entered into today’s clinics in a secretarial role. Doctors, nurses, and patients still spend a great deal of their time in the clinic filling forms, detailing records, and analyzing images. Computers have done very little to streamline the average clinic visit—let alone to improve patient

¹ Slack W et. al. A computer-based medical-history system. *N Engl J Med.* 1966;274:194-8

² Mayne J, et. al. Toward automating the medical history. *Mayo Clin Proc.* 1968; 43(1):1-25

³ Weed L. *Medical Records, Medical Education, and Patient Care. The Problem-oriented Record as a Basic Tool.* Chicago, IL: Year Book Medical Publishers, The Press of Case Western Reserve University, 1969.

⁴ Williams C, et. al. Usability of a Computer-assisted interview System for the Unaided Self-entry of Patient Data in an Urban Rheumatology Clinic. *J Am. Med. Inf. Assoc.* 2004; 11(4):249-259

care, patient comfort, information-gathering efficiency, or patient education in the waiting room.

This thesis presents TechThesys, a system designed to collect health-data directly from patients at the point of care. In particular, the following review and analysis focuses on TechThesys design decisions, implementation, functionality, and usability-testing results.

TechThesys integrates video into an unthreatening user interface in order to establish an emotional connection between the patient and the application and audio prompts are provided to direct and reassure users who are unfamiliar or uncomfortable with the technology. Data collection centers around information the patient is expected to know: biographical data such as age and gender and personal health information such as allergies and current medications. Sensitive information regarding possible health-risk behaviors is also collected, as research shows that patients may be more open and health-care providers more comfortable with computerized (rather than face-to-face) retrieval of this information. Currently, sensitive questions are integrated into the flow of the application in the form of questions on smoking-habits and the CAGE alcoholism assessment.

The question-flow presented by the system is specified dynamically by an external XML document and TechThesys should therefore be relatively easy to adapt to other situations and emerging health-data sharing standards such as HL7. The challenges involved in meeting these standards are mostly a matter of the primitive parsing of XML documents in Macromedia Flash, the program in which TechThesys was developed.

These issues will be discussed and elaborated upon in the thesis. Appendix A lists the code that implements TechThesys, where each frame in the code controls a stage in the patient's progression through TechThesys. The standard survey questions asked to test-users of TechThesys is in Appendix B. A transcript of the verbal prompts that accompany each stage of the progression through TechThesys is contained in Appendix C. Appendix D is the XML document used to generate the question flow, and is a suitable template with which the application can be custom tailored for particular clinics' needs. Appendix E is the polite phrasing of a preface to very sensitive health-behavior questions. The preface was not incorporated into TechThesys, rather it demonstrates how survey-makers and clinicians may approach tough questions through an emotionally sensitive video appeal.

Background

Recent literature agrees that modern technology is poised to streamline patient care, improve patient comfort, and facilitate better treatment. Unfortunately, even with recent advances, adoption of technology across most health-related settings has been slow at best. Researchers have suggested myriad reasons why technology hasn't already merged with the doctor or the patient workflows in outpatient clinics; among the most popular explanations for lagging technology adoption are poor usability, lack of patient comprehension, credibility concerns, ethical concerns, and lack of momentum.^{5,6,7,8}

⁵ Jimison H. The Use of Multimedia in the Informed Consent Process. *J Am. Med. Inf. Assoc.* 1998; 5(3): 245-256

⁶ Kaplan B, Brennan PF. Consumer Informatics supporting Patients as Co-Producers of Quality. *J Am. Med. Inf. Assoc.* 2001; 8(4): 309-316

⁷ Wagner T, Jimison H. Computerized Health Information and the Demand for Medical Care. *Value in Health* 2003; 6(1):29-39

Tied to these explanations are the authors' specific and general guidelines for improvement. Much of the time, these guidelines are a cookbook for better technology. For example, Sittig et al. outline a method for verifying technology usability, which includes reviews, interviews, focus groups, design scenarios, and other feedback mechanisms.⁹ Other researchers present data and pose clinical-informatics "do's and don'ts." This is the case with Wagner and Jimison who conclude, among other things, that many recent health-informatics studies correlate health knowledge with health-information use, and correlate increasing availability of knowledge with better care, which is inappropriate at best. The authors suggest that doctors will play a lead role in validating technology and in encouraging effective patient use of health technology and online information.

TechThesys implements the advice of informatics researchers, clinicians, and end-users, towards a high-usability, ethically sound program, which will be valuable to doctors and patients for its educational content and data collection capabilities.

Materials and Methods: Preliminary Design Choices and Flash

Flash: Programmability, Animation, and Server Communication

The aim for TechThesys is to provide a quick and easy interface for patient data-collection. Macromedia (now Adobe) Flash was chosen for its overall flexibility in creating a clean User Interface (UI) and for its relatively straightforward coding environment. Flash employs built in functions for navigation in time (through keyframes) and space (the presentation area) and integrates these into a full-fledged language, called

⁸ Gustafson D, et. al. Consumers and Evaluation of Interactive Health Communication Applications. Am. J. of Prev. Med. 1999; 16(1):23-29

⁹ Sittig et al. Techniques for identifying the Applicability of New Information Management Technologies in the Clinical Setting: An Example Focusing on Handheld Computers.

Actionscript 2.0. Actionscript is somewhere between a markup language and a programming language and bridges the worlds of data manipulation and visual elements, integrating them into the data stream and the user experience. Actionscript reads much like C++, but with a few shortcuts; it is therefore a quick learn for computer scientists or for artists with any proclivity for mathematics. Therefore, and due also to the time scale available to this project, Flash was foremost among a very few alternatives for the construction of TechThesys.

Flash was considered also for its execution of animation. Non-essential animation in serious programming (especially when associated with web-design software such as Flash) has earned the hatred of computer programmers and end-users alike. However, to the extent that Flash emerged as part of the “include motion whenever possible,” .gif-happy computing culture of the mid-90s, Flash software and its users have also matured and Flash animation is being utilized to visual and practical benefit. Even so, most serious software developers have stopped short of exploring the emerging space for Flash in software design, to the detriment of user experience in fields such as bioinformatics. TechThesys is a first step in remedying this oversight.

Flash’s handling of PHP variables and its ability to post to PHP scripts is straightforward and so, with a view towards posting patient data to a MySQL server (through PHP) during data-collection, Flash emerged as the only complete solution for the front end of TechThesys. On the backend, PHP scripts are used to load variables from medication and dosage databases into TechThesys and to save patient data to a MySQL database.

A Feasible Alternative to Flash: Smarty Template Engine

Based on doctors' responses to design scenario descriptions, it was clear very early on that a web-deployable application would be preferable to traditional software, which would likely require computer know-how for installation or possible future home-login. Thus, the software of choice for TechThesys was narrowed to two: Flash and Smarty.

Smarty is a template engine written in PHP for the dynamic generation of HTML content. It is intended specifically for improved presentation over simple html or javascript applications and also includes features for business applications. Smarty was considered as a serious alternative to Flash for the construction of TechThesys for its clean, standard interface. The layout is inevitably conducive to information dense pages and Smarty applications are reminiscent of professional webpages—thus they are immediately familiar to the internet savvy. Ultimately, Smarty was passed over for its unwieldy organization. To preserve abstraction and modularity, the actual Smarty code-pages behind the UI sprawl out over an unacceptable number of folders and files. At times, the organizational requirements presented by Smarty consume any possibility of quick and creative coding and move the development-focus decidedly from user-satisfaction to technology management.

Medical Practitioner Input and End-User Survey

Sittig and coworkers suggest myriad methods for thorough analysis of medically-oriented software, including: literature reviews, design scenarios, paper survey, focus groups, and so on. Literature review was conducted as indicated by citations throughout the present report and went a long way in establishing some of the practical benefits of

the features of Flash and other design software under consideration. Design scenarios were implemented informally as an initial measure prior to the construction of TechThesys: the advice of doctors and medical practitioners was obtained in reaction to a verbal description of the vision for TechThesys and its several components and functions. Given the scope of this project, statistical surveys were not considered. However, verbal surveys (Appendix B) and observational analysis of end-user interaction with TechThesys proved invaluable.

Audio and Video

The emergence of low cost camcorders has enabled the extensive use of video in teaching programs and other digital media. However most software, and in particular most medically oriented software, fails to take advantage of the emotional advantages conferred by a human introduction to a given set of tasks. Lack of human interaction in software also explains how a program or technique may be popular during usability testing, where there is a real person administering the service and then may fail upon launch due to the coldness of the technology or dullness of the tasks it presents.

Unfortunately, well-integrated video is a facet of TechThesys where cost is not a trivial matter. In order for video to overlay Flash content seamlessly, it must contain an alpha channel, for which Flash has its own video encoder and internal methods. However, in order to produce video that Flash can encode, green screening and an appropriately color-sensitive camera is necessary. TechThesys video was shot over green screen with the Panasonic AG-HVX200 onto Panasonic P2 cards, keyed with Apple Shake, and encoded with Shake and Flash. All told, this requires an investment of approximately \$13,000 (or several hundred dollars a day to rent).

The same camera, given its high quality, 4-channel audio inputs, was used to record audio with the Audio-Technica AT815b Shotgun Microphone.

Procedure: Construction and Testing of TechThesys

Design Choices: Emotional Appeal

...the Hitch Hiker's Guide has already supplanted the great Encyclopedia Galactica as the standard repository of all knowledge and wisdom, for though it has many omissions and contains much that is apocryphal, or at least wildly inaccurate, it scores over the older, more pedestrian work in two important respects. First, it is slightly cheaper; and secondly it has the words Don't Panic inscribed in large friendly letters on its cover.

-The Hitchhiker's Guide to the Galaxy

The TechThesys introduction consists of a brief video, where a spokesperson introduces the program: what is to come, what changes and improvements might be seen in TechThesys in future generations, and reassurance that questions may be personal, but that reason for this is medical accuracy. The video is a key component of TechThesys and its success in engendering patients' emotional interest in data-collection will be discussed in detail in the Results section. The brief commentary on "future directions of TechThesys" foreshadows other commentary on ongoing testing that is present in the closing "Thank you for participating" verbal prompt. As with the video introduction in general, this "future directions" aspect serves to co-opt the user as a partner in development—as more than simply a passive element in the TechThesys implementation and testing. The assumption throughout is that each additional step taken to draw a user in emotionally will show an added return in the user's attention-span and willingness to volunteer personal information.

Most buttons throughout the program are large and friendly. Button-corners are rounded and, when possible, an illustrative icon (a question mark, red x, check mark, plus sign, etcetera) accompanies button text. When new buttons or tabs become activated for a

particular question, the newly activated button or option-region will “fly” into view, calling the user’s attention to that region of the screen. The fly-in is quick enough to avoid distracting the user while still being useful (as an almost subliminal) attention-getter.

Early on, users are given a simultaneous verbal and textual prompt to choose between two levels of familiarity with computers: “New to computers” or “Experienced.” Users who choose the former are given a verbal prompt at each new question (Appendix C). The phrases are not custom tailored to each question, but rather to the *type* of question being asked, communicating to the user what kind of response is expected (multiple response, single response, text entry). This is in order to provide the user enough instruction to proceed quickly through the question, while still simulating a dynamic doctor-created set of questions for which the doctor has not personally recorded an audio prompt.

Unique Design: Video

TechThesys begins with an alpha-layered introduction video consisting of a human spokesperson whose form is integrated into the background of the data-collection device itself (figure 1).

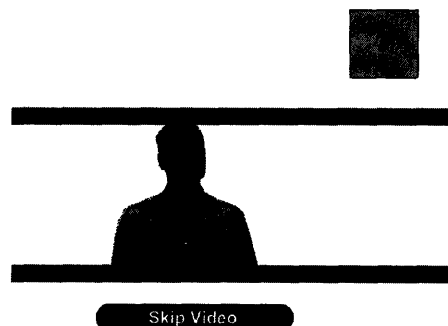


Figure 1. TechThesys First Impression: Spokesperson Introduction

Thus, the data-collection spokesperson is at once a part of the new software and also the user's world. Then, the spokesperson bridges the gap as he personally and explicitly invites emotional connection and patient participation. Users who identify themselves as "New to computers" are shown an additional video (which they have the option to skip if they are bored with introductions), which assures them that they are ready for TechThesys and encourages them to listen to the verbal cues and to click the question mark for help.

Design Choices: Question Content and Experience Customization

Before the construction of TechThesys, doctors and bioinformatics researchers gave input regarding the best method for customizing the TechThesys patient experience. Based on these suggestions, TechThesys implements an XML input function that parses a tagged file and assesses each question's type, cataloguing its responses for future display and, depending upon the question type, noting the mode in which responses may be selected. Thus, the types of questions and responses are completely customizable to the needs of any individual clinic or implementer of TechThesys. (See Appendix D for a sample XML input file.)

XML was chosen as the question customization format mainly because it presented the greatest challenge for integration into the Flash data stream. As such, successfully implementing XML on the timescale of this project is something of a proof-of-concept for the full range of more easily-integrated non-XML options (such as plain-text input or the use of static stock-questions). The challenge behind XML input is that Flash only provides for the firstNode and childNodes operators, which, as the name

suggests, makes finding information in a file the matter of some guess work, lots of recursion, and lots of trial and error. This is far more involved than, for example, querying a question database with a set of clinic-defined question-keywords and inputting the resulting question text one question at a time. This database alternative would likely use a combination of PHP and clear text, both of which are handled much more simply in Flash than XML.

XML is also particularly useful as a data input method given the trend of medical data standardization that is collecting around XML data. Health Level 7 (HL7), a non-for-profit organization that coordinates health-care standards, recently moved to make a standard for XML-based medical data. As the effort continues, TechThesys will be poised to send and receive medical messages and share medical information with standard databases and other applications.

Feedback Survey Procedure and Participants

End-user surveys were informal and the observational feedback was just as valuable as the verbal feedback. Two types of users were surveyed, those with only a basic introduction to computer use and the “tech-savvy.” For the basic group, five recent participants from the Families Accessing Computer Technology (FACT) program volunteered to use the software. Within the FACT group, one of the participants was a recovering stroke victim, suffering from reduced vision, Ataxia, and extremely impaired mobility. For the tech-savvy group, MIT undergraduates were surveyed indiscriminately. A standard set of questions was asked of each test-user in addition to unscripted questions and comments.

An alternate form of the thesis software was created for tablet PC, with a virtual keyboard integrated into the TechThesys project and visible on screen. Due to time constraints, this version saw only limited user-testing. Based on the limited feedback that was obtained, it was shown that the stylus did not diminish or improve ease-of-use for able-bodied participants. It is important to note, however, that the recovering stroke-victim declined to test the stylus, citing his lack of mobility and current frustration with pen implements.

Results

Creativity and Implementation in Flash

Flash was a superb tool throughout the course of the TechThesys project, both in design and in data handling. As with any organized coding project, once a set of functions and shapes were defined, filling out the software was mostly a matter of using those functions to manipulate shapes, dialogues, and prompts.

A relevant example is the display and control functions for the response tabs that disappear and then unfold with each new question. Despite the fact that the data-display behaviors and various properties of the tabs varies depending upon what type of question or question-transition has just been loaded, the user sees only a standard and familiar interface. This is because the Flash Actionscript environment, as with most other popular languages, allows for abstraction—and in the case of display tabs, this means that various events can manipulate separate aspects of tab movement, display, and data-input, independently.

This being said, a caveat is in order, which is well summarized (although somewhat exaggerated) by an online posting regarding flash as a coding engine:

Computers were not meant to create a demand for coders; computers were meant to solve problems.,[sic] it's about getting your ideas implemented sooner so you can iterate sooner. Fortunatley[sic], Flash is like the Perl of UI; easy to write, easy to deploy. However it's also difficult to re-purpose, and difficult to maintain. Using Flash as a UI Framework or IDE will result in much pain. Love it for what it is: a kick ass design tool. Creativity is at the heart of Flash. Macromedia will hopefully seize the opportunity to re-architect the flash player one day to support maintainability as well as creativity, but in the meantime for my situation, the most correct way to use Flash is to write incorrect code. That's fine, I still feel the Flash love :)

p.s. This freaks out people who write correct code:¹⁰

¹⁰ http://www.samuelwan.com/information/archives/cat_actionscript_theory.html

Which is then followed by a block of code that is reasonable from a Flash perspective and unusual at best from the perspective of professional programmers. While, the above commentary is not the final word on Flash (among other things) nor entirely in keeping with the view of the author, the caveat is worth considering for anyone approaching Flash as a long term application development solution. Maintainability is an issue, simply because code that interacts with visual elements may be difficult or impossible to abstract. Global variables are a necessity as information is passed not only within the program, but between the program and another version of itself, as it changes through time (i.e. the frame by frame timeline of the presentation).

On the other hand, to the extent that the Flash stage (where visual elements are manipulated) is well organized and to the extent that one can review and cleverly abstract one's code, maintaining flash is no different than maintaining or improving other software. The catch here is that, with Flash, there is usually no industry or coding-guru standard for organization or performance efficiency.

Basic-User Feedback

User feedback was extremely positive from both the basic and experienced users. Amazingly, all of the basic users called a few hours in advance of their interviews to cancel, sure that they would not be able to use the software well and apologetic that they would surely ruin the project by using TechThesys poorly. Two minutes into the survey, all of them were clicking through confidently and speedily, singing another tune.

Survey participants were open and honest with their information (even when prompted by the introduction that TechThesys is an initial test-software for usability and

that accurate information is not necessary). Participants' openness, particularly when recording a telling alcohol or medication history through TechThesys, is reminiscent of patient behavior in a study on high-risk behaviors in mobile blood donor clinics conducted by Slack, Safran, and others, where a computerized program isolated health risk factors that were not picked up by face-to-face or written surveys.¹¹ In the present research, test-users commented that, prior to using TechThesys, they had second thoughts about divulging personal demographic and medical data, but that they did not recall those fears during the actual testing. The consensus among TechThesys test-users in the basic-user group was that that introduction was professional without being intimidating and that, after the introduction, users felt both secure in their data entry and empowered to complete each question properly.

Descriptive commentary included: "introduction was succinct," "pace was deliberate," "instructions were clear," "tone and presentation wasn't intimidating or perplexing," "the program was simple without being simplistic," "the software was professional." One FACT participant said enthusiastically: "I wish computer orientation software was as easy to use as this!"

It should be noted that, with the aid of a large screen monitor, the stroke victim passed through the survey almost as quickly as any of the other basic users and that his control over the mouse was sufficient to make his way through the program. A large touch-screen would have definitely been better, as the user's Ataxia occasionally caused him to right click when he did not mean to or when he was trying to left click.

¹¹ Locke SE, et. al. Computer-based interview for screening blood donors for risk of HIV transmission. JAMA. 1992; 268(10)

Despite constant badgering and prompting to discuss room for improvement in TechThesys, none of the basic users could find fault or room for improvement within the program. In addition, all of the participants suggested that next time they would be able to use the “experienced” track of the software without verbal prompts and more than half of the basic group said that, in retrospect, they probably could have gotten through without verbal prompts the first time through as well.

Nevertheless, it is probably not true that any of them could have gotten through without verbal prompts the first time. For example, it was clearly observable that the basic users would pick a few responses during multiple-response questions and then forget to hit submit, at which point the verbal cue would set them on the right track again. There were other similar miscues and pauses in progress. The exuberance with which basic users declared their graduation into the “experienced” track is therefore cast into question—and likewise their claim that the software had no room for improvement from the perspective of ease-of-use. However, the confidence shown by these particular basic-users is at very least a confirmation of the success of this program in presenting a clear and emotionally engaging method for data collection.

Design-Flaw: Clickable Area

Basic users all had one or two stoppages requiring advice from the survey administrator. Interestingly, all of these stoppages were of the same kind. The software was designed such that, if there is a text box for data entry on the page, the text box will always be the focus of the page and keyboard entry will immediately be entered into the box. So whether the user has a stray click outside the text box or whether the user clicks inside the text box (or whether the user clicks nowhere at all), the flashing cursor will

always be present inside the text box, awaiting data entry. This is excepting the corner case: where the user clicks the box on its very border, which inexplicably removes the focus from the text box such that data-entry is not possible. Despite the near impossibility of this eventuality (and despite the fact that the software's author cannot recreate this occurrence), every one of the basic-users clicked just at the edge of the box and needed prompting to click inside the box in order to enter their nickname and continue.

The same issue was seen in clicking buttons and tabs: basic-users had an affinity for clicking the very border of the button (sometimes missing the button by a matter of pixels). Additionally, a few users were confused when the center or bottom of the mouse cursor would not select a button and required prompting to use the mouse-point to select. There are several possible remedies. Flash allows for the cursor to be replaced with an image. It is possible to use a simple hollow circle (or some other form) as the cursor in the "beginner interface," such that if any part of the cursor overlaps the button in question, it will be selected. Also, it is possible to extend the clickable area of a button in flash without extending its viewable area and this would preclude the issue of clicking on the border of buttons and input boxes.

Experienced-User Feedback

Experienced users navigated through the software extremely quickly. In TechThesys, the transition from question to question is a fraction of a second, yet I found the experienced users waiting, mouse at the ready, to choose the appropriate answer tab as the tab labored over its literally half-second unfolding to make itself visible.

Experienced users commented, almost dismissively, on the ease of use of the software. Most had apparently expected something more enriching or more challenging.

It is the aim of future versions of the software to provide custom-tailored educational and entertainment medical content and it is quite likely that this will allay the sense of dullness non-verbally communicated by experienced users.

Experienced users caught glitches in the software. For example, during Medication entry, TechThesys often says that there are “No Results” for a user-entered medication-prefix, only to remove the “No Results” posting and unfold several result tabs a split second later. This is due to Flash pretending that it has instantly downloaded data from a PHP script, while the data is in fact still in the process of downloading—so Flash finds nothing and TechThesys displays “No Results.” Then the data falls into place a split-second later and TechThesys updates its display. Basic-users did not catch this or similar glitches, while several doctors and the experienced users did.

Experienced users were happy with the overall experience and impressed by the introductory video and the crispness of the interface. Loading glitches dominated the discussion on potential improvements to the software.

Conclusions

Now Showing: Friendly Software

The idea to include a personal introduction or an emotional invitation in the TechThesys experience was not inspired by the advice of medical professionals, or by the contents of the tomes and tomes of bioinformatics journals perused in preparation for this project, or by the many generations of data collection software that exist to inform this project. In fact, video as a means to emotional connection is conspicuously absent from these sources. The “competitive advantage” of TechThesys is built on the premise that an

ounce of investment in emotional appeal is worth several more in technology or question-design or focus-group feedback. In this study, the basic-users largely didn't care what they were being asked or how it was being asked—they were busy being amazed at their quick and fulfilling progress through the world of computing.

Bioinformatics literature is replete with studies on medical-data standards, how to ask questions and which questions to ask in a given field, how to improve software once it has failed to elicit the response expected, and etcetera. However, there is precious little that documents the actual benefits of “humanizing” bioinformatics software. The assumption that seems to be underlying the vast majority of studies in the field is that if doctors and outpatient clinic secretaries are sufficiently happy with behind-the-counter programs that are basically “Excel on steroids,” patients should be equally delighted to use the same software, with a shade of blue added here and there for professional or artistic considerations. What really matters in the world of this assumption is the questions one puts inside the software. As discussed throughout, this approach is insufficient given the potential benefits conferred by patients' emotional investment in a given information-gathering process.

With low-cost alternatives to the mouse, yet other researchers are caught up testing nearly identical interface methods for user satisfaction, often focusing on nuances that may be far less pertinent to usability and user-reception than they suppose. On the opposite side of the emotional-machine spectrum, software intelligence research is very far away from creating a convincing dynamic, emotional experience for users and computer-generated prompts are still closer to automated telephone tech-support than human voice. With fast computers and cheap cameras at our disposal, today's quick-fix

will remain video; the question at hand is: "How long before the informatics field realizes it?" Video doesn't steal the show, but it does turn the house-lights up a few notches and more applications should be taking advantage.

A patient's emotional connection with a new acquaintance, be it a new doctor or a new piece of software, begins at the very first second of interaction. When this second is dominated by an impersonal or confusing computer screen, or a piece of paper, or even an unsympathetic human being, the data-collection endeavor has already failed.

Changing the Outlook

Floyd and coworkers conducted a study regarding interview methods and data-collection for HIV-risk factors.¹² Floyd and others have noted the value of computerized data collection in this particular field as doctors are often unwilling to broach the subject of a patient's sexual history.^{13,14} However, Floyd's study focuses on which particular questions are tolerable and how very particular phraseology affects reception. When the researchers in the study found a question too personal or graphic for patients, they suggested that changing or omitting the question would be preferable to losing the patient's trust. (For a possible appropriate solution to the HIV-risk factors graphic-questions-dilemma, see Appendix E.) This approach basically admits defeat even when critical pieces of information may be discarded despite their role as important health-risk determinants.

¹² Floyd M, et. al. Evaluating Interview Techniques for the Sexual Practices History. Arch Fam Med. 1999;8:218-223.

¹³ Merrill JM, et. al. Why doctors have difficulty with sex histories. South Med J. 1990;83:613-617.

¹⁴ Lewis CE. Sexual practices: are physicians addressing the issues? J Gen Intern Med. 1990;5(5 suppl):S78-S81

Given the reception to TechThesys, its flow, and its presentation style, it is time for clinicians and medical professionals to ask “How can I make patients comfortable enough with my outpatient survey that personal questions become an acceptable norm?”

Appendix A – Code

Frame 1: Intro Video

```
////////////////////////////////////actions
stop();
top = this;
begin._visible = false;

//once the intro video is finished the user may select "begin"
var listenerObject:Object = new Object();
listenerObject.complete = function(eventObject:Object):Void
{
    sliders.play();
    begin._visible = true;
    begin.play();
    banner.play();
};
welcome.addEventListener("complete", listenerObject);

//the begin button
begin.onRelease = function()
{
    top.gotoAndStop(top._currentframe + 1);
}

//the help button
question.onRelease = function()
{
    playSound(_global.currentsound);
}
question._visible = false;

//early initialization of the global medcount variable
_global.medcount=0;

////////////////////////////////////sound flv initializations
_global.usertype = "audio/usertype.flv";
_global.user = "audio/username.flv";
_global.thanks = "audio/thanks.flv";
_global.singleresponse = "audio/singleresponse.flv";
_global.multipleresponse = "audio/multipleresponse.flv";
_global.medications1 = "audio/medications1.flv";
_global.medications2 = "audio/medications2.flv";
_global.dosage = "audio/dosage.flv";
_global.dosage = "audio/pleaserespond.flv";

//open A/V stream
var my_nc:NetConnection = new NetConnection();
my_nc.connect(null);
var my_ns:NetStream = new NetStream(my_nc);
top.attachVideo(my_ns);

playSound = function(sound)
{
    if(_global.userlevel == "beginner")
    {
        top.my_ns.close();
        top.my_ns.play(sound);
        _global.currentsound = sound;
    }
}

//debugging
quickskip.onRelease = function()
{
    top.gotoAndStop(top._currentframe + 1);
}
```

Frame 2: Experienced or Beginner?

```
stop();
top = this;

beginner.gotoAndPlay(2);
experienced.play();
beginner.onRelease = function()
{
    top.gotoAndStop(top._currentframe + 2);
    top.my_ns.close();
    _global.userlevel = "beginner";
}
experienced.onRelease = function()
{
    top.gotoAndStop(top._currentframe + 3);
    top.my_ns.close();
    _global.userlevel = "experienced";
}

//prompt user: beginner or experienced?
top.my_ns.play(_global.usertype);
```

Frame 3: Beginner Intro Video

```
//////////actions
var top = this;
stop();

//skip beginner intro video button
skipbut.onRelease = function()
{
    top.gotoAndStop(top._currentframe + 1);
}

//when the beginner orientation video is complete, progress to the software
var listenerObject:Object = new Object();
listenerObject.complete = function(eventObject:Object):Void
{
    top.gotoAndStop(top._currentframe + 1);
};
beginner.addEventListener("complete", listenerObject);

//the question button should be visible from here on
question._visible = true;
```

Frame 4: Login

```
//////////////////////////////////////ACTIONS
stop();
save.savetext = "Enter";

inputbox.prompt1 = "Enter a nickname:";
/*
Selection.setFocus(inputbox.prefixbox);

var mouseListener:Object = new Object();
mouseListener.onMouseUp = function()
{
    Selection.setFocus(inputbox.prefixbox);
};
Mouse.addListener(mouseListener);
*/
inputbox.prefixbox.onChanged = function()
{
    if(save._currentframe == 1)
    {
        save.play();
    }
}

//////////////////////////////////////
//Visuals
//////////////////////////////////////
save.savebut.onRelease = function()
{
    if(inputbox.prefixbox.text != "" && inputbox.prefixbox.text != " " &&
inputbox.prefixbox.text != " ")
    {
        _global.username = inputbox.prefix;
        gotoAndStop(_currentframe + 1);
        turnOffInput();
    }
}

//////////////////////////////////////
//Input Visibility Functions
//////////////////////////////////////
turnOffInput = function()
{
    turnOffNext();
    inputbox.prefix = "";
    inputbox.prefixbox._visible = false;
}

turnOnInput = function()
{
    inputbox.prefixbox._visible = true;
}

turnOffNext = function()
{
    if(save._currentframe>1 && save._currentframe<=12)
        save.play();
}

turnOnNext = function()
{
    save.gotoAndPlay(2);
}

//////////////////////////////////////SOUND
playSound(_global.user);
```

Frame 5: Biographical and Behavioral Questions

```
my_xml = new XML();
my_xml.ignoreWhite = true;
Qholder = new Array();
var infodisplay = infodisplaybox.holder;

////////////////////////////////////
//Visuals
////////////////////////////////////

rollUpGreys = function()
{
    for(i=0;i<10;i++)
    {
        if(home["grey" + i]._currentframe > 2 && home["grey" + i]._currentframe <
Math.ceil(home["grey" + i]._totalframes/2))
            home["grey" + i].gotoAndPlay(Math.ceil(home["grey" +
i]._totalframes/2));
    }
}

rollOutGreys = function(index, Q)
{
    for(i=0;i<10;i++)
    {
        if(Q[index].responsechoices[i] && (home["grey" + i]._currentframe <= 2 ||
home["grey"
+ i]._currentframe > Math.ceil(home["grey" + i]._totalframes/2)))
            home["grey" + i].gotoAndPlay(2);
        else if(!Q[index].responsechoices[i] && !(home["grey" + i]._currentframe <= 2 ||
home["grey" + i]._currentframe > Math.ceil(home["grey" + i]._totalframes/2)))
            home["grey" + i].gotoAndPlay(Math.ceil(home["grey" +
i]._totalframes/2));
    }
}

formatText = function(index)
{
    //make long phrases into smaller font and short phrases into 18 point font
    if(home["grey" + index].medtext.length>10)
    {
        home["grey" + index].medbox.setTextFormat(smallText);
        home["grey" + index].medbox._y = -2;
    }
    else if (this["grey" + index].medtext.length<=10)
    {
        home["grey" + index].medbox.setTextFormat(largeText);
        home["grey" + index].medbox._y = 4;
    }
}

clearOldText = function(index)
{
    for(i = index; i<10; i++)
    {
        home["grey" + i].medtext = "";
        home["medbut" + i]._visible = false;
    }
}

uncheckAll = function()
{
    for(i=0;i<10;i++)
    {
        home["grey" +i].checkmark._visible = false;
    }
}
```



```

uncheckNone = function()
{
    for(i=0;i<10;i++)
    {
        if(home["grey" + i].medbox.text == "None")
        {
            home["grey" + i].checkmark._visible = false;
        }
    }
}

////////////////////////////////////
//Dynamic Text
////////////////////////////////////
myformat = new TextFormat();
myformat.color = 0x000000;
myformat.bullet = false;
myformat.underline = false;
myformat.size = 16;
myformat.font = "arial";
myformat.align = "right";
var space = 5; //vertical space between recorded data elements on right side tab
var offset = 75;

myleftformat = new TextFormat();
myleftformat.color = 0x000000;
myleftformat.bullet = false;
myleftformat.underline = false;
myleftformat.size = 16;
myleftformat.font = "arial";
myleftformat.align = "left";

mygreyformat = new TextFormat();
mygreyformat.color = 0xCCCCCC;
mygreyformat.bullet = false;
mygreyformat.underline = false;
mygreyformat.size = 16;
mygreyformat.font = "arial";
mygreyformat.align = "left";

applyText = function(id, Qnumber, depon)
{
    var spacing = Qnumber*(myformat.size + space) + offset;

    // (name, depth,
    x, y, width, height)
    infodisplay.createTextField(id,infodisplay.getNextHighestDepth(), 0,spacing,150,100);
    infodisplay[id].multiline = true;
    infodisplay[id].wordWrap = true;
    infodisplay[id].border = false;

    infodisplay[id].text = id + ":";
    infodisplay[id].setTextFormat(myformat);
    if(depon)
        infodisplay[id].setTextFormat(mygreyformat);

    var answer = "A" + id;

    infodisplay.createTextField(answer,infodisplay.getNextHighestDepth(),
150,spacing,150,100);
    infodisplay[answer].multiline = true;
    infodisplay[answer].wordWrap = true;
    infodisplay[answer].border = false;

    infodisplay[answer].text = "";
    infodisplay[answer].setTextFormat(myleftformat);
}

pushResponsesDown = function (index, pushnumber)
{
    while(!_global.Q[index])
    {
        id = _global.Q[index].id;
        answer = "A" + id;
    }
}

```

```

        infodisplay[id]._y += (pushnumber-1)*16;
        infodisplay[answer]._y += (pushnumber-1)*16;
        index++
    }
}

////////////////////////////////////
//End Text
////////////////////////////////////

saveResult = function()
{
    var saveEntry = new LoadVars();
    var uploadsite = "upload.php?username=" + _global.username + "&responses=" +
infodisplay["A" + _global.Q[_global.currentQNumber].id].text + "&id=" + _global.Q
[_global.currentQNumber].id;
    saveEntry.load(uploadsite);
    //trace(uploadsite);
}

saveMultipleResult = function(answerholder)
{
    var saveEntry = new LoadVars();
    var uploadsite = "upload.php?username=" + _global.username + "&responses=" +
answerholder + "&id=" + _global.Q[_global.currentQNumber].id;
    saveEntry.load(uploadsite);
    //trace(uploadsite);
}

isViableQuestion = function()
{
    depon = "A" + _global.Q[_global.currentQNumber].depon;
    if(infodisplay[depon].text == "No")
    {
        return false
    }
    else
        return true;
}

gotoNextViableQuestion = function()
{
    if(isViableQuestion())
        gotoQuestionNumber(_global.currentQNumber, _global.Q);
    else
    {
        _global.currentQNumber++;
        gotoNextViableQuestion();
    }
}

gotoQuestionNumber = function(QNumber, Q)
{
    if(!Qholder[QNumber]) //if the xml questions are done and it is time for
medication
input
        gotoAndStop(top._currentframe + 1);

    inputbox.gotoAndPlay(2);
    inputbox.prompt1 = Qholder[QNumber].question;

    for(i=0;i<10;i++)
        home["grey" +i].checkmark._visible = false; //initializes checkmarks
for each question

    if(_global.Q[_global.currentQNumber].myType == "Multiple selection")
    {
        //sound
        playSound(_global.multipleresponse);

        inputbox.prompt1 += "\n(Click the submit button after making your
selections).";

        if(save._currentframe == 1 || save._currentframe >=12)
            save.gotoAndPlay(2);
    }
}

```

```

save.savetext = "Submit";

save.savebut.onRelease = function()
{
    //update myreponses:

    id = _global.Q[_global.currentQNumber].id;
    answer = "A" +_global.Q[_global.currentQNumber].id;
    infodisplay[answer].count = 0;
    infodisplay[answer].answerholder = new Array();

    for(i=0;i<10;i++)
    {
        if(home["grey" +i].checkmark._visible == true)
        {

infodisplay[answer].answerholder[infodisplay[answer].count] = home["grey" +
i].medbox.text;
                                infodisplay[answer].count++;
                                infodisplay[answer].text += home["grey" +
i].medbox.text + "\n";
infodisplay[answer].setTextFormat (myleftformat);
                                infodisplay[id].setTextFormat (myformat);
        }
    }

    if(infodisplay[answer].count > 0) //if there has been a
response
    {
        var answerholder = infodisplay[answer].answerholder;
        home.prompt = "";
        pushResponsesDown(_global.currentQNumber +
1,infodisplay [answer].count); //so that
multiline info doesn't runover into next response
        saveMultipleResult (answerholder);
        _global.currentQNumber++;

gotoNextViableQuestion(_global.currentQNumber,_global.Q);

    }
    else
    {
        home.prompt = "Please select a response. Select the tab
that says \"none\" if
appropriate."

        //sound
        playSound(_global.pleaserespond);
    }

}

}

else if(save._currentframe >=2 && save._currentframe < 13)
{
    save.gotoAndPlay(13);
    //sound
    playSound(_global.singleresponse);
}

else
    playSound(_global.singleresponse);

rollOutGreys(QNumber, Q);
displayChoices(QNumber, Q);

}

```

```

displayChoices = function(QNumber, Q)
{
    var i = 0;

    while(Q[QNumber].responsechoices[i])
    {
        home["medbut" + i]._visible = true;
        home["grey" + i].medbox.text = Q[QNumber].responsechoices[i];
        i++;
    }
    clearOldText(i);
}

loadQuestions = function(xml)
{
    var questions = xml.firstChild.childNodes;
    var QNumber = 0;

    for(i = 0; i<questions.length; i++)
    {
        //loadQuestions(i,null,

        var responses =questions[i].childNodes[1].childNodes;
        var eachQuestion = questions[i].firstChild.firstChild;

        if(questions[i].nodeName == "question")
        {
            Qholder[QNumber] = new Object(); //a new array for this Question's
question-data and answer items

            thisQ = Qholder[QNumber];
            thisQ.id = questions[i].attributes.id; //id tag, eg: age, sex, etc.
            thisQ.question = eachQuestion;
            thisQ.responsechoices = new Array(); //an array for the response-
to each question
            thisQ.myType = questions[i].childNodes[1].attributes.type; // single
selection,
multiple selection etc.
            thisQ.depon = questions[i].childNodes[2].attributes.testquestion;

            responsechoices = new Array();

            applyText(thisQ.id, QNumber, thisQ.depon); //sets up right side tab
for
responses-thus-far

            for(j = 0; j<responses.length; j++)
            {
                responsechoices[j] = responses[j].firstChild;
                var responseitem = responsechoices[j];
                thisQ.responsechoices = responsechoices;
                //if(thisQ.myType == "Multiple selection")
            }

            if(thisQ.myType == "Multiple selection")
            {
                thisQ.responsechoices[j] = "None";
            }

            QNumber++;

        }

    }

    return Qholder;
}

selectionType = function(index)
{

```

```

if(_global.Q[_global.currentQNumber].myType == "Single selection")
{
    //update myreponses:
    id = _global.Q[_global.currentQNumber].id;
    answer = "A" + _global.Q[_global.currentQNumber].id;
    infodisplay[answer].text = home["grey" + index].medbox.text;
    infodisplay[answer].setTextFormat(myleftformat);
    infodisplay[id].setTextFormat(myformat);

    //go to the next question
    saveResult();
    _global.currentQNumber++;
    gotoNextViableQuestion(_global.currentQNumber,_global.Q);

}
else if(_global.Q[_global.currentQNumber].myType == "Multiple selection")
{
    if(home["grey" + index].medbox.text == "None" && home["grey"
+index].checkmark._visible == false)
    {
        uncheckAll();
        home["grey" +index].checkmark._visible = true;
    }
    else if(home["grey" +index].checkmark._visible == false)
    {
        uncheckNone();
        home["grey" +index].checkmark._visible = true;
    }
    else
        home["grey" +index].checkmark._visible = false;
}
}

my_xml.onLoad = function(success)
{
    var Q = loadQuestions(this);
    _global.Q = Q;
    _global.currentQNumber = 0;
    gotoQuestionNumber(_global.currentQNumber, Q);
}

//////////////////////////////////////////BUTTONS SELECTION VISITOR FLOW
buttonMaker = function(index)
{
    tab["medbut" + index].onRelease = function()
    {
        selectionType(index);
    }
}

for(i = 0; i<10; i++)
{
    buttonMaker(i);
}

//////////////////////////////////////////
//Input Visibility Functions
//////////////////////////////////////////
turnOffInput = function()
{
    turnOffNext();
    inputbox.prefix = "";
    inputbox.prefixbox._visible = false;
}

turnOnInput = function()
{
    inputbox.prefixbox._visible = true;
}

```

```

}

turnOffNext = function()
{
    if(save._currentframe>1 && save._currentframe<=12)
        save.play();
}

turnOnNext = function()
{
    save.gotoAndPlay(2);
}
/*
tab.medbut0.onRelease = function()
{

}
*/
////////////////////////////////////ACTIONS
top = this;
home = tab;
my_xml.load("salusys_test.xml");
stop();
inputbox.gotoAndStop(1);
inputbox.inputbg._visible = false;
inputbox.inputbox._visible = false;

```

Frame 6: Add a Medication?

```
////////////////////////////////////ACTIONS
stop();
top = this;
home = tab;
home.prompt = "";
inputbox.gotoAndPlay(2);
inputbox.inputbg._visible = false;
inputbox.inputbox._visible = false;
inputbox.prompt1 = "";
////////////////////////////////////SOUND
playSound(_global.medications1);

clearOldText = function(index)
{
    for(i = index; i<10; i++)
    {
        home["grey" + i].medtext = "";
        home["medbut" + i]._visible = false;
    }
}

clearOldText(0);

medlist.onRelease = function()
{
    top.finish.play();
    top.medlist.play();
    top.gotoframe = top._currentframe + 1;
}

finish.onRelease = function()
{
    top.finish.play();
    top.medlist.play();
    top.gotoframe = top._currentframe + 3;
}
```

Frame 7: Enter Medication Prefix, Query Database

////////////////////////////////////VISUALS

```
rollUpGreys = function()
{
    for(i=0;i<10;i++)
    {
        if(home["grey" + i]._currentframe > 2 && home["grey" + i]._currentframe <
Math.ceil(home["grey" + i]._totalframes/2))
            home["grey" + i].gotoAndPlay(Math.ceil(home["grey" +
i]._totalframes/2));
    }
}

rollOutGreys = function()
{
    for(i=0;i<10;i++)
    {
        if(meddata["med" + i] && (home["grey" + i]._currentframe <= 2 || home["grey" +
i]._currentframe > Math.ceil(home["grey" + i]._totalframes/2)))
            home["grey" + i].gotoAndPlay(2);
    }
}

formatText = function(index)
{
    //make long phrases into smaller font and short phrases into 18 point font
    if(home["grey" + index].medtext.length>10)
    {
        home["grey" + index].medbox.setTextFormat(smallText);
        home["grey" + index].medbox._y = -2;
    }
    else if (this["grey" + index].medtext.length<=10)
    {
        home["grey" + index].medbox.setTextFormat(largeText);
        home["grey" + index].medbox._y = 4;
    }
}

clearOldText = function(index)
{
    for(i = index; i<10; i++)
    {
        home["grey" + i].medtext = "";
        home["medbut" + i]._visible = false;
    }
}

setCancel = function()
{
    home.medbut9._visible = true;
    home.grey9.cancel._visible = true;
    home.grey9.medtext = "Go Back";
    home.grey9.play();
}

upsetCancel = function()
{
    home.grey9.cancel._visible = false;
}
////////////////////////////////////END VISUALS
```

////////////////////////////////////VARIABLES & INITIALIZATIONS

```
var home = tab;
var phpsite = "medpre.php?prefix="
var okToRollGreys = false;
var prefixwas = "";
```

```
largeText = new TextFormat();
largeText.size = 18;
```



```

smallText = new TextFormat();
smallText.size = 14;

for(i=0;i<10;i++)
{
    home["medbut" + i]._visible = false;
}

//////////////////////////////////////END VARIABLES & INITIALIZATIONS

//////////////////////////////////////MED FUNCTIONS

getNewMed = function()
{
    medInit();
    rollUpGreys();
    meddata.load(phpsite + inputbox.prefix);
}

medInit = function()
{
    delete meddata;
    meddata = new LoadVars();
    meddata.onLoad = function()
    {
        home.okToRollGreys = true;
        rollOutGreys();
        showMedData();

        if(prefix.length > 2 && meddata.med0 == undefined)
        {
            tab.prompt = "";
            tab.info = "There are no results that start with these
letters.";
        }
        else if(prefix.length <= 2 && meddata.med0 == undefined)
        {
            tab.prompt = "";
            tab.info = "Please type a few more letters."
        }
        else
        {
            tab.prompt = "Please click on the medication that you are
taking.";
            tab.info = "";
        }
    }
}

showMedData = function()
{
    var i = 0;
    while(meddata["med" + i])
    {
        home["medbut" + i]._visible = true;
        home["grey" + i].medtext = meddata["med" + i];
        formatText(i);
        i++;
    }
    clearOldText(i);
}

//////////////////////////////////////END MED FUNCTIONS

//////////////////////////////////////BUTTONS SELECTION VISITOR FLOW
buttonMaker = function(index)
{
    tab["medbut" + index].onRelease = function()
    {

```

```

        _global.med = home["grey" + index].medtext;
        home.prompt = "Please choose the dosage of " + home["grey" + index].medtext + " that
you currently take.";
        rollUpGreys();
        clearOldText(0);
        gotoAndStop(top._currentframe+1);
    }
}

for(i = 0; i<9; i++)
{
    buttonMaker(i);
}

//the last button is to go back a page
setCancel();

tab.medbut9.onRelease = function()
{
    upsetCancel();
    rollUpGreys();
    clearOldText(0);
    gotoAndStop(top._currentframe-1);
}

inputbox.prefixbox.onChangeed = function()
{
    tab.info = "please wait";
    getNewMed();
}

//////////////////////////////////////END BUTTONS SELECTION VISITOR FLOW

//////////////////////////////////////
//Input Visibility Functions
//////////////////////////////////////
/*
turnOffInput = function()
{
    turnOffNext();
    inputbox.prefix = "";
    inputbox.prefixbox._visible = false;
}

turnOnInput = function()
{
    inputbox.prefixbox._visible = true;
}

turnOffNext = function()
{
    if(save._currentframe>1 && save._currentframe<=12)
        save.play();
}

turnOnNext = function()
{
    save.gotoAndPlay(2);
}
*/

//////////////////////////////////////ACTIONS
inputbox.inputbg._visible = true;
inputbox.prefixbox._visible = true;
inputbox.prompt1 = "Type in the first few letters of your medication's name:";

//Mouse.removeListener(mouseListener);
Selection.setFocus(top.inputbox.prefixbox);

var mouseListener2:Object = new Object();
mouseListener2.onMouseUp = function()

```

```
{
  Selection.setFocus(top.inputbox.prefixbox);
};
Mouse.addListener(mouseListener2);

stop();

//////////////////////////////////////END ACTIONS

//////////////////////////////////////SOUND
playSound(_global.medications2);
```

Frame 8: Select Dosage

```
////////////////////////////////////VISUALS
rollUpGreys = function()
{
    for(i=0;i<10;i++)
    {
        if(home["grey" + i]._currentframe > 2 && home["grey" + i]._currentframe <
Math.ceil(home["grey" + i]._totalframes/2))
            home["grey" + i].gotoAndPlay(Math.ceil(home["grey" +
i]._totalframes/2));
    }
}

rollOutGreys = function()
{
    for(i=0;i<10;i++)
    {
        if(dosedata["dose" + i] && (home["grey" + i]._currentframe <= 2 || home["grey"
+
i]._currentframe > Math.ceil(home["grey" + i]._totalframes/2)))
            home["grey" + i].gotoAndPlay(2);
    }
}

formatText = function(index)
{
    //make long phrases into smaller font and short phrases into 18 point font
    if(home["grey" + index].medtext.length>10)
    {
        home["grey" + index].medbox.setTextFormat(smallText);
        home["grey" + index].medbox._y = -2;
    }
    else if (this["grey" + index].medtext.length<=10)
    {
        home["grey" + index].medbox.setTextFormat(largeText);
        home["grey" + index].medbox._y = 4;
    }
}

clearOldText = function(index)
{
    for(i = index; i<9; i++)
    {
        home["grey" + i].medtext = "";
        home["medbut" + i]._visible = false;
    }
}

setCancel = function()
{
    home.medbut9._visible = true;
    home.grey9.cancel._visible = true;
    home.grey9.medtext = "Go Back";
}

upsetCancel = function()
{
    home.grey9.cancel._visible = false;
}
////////////////////////////////////END VISUALS
```

```
////////////////////////////////////VARIABLES & INITIALIZATIONS
var top = this;
var home = tab;
var dosesite = "patientMedicationDoseInput.php?brand_name="

largeText = new TextFormat();
largeText.size = 18;
```

```

smallText = new TextFormat();
smallText.size = 14;
home.prompt = "Enter the dose of " + _global.med + " that you take." ;

//////////////////////////////////////END VARIABLES & INITIALIZATIONS

//////////////////////////////////////DOSE FUNCTIONS

delete dosedata; //in case we've been to this frame before

dosedata = new LoadVars();
dosedata.onLoad = function()
{
    parseDoseData();
    showDoseData();
    home.info = "";
}

showDoseData = function()
{
    rollOutGreys();
    var i = 0;
    while(dosedata["dose" + i])
    {
        home["medbut" + i]._visible = true;
        home["grey" + i].medtext = dosedata["dose" + i];
        formatText(i);
        i++;
    }
    setCancel();
    clearOldText(i);
}

parseDoseData = function()
{
    var i = 0;
    while(dosedata["route" + i])
    {
        //strength
        dosedata["dose" + i] = dosedata["strength" + i] + " ";

        //units
        if(dosedata["units" + i] == "MG")
            dosedata["dose" + i] += "mg ";
        else if(dosedata["units" + i] == "MCG/ML")
            dosedata["dose" + i] += "mcg/ml ";
        else if(dosedata["units" + i] == "MG/ML")
            dosedata["dose" + i] += "mg/ml ";
        else
            dosedata["dose" + i] += dosedata["units" + i] + " ";

        //route
        if(dosedata["route" + i] == "ORAL")
            dosedata["dose" + i] += "oral ";
        else if(dosedata["route" + i] == "TOPICAL")
            dosedata["dose" + i] += "topical ";
        else if(dosedata["route" + i] == "INTRAVENOUS")
            dosedata["dose" + i] += "intravenous ";
        else if(dosedata["route" + i] == "INJECTABLE")
            dosedata["dose" + i] += "injection ";
        else if(dosedata["route" + i] == "NASAL")
            dosedata["dose" + i] += "nasal ";
        else
            dosedata["dose" + i] += dosedata["route" + i] + " ";

        //form
        if(dosedata["form" + i] == "TAB")
            dosedata["dose" + i] += "tablet";
        else if(dosedata["form" + i] == "SYRUP")
            dosedata["dose" + i] += "syrup";
    }
}

```

```

        else if(dosedata["form" + i] == "CAP")
            dosedata["dose" + i] += "capsule";
        else if(dosedata["form" + i] == "CAP,SA")
            dosedata["dose" + i] += "capsule";
        else if(dosedata["form" + i] == "CAP,ORAL")
            dosedata["dose" + i] += "capsule";
        else if(dosedata["form" + i] == "INJ,SOLN")
            dosedata["dose" + i] += "injection";
        else if(dosedata["form" + i] == "SOLN,SPRAY,NASAL")
            dosedata["dose" + i] += "spray";
        else if(dosedata["form" + i] == "POWDER, TOP")
            dosedata["dose" + i] += "topical powder";
        else if(dosedata["form" + i] == "CREAM, TOP")
            dosedata["dose" + i] += "topical cream";
        else
            dosedata["dose" + i] += dosedata["form" + i];

    i++
}
dosedata["dose" + i] = "I don't know";
dosedata.dose9 = "cancel";
}

//////////////////////////////////////END DOSE FUNCTIONS

//////////////////////////////////////DOSE SELECTION VISITOR FLOW
//////////////////////////////////////
//Dynamic Text
//////////////////////////////////////
myformat = new TextFormat();
myformat.color = 0x000000;
myformat.bullet = false;
myformat.underline = false;
myformat.size = 16;
myformat.font = "arial";
myformat.align = "right";
var space = 5; //vertical space between recored data elements on right side tab
var offset = 75;

myleftformat = new TextFormat();
myleftformat.color = 0x000000;
myleftformat.bullet = false;
myleftformat.underline = false;
myleftformat.size = 16;
myleftformat.font = "arial";
myleftformat.align = "left";

applyMedText = function()
{
    var spacing = _global.medcount*(myformat.size + space) + offset;

    x, y, width, height // (name, depth,
    infodisplay.createTextField("med" +
    _global.medcount, infodisplay.getNextHighestDepth(), 0, spacing, 150, 100);
    infodisplay["med" + _global.medcount].multiline = true;
    infodisplay["med" + _global.medcount].wordWrap = true;
    infodisplay["med" + _global.medcount].border = false;
    infodisplay["med" + _global.medcount].text = _global.med + ":";
    infodisplay["med" + _global.medcount].setTextFormat(myformat);

    infodisplay.createTextField("dose" +
    _global.medcount, infodisplay.getNextHighestDepth(), 150, spacing, 150, 100);
    infodisplay["dose" + _global.medcount].multiline = true;
    infodisplay["dose" + _global.medcount].wordWrap = true;
    infodisplay["dose" + _global.medcount].border = false;
    infodisplay["dose" + _global.medcount].text = _global.dose;
    infodisplay["dose" + _global.medcount].setTextFormat(myleftformat);
}
saveMedResult = function(dose)
{
    applyMedText();
}

```

```

var saveEntry = new LoadVars();
var uploadsite = "uploadmed.php?username=" + _global.username + "&responses=" +
_global.med + "&id=Medication" + _global.medcount + "&dose=" + dose;
saveEntry.load(uploadsite);

_global.medcount++;
top.gotoAndStop(top._currentframe - 2);
fadeprompt.prompt = _global.med + " was successfully entered!";
fadeprompt.play();
rollUpGreys();

//trace(uploadsite);
}

buttonMaker = function(index)
{
    tab["medbut" + index].onRelease = function()
    {
        _global.dose = home["grey" + index].medtext
        saveMedResult(_global.dose);
        /*
        home.prompt = "Please choose the dosage of " + home["grey" + index].medtext + " that
you currently take.";
        rollUpGreys();
        clearOldText(0);
        gotoAndStop(5);
        */
    }
}

for(i = 0; i<9; i++)
{
    buttonMaker(i);
}
home.medbut9.onRelease = function()
{
    inputbox.gotoAndPlay(2)
    home.prompt = "";
    rollUpGreys();
    gotoAndStop(top._currentframe - 1);
}

//////////////////////////////////////END MED SELECTION VISITOR FLOW

//////////////////////////////////////
//Input Visibility Functions
//////////////////////////////////////
turnOffInput = function()
{
    turnOffNext();
    inputbox.prefix = "";
    inputbox.prefixbox._visible = false;
}

turnOnInput = function()
{
    inputbox.prefixbox._visible = true;
}

turnOffNext = function()
{
    if(save._currentframe>1 && save._currentframe<=12)
        save.play();
}

turnOnNext = function()
{
    save.gotoAndPlay(2);
}

//////////////////////////////////////ACTIONS
stop();

```

```
infodisplay = infodisplaybox.holder;
inputbox.prefix = "";
inputbox.play();
dosedata.load(dosesite + _global.med);
home.info = "please wait";
home = tab;
top = this;

//////////////////////////////////////END ACTIONS

//////////////////////////////////////SOUND
playSound(_global.dosage);
```


Frame 9: Survey Completed, Thanks.

```
////////////////////////////////////actions  
stop();  
top = this;  
begin._visible = false;  
  
////////////////////////////////////SOUND  
playSound(_global.thanks);
```

Appendix B – User Survey Questions

1. What are your first impressions of this software?
2. What kind of other software do you use/have you used?
3. Why did you choose [new user or experienced]?
4. If you chose “new user”: In retrospect, was the software sufficiently straightforward that you could have chosen experienced?
5. Did you find the voice prompts helpful?
6. Did you find the voice prompts annoying?
7. Can you suggest improvements to this software?

Appendix C – Verbal Prompts for Basic-Users

Event	Prompt
User clicks large “Begin” button and is presented with two new buttons: “new to computers” and “experienced.”	If you’re new to computers or think you might have trouble with this software, click the “new to computers button” and I’ll guide you through the questions one by one. If you’re an experienced user, click the “experienced button to proceed through the questions by yourself.
User clicks “new to computers” and goes to the login screen.	Type in a nickname that the software will use to remember you. Any word will do. After you have used the keyboard, an enter button will appear. When you are finished typing, click it.
Single Response question	This is a single response question. Read the question carefully and click on one tab below to answer and proceed to the next question.
Multiple Response question	This question allows for multiple responses. Look over the question and the possible responses and click on all the tabs that apply to you. If none of the tabs apply to you, click the “none” tab which is at the bottom right of the response options. When you have selected the appropriate tab or tabs, click on the “submit” button which is next to the question.
Submit button pressed without response selected.	You’ll need to select a response from the options below. If none of the options apply to you, click the “none” button and then click submit.
Add Another Medication prompt.	Do you take medications? If not or if you’ve already entered all of your medications, click the “Finish” button, the one with the check mark on it. If you have medications to enter, click on the “List Another Medication” button, the one with the plus sign on it.
Medication Finder user-input prompt	You don’t have to remember exactly how to spell the name of your medication. Just type the first few letters and wait to see if your medication appears on the tabs below. If it does, click on its tab below to proceed. If your medication does not appear in the response tabs, try typing a few more letters of the medication name or click the red “Go Back” button to skip this medication.

Dosage selection prompt

Do you know what dosage of this medication you take? If so, choose the appropriate tab. If you don't know the dosage, don't worry, just click the "I don't know" tab.

Thanks.

Alright you're done! Thanks for testing the software. Your feedback will be extremely helpful in making the next version of the software even easier to use!

Appendix D – Sample XML Input File

```
<?xml version="1.0" encoding="iso-8859-1"?>
<interview>
  <question id="age" type="SpecialQuestion_DateOfBirth" reportcategory="General
Information" reportlabel="DOB">
    <text>What age group are you in?</text>
    <responses type="Single selection">
      <item>18-20</item>
      <item>21-30</item>
      <item>31-40</item>
      <item>41-50</item>
      <item>51-60</item>
      <item>61-70</item>
      <item>71-80</item>
    </responses>
  </question>

  <question id="sex" type="SpecialQuestion_Sex" reportcategory="General Information"
reportlabel="Sex">
    <text>What is your sex?</text>
    <responses type="Single selection">
      <item>Male</item>
      <item>Female</item>
    </responses>

  </question>

  <question id="allergies" type="SpecialQuestion_Allergies" reportcategory="Allergies"
reportlabel="Allergies">
    <text>To which of the following are you allergic?</text>
    <responses type="Multiple selection">
      <item>Animal dander</item>
      <item>Antibiotics</item>
      <item>Aspirin</item>
      <item>Peanuts</item>
      <item>Penicillin</item>
      <item>Pollen</item>
      <item>Sulfa drugs</item>
    </responses>
  </question>

  <question id="medications" type="SpecialQuestion_Medications"
reportcategory="Medications" reportlabel="Medications">
    <text>Which of the following medications do you take?</text>
    <responses type="Multiple selection">
      <item>Antibiotics</item>
      <item>Aspirin</item>
      <item>Lipitor</item>
      <item>Allegra</item>
    </responses>
  </question>

  <question id="smoker" reportcategory="General Information" reportlabel="">
    <text>Have you ever smoked?</text>
    <responses type="Single selection">
      <item>Yes</item>
      <item>No</item>
    </responses>
  </question>

  <question id="packs per day" reportcategory="General Information" reportlabel="">
    <text>How many packs per day?</text>
    <responses type="Single selection">
      <item>1/2</item>
      <item>1</item>
      <item>2</item>
      <item>3</item>
      <item>4 or more</item>
    </responses>
    <condition testquestion="smoker" operator="equals" testvalue="Yes" />
  </question>
```

```

<question id="years of smoking" reportcategory="General Information" reportlabel="">
  <text>How many years have you smoked?</text>
  <responses type="Single selection">
    <item>1-10</item>
    <item>11-20</item>
    <item>21-30</item>
    <item>31-40</item>
    <item>41-50</item>
    <item>51-60</item>
    <item>61-70</item>
    <item>71-80</item>
  </responses>
  <condition testquestion="smoker" operator="equals" testvalue="Yes" />
</question>

<question id="alcohol" reportcategory="General Information" reportlabel="">
  <text>Do you consume alcoholic beverages?</text>
  <responses type="Single selection">
    <item>Yes</item>
    <item>No</item>
  </responses>
</question>

<question id="reduce drinking" reportcategory="General Information" reportlabel="">
  <text>Have you ever felt you should cut down your drinking?</text>
  <responses type="Single selection">
    <item>Yes</item>
    <item>No</item>
  </responses>
  <condition testquestion="alcohol" operator="equals" testvalue="Yes" />
</question>

<question id="are people critical" reportcategory="General Information" reportlabel="">
  <text>Have people annoyed you by criticizing your drinking?</text>
  <responses type="Single selection">
    <item>Yes</item>
    <item>No</item>
  </responses>
  <condition testquestion="alcohol" operator="equals" testvalue="Yes" />
</question>

<question id="guilty about alcohol" reportcategory="General Information"
reportlabel="">
  <text>Have you ever felt bad or guilty about your drinking?</text>
  <responses type="Single selection">
    <item>Yes</item>
    <item>No</item>
  </responses>
  <condition testquestion="alcohol" operator="equals" testvalue="Yes" />
</question>

<question id="morning drinks" reportcategory="General Information" reportlabel="">
  <text>Have you ever had a drink first thing in the morning to steady your nerves or
get rid of a hangover?</text>
  <responses type="Single selection">
    <item>Yes</item>
    <item>No</item>
  </responses>
  <condition testquestion="alcohol" operator="equals" testvalue="Yes" />
</question>

<question id="drinks per week" reportcategory="General Information" reportlabel="">
  <text>How many drinks do you have per week?</text>
  <responses type="Single selection">
    <item>1-5</item>
    <item>6-10</item>
    <item>11-15</item>
    <item>16-20</item>
    <item>21-25</item>
    <item>26-30</item>
  </responses>
  <condition testquestion="alcohol" operator="equals" testvalue="Yes" />
</question>
</interview>

```

Appendix E –Challenge for Biomedical Informatics to Present Well and Ask Tough Questions

Although this survey was done before the time of ubiquitous video, today's solution might be a TechThesys style video-introduction as follows:

“Thanks for agreeing to take this health survey. Doing so allows your doctor to better serve you and to deliver the care and attention you deserve. You are about to answer some questions that are very direct or very personal and may even seem offensive. The offensive questions probably do not apply to you, but we need to include them in case they apply to someone else who is taking this survey. Just answer each question honestly and trust us to analyze only the data that is relevant to you. That way, with all of the relevant data collected, your doctor will be better equipped to serve your health needs. We apologize again if the questions catch you off guard and we appreciate your patience as you progress through the survey.”