Using Microsoft Excel to Collect Usability Data

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ABOUT THE AUTHOR

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Introduction

Anyone who has ever conducted a usability evaluation of a website, software application, or consumer product, knows that human behavior research often produces reams of data that can take significant time to analyze. To be productive, researchers must be able to effectively organize and reduce these data so that they can more efficiently perform their analysis and proceed with improving the product.

For many human factors researchers, basic note-taking on a paper form or electronic document represents the common data collection strategy. Unfortunately, this approach can make data compilation a cumbersome process. More complex and powerful tools to assist with compilation and analysis are becoming more common, but they can be expensive and more than most researchers need or want in many cases. In addition, such proprietary tools are frequently restricted to the Windows operating system, and they offer little, if any, ability for customization, making it difficult for practitioners to tailor the tool to meet their specific needs.

This paper examines the data collection process for usability research and provides a cursory view of the popular data logging solutions available today. It then discusses the use of Microsoft Excel with Visual Basic macros as a potential data collection tool for usability research. Advantages and disadvantages associated with Microsoft Excel are reviewed, and a sample data collection tool is presented.

Defining and Collecting Usability Data

Before entering into a discussion on logging the data that arises from usability research, a brief overview of the common terminology associated with usability research and data may prove valuable.

EFFECTIVENESS, EFFICIENCY, AND SATISFACTION

According to the International Standards Organization (ISO 1998) there are three primary attributes that comprise usability: *Effectiveness*, *Efficiency*, and *Satisfaction*. Other definitions from the field propose that additional contributing elements such as *learnability* and *retention* also be considered. Table 1 reveals how some of the more popular definitions of usability map to one another.

Table 1. Three Popular Definitions of Usability (van Welie, van der Veer et al. 1999)

ISO 9241-11	(Nielsen 1993)	(Shneiderman 1998)
Efficiency	Efficiency Learnability	Speed of Performance Time to Learn
Effectiveness	Memorability Errors/Safety	Retention over Time Rate of Errors by Users
Satisfaction	Satisfaction	Subjective Satisfaction

QUANTITATIVE/QUALITATIVE AND OBJECTIVE/SUBJECTIVE DATA

The terms *quantitative* and *qualitative* have become pervasive in the user-centered design process over the years. Thanks to the close working relationship between marketing and user experience groups in the product design process, there can often be confusion surrounding the application of these terms. In this author's experience, the confusion is generally due to the tendency to refer to research "methods" and "data" as if they are always the same. This is not always true, however.

For example, a survey of 1000 people is often regarded as quantitative research, yet it may collect both quantitative and qualitative data. Similarly, interviews and usability tests are often considered qualitative research, yet they too can collect both quantitative and qualitative data. By reducing the "research" to a single type, we fail to recognize that different types of data may be collected, and that different types of analysis are appropriate.

Another dimension of data that can be confusing to people is the *objective* and *subjective* dimension. In general, objective data, that which is "external to the mind", based on facts, and unbiased by opinion or interpretation is more valuable than subjective data, that which "exists in the mind" and belongs to the thinking subject rather than the object of thought. Just as both *quantitative* and *qualitative* data may be collected in usability research, both *objective* and *subjective* data may be collected. For a more complete discussion of the difference between quantitative/qualitative and objective/subjective data, read Philip Hodgson's essay on the Userfocus website (http://www.userfocus.co.uk/articles/datathink.html).

Effectively determining the types of data to be collected in a study is really a function of the research questions that need to be answered. Table 2 provides some examples of usability data collection to help convey the possibilities.

Table 2. Types of Data Collected for Effectiveness, Efficiency, Satisfaction

	Quantitative Objective	Quantitative Subjective	Qualitative Objective	Qualitative Subjective
Effectiveness	Count of tasks completed successfully (according to predefined criteria). Count of errors committed by user during task performance (according to predefined criteria).	Likert scale rating by participant of how well the product solves the intended job.	A description of the observed sequence of steps performed by user.	Participant's comments related to completing a given task.
Efficiency	Time spent per completed task. Count of number of clicks performed during task completion.	Likert scale rating by participant of how efficient they perceive the product to be.	*	Participant's comments related to perceived efficiency of product.
Satisfaction	*	Likert scale rating of participant satisfaction.	*	Participant's comments related to satisfaction with product. A description of observed behavior by participant (frustration, delight, etc.)

*Usability research does not lend itself easily to collecting these types of data for these usability attributes.

FORMATIVE AND SUMMATIVE EVALUATIONS

One final distinction that exists in the field of usability research is the one between *formative* and *summative* evaluations. In a formative evaluation, the emphasis is on the "formation" of the future design and direction of a product. Data collected to help drive this future direction may include qualitative data that is largely based on users' observed behaviors and comments about the product. It may also include quantitative data, however, especially when the research question involves an A-B comparison between two early prototypes.

A summative evaluation is intended to provide a "summation" of the products' current state, ideally in the form of a measurable score. Due to the desire for a numerical score, quantitative data

collection is generally the priority in summative research. Qualitative data may still be collected as a 'bonus' to supplement the value gained from the study, provided it does not interfere or influence the collection of quantitative data. For example, a think-aloud protocol are generally not performed during a summative study due to its impact on the time required to complete a task. However, qualitative comments may be recorded after tasks and/or at the end of a study without adversely affecting other data collection.

PRESENTING YOUR DATA WITH CONFIDENCE

Finally, it's worth noting a relatively recent enthusiasm in the usability community for including confidence intervals when presenting the effectiveness results from a usability study. Sauro (2005) makes a case for the benefit of including confidence intervals in addition to point estimates (i.e. the basic task completion percentage that is commonly reported) in order to help convey the margin of error associated with the results, and to "temper both excessive skepticism and overstated usability findings".

Calculating confidence intervals is a relatively straightforward procedure, although as Lewis and Sauro (2006) point out, there are numerous subtleties to be considered in your selection of method used. In practice, however, the results seem to be quite similar across the different methods of calculation, such that applying any one of their top 2-3 recommended methods will allow you to achieve the goal of communicating that a margin of error is associated with your results.

Datalogging Practices

COMMON PRACTICES

As with most types of research, usability research is frequently characterized by "tailored approaches" refined and customized by organizations and individuals to meet their specific needs. This is particularly true when it comes to collecting data.

In an *Idea Market* session conducted at UPA 2004, Dr. David Dayton (Southern Polytechnic State University) delved into the details of how six different practitioners (including himself) logged usability data. As part of his review of datalogging practices, Dayton (2004) describes four popular types:

Table 3. Common Types of Data Logging Practices

	Type of Datalogging Practice	Practitioners reporting regular use
1	**Problem Coding** Record predictable events and sort them on the fly into one or more categories. Analyze the resulting quantitative data with statistical methods and compare to pre-defined benchmarks to assess the usability of the product.	0 of 6
2	**Event Description** Records free-form handwritten notes to capture significant events and/or usability problems. Analyze notes post-test, group and categorize events, and rate their severity.	4 of 6
3	**Event Description w/ Problem Coding** Combine methods 1 and 2. Code events into certain pre-set categories, and enter descriptive notes for later team review and discussion of the most significant problems.	1 of 6
4	**Event Description w/ Problem Coding & Video Time Stamps** Capture the "story" of a test session in shorthand notes. Code significant events into preset categories ("navigation problem", "mental model gap"). Time-stamp to sync notes with video.	1 of 6

Dayton (2004) made two other interesting observations about data logging in his UPA workshop. He noted that his collection of participants and attendees at the session were generally able to agree that an effective data log is one that "allows a team to find answers to its questions without having to review the session tapes." Interestingly, of the six data points mapped to his common practices

in Table 3, the only practitioner who regularly includes a reference to recorded video data was Dayton himself.

Dayton (2004) also discovered from his work with experienced practitioners, that the most common mistake made by those new to logging is the tendency for "observation overkill". That is, the tendency to record excess information that ends up impeding the team in reviewing the logs during analysis sessions. In this author's experience, this signal to noise ratio of "data to information" certainly determines the value of your logged results.

SEPARATING DATA COLLECTION FROM ANALYSIS

With respect to the types of data collection commonly practiced, an interesting issue presents itself regarding the 'on the fly' coding of data according to preset categories. Researchers should consider how important it is to their study that they separate data collection from data analysis, for this decision may have implications on the time required to complete the analysis phase, as well as the quality of analysis performed.

Keeping data collection separate from analysis allows the researcher to concentrate on making quality observations, and leaves the analysis and pattern identification of problems to be performed later once all data has been gathered. This approach may be especially appropriate when the product being evaluated is new and a predetermined set of categories or codes may not be entirely appropriate for that product.

Alternatively, pre-defined categories for coding data 'on the fly' may help expedite a research study by reducing the amount of time spent in data analysis. When the product being tested has been tested previously, pre-defined categories are more likely to be anticipated with a high degree of accuracy.

LOW-TECH DATA COLLECTION

As Dayton (2004) revealed by his small sample from a UPA conference, data logging practices may consist of a basic paper notepad or electronic document. A pre-designed form or template may further facilitate logging by anticipating in advance some of the patterns to be recorded and providing a checklist approach to recording common observations. Even with a well-designed form, however, this method can result in a significant "paper shuffle" at the end of the study. Multiple pages of documents with scribbled notes and numbers, often out of order and inconsistently labeled, must then be collated, coded, entered into some type of sorting software, and categorized by task or question - all of this just so the analysis phase can begin!

Low-tech solutions are generally limited as well when it comes to collecting efficiency measures. Typically, measuring efficiency requires the use of a stopwatch or some external timekeeping tool whose results are then manually recorded onto the printed form. During analysis, these efficiency data may get manually entered a second time from the paper form into some analysis software before insertion into the final report. Practices which require little or no data re-entry are most desirable from a data-integrity perspective.

ELECTRONIC DATA COLLECTION

In recent years, an increasing number of computer software packages have been developed specifically to support usability researchers in collecting, coding, analyzing, and even reporting their usability data. Several of these programs provide particularly excellent solutions for managing the video data captured during a usability study. Like any solution, however, these applications have their strengths and weaknesses. The following section presents a quick review of some of the available solutions on the market.

A SURVEY OF USABILITY DATA LOGGING SOFTWARE

The following software products represent a range of solutions currently available in the North American marketplace:

Bit Debris

URL: http://www.bitdebris.com/
The *Usability Activity Log v2.3* "offers an effective means to easily and unobtrusively document observational data and task performance". This application can be synchronized with existing video equipment so that recorded observations are directly 'linked' to the accompanying video data for easy access by the researcher. The product is a Windows application (NT recommended) and costs $300.00 USD per license.

Noldus

URL: http://www.noldus.com/
The *Noldus Observer* is "a professional system for the collection, analysis, presentation and management of observational data." This application is able to accommodate data entry directly from a computer, a handheld device, or a video recorder, and offers extensive coding and analysis options to the researcher. While the Observer is packed with powerful features that may be needed for extensive qualitative research, it may be overkill for many usability researchers. Observer is Windows only.

OvoStudios

URL: http://ovostudios.com/
OVO Logger 4.2 comes in three different flavours (freeware, a la carte, fully featured) and provides extensive logging options for both notes and "tapeless" video as well as powerful bookmarking and reporting features designed to optimize the analysis and reporting phase of a study. While the fully featured version may be more than many researchers need or have a budget for, the freeware version may be just the right ticket. OVO Logger is a Windows-only product.

Techsmith

URL: http://www.techsmith.com/
Morae is touted as "the only fully integrated, all-digital solution for analyzing human-computer interaction". This application takes full advantage of digital video technology to allow researchers to capture, store, locate, and edit their video data from a usability study. Priced at $1298.00 USD, this application may be an attractively priced solution for managing video data. In addition, the software provides the ability to enter notes and set markers to reference the corresponding video. Morae is Windows only.

Usability Systems/Alucid

URL: http://www.usabilitysystems.com/
UsabilityWare 4.0 is "a single program that can be relied upon as a beginning-to-end tool for all of your data collection, analysis, and final deliverables." This program allows you to enter your recruitment and scheduling details prior to a study, record your observations during the study, analyze the results, and build a report based on the data. The product is a Windows application and costs $4500.00 USD per license.

PROS AND CONS OF COMMERCIAL SOFTWARE DATALOGGERS

Pros

- They address the majority of a usability data needs in a single tool (e.g. test protocols, participant details, qualitative observations, quantitative measures, data analysis and/or export to other analysis tools, and automatic report generation).
- Ability to bookmark specific points on corresponding video to facilitate easy retrieval and editing following completion of the study.
- Automatic linking within the final report to desired video selections.
- Various levels of note-taking ability to allow capture of observations, issues, etc.
- Remote capabilities allowing team members at remote locations to view sessions over the Internet and contribute notes, markers, etc. to a common data file.
- Automatic collection of quantitative data (e.g. time on task, mouse clicks)
- Exporting capabilities to transfer quantitative data to analysis tools (e.g. MS Excel).

Cons

- Expensive, ranging from a few hundred dollars to several thousand dollars.
- Complex to learn and master depending on the product's feature list.
- Limited to the PC platform (few options for Macintosh-based researchers).
- Often focused primarily on the recording, storage, and retrieval of selected video data, with less attention paid to recording and analyzing observed data.
- Lack of customization available.
- Require significant hard drive space for installation.

Using Microsoft Excel for Data Logging

Since VisiCalc (short for 'visible calculator') arrived on the scene in 1978, the computer spreadsheet has been considered by many to be the original 'killer software application'. A few years later, Lotus 1-2-3 assumed the lead position in the spreadsheet category, and shortly after that Microsoft Excel captured first place. Today, Microsoft Excel holds one of the largest installed bases of any software application, and is an integral part of the Microsoft Office suite of business applications.

Pros

- Ubiquitous nature of Microsoft Excel means it is familiar to many people and already resides on the majority of computers.
- Built-in statistical and charting capabilities facilitate a variety of analyses.
- Many researchers already use Excel to organize, sort, and chart their data.
- Ability to incorporate numbers, text, formulas, and Visual Basic programming, permits significant customization to meet individual needs.
- Cross-platform compatibility accommodates PC and Macintosh users.
- Lightweight file size requires little additional hard drive space (assuming that Microsoft Excel application already exists on the computer).

Cons

- Limited layout and formatting abilities due to fixed grid pattern of columns/rows.
- Limited timing ability even with Visual Basic programming enhancements,
- Visual Basic knowledge is required in order to make certain customizations.
- Visual Basic macros employ absolute references rather than relative references, making it necessary to update certain macros with certain customizations.
- Entering the cursor into a cell interrupts any visible Visual Basic macros that are currently running (e.g. timer feature).

The Usability DataLogger v4.2

The remainder of this paper describes the *Usability DataLogger v4.2*, an Excel-based tool designed to facilitate the recording of observed data and measurements during a usability evaluation. The first section delineates what the tool does and does not offer. The sections that follow describe the basic architecture of the tool, and provide screen shots and general instructions for use.

What it Offers:

- A Microsoft Excel file (requiring Microsoft Excel in order to run)
- Free of charge (download it at: http://www.userfocus.com)
- Cross-platform compatibility (PC or Macintosh)
- Ability to collect both quantitative and qualitative data
- Ability to support both formative and summative evaluations
- Customizable by you to meet your specific needs
- Enter your initial test details:
    - Participant profile details (gender, age, role/occupation, additional demographics)
    - Scheduled dates and times for each session
    - Manage up to 20 participants, 20 tasks, 30 interview questions
    - Automatically generate linear or random task order, or manually enter custom order
    - Choose from SUS or Perceived Ease of Use & Usefulness (TAM) satisfaction scales
    - Reset all performance scores for easy reuse of test protocol
    - Reset all test details (incl performance scores) while saving your customized changes to the datalogger for future use
- Print your test-related materials
    - Print a table of participant profile details (or insert table into test report)
    - Print a list of tasks and/or set of individual task cards with one task per card
    - Print a list of questions for use during a test or interview
    - Print a copy of your selected satisfaction questionnaire for participant use
    - Print your data summaries of task observations and questions for each participant
- Enter data during or after the study:
    - Take notes of qualitative observations for each task and enter directly during the study or from your paper notes after the study is over
    - Record participants' success ratings from a menu of your predefined effectiveness levels on each participant page
    - Record task performance time with a built-in timer on each participant page
    - Record participants' satisfaction scores from a menu of your preselected satisfaction questionnaire
- Organize your data for easy analysis following completion of a study
    - Review and print automatically compiled summaries of observations and questions
    - Review and print (or insert) Effectiveness charts showing regular task performances and adjusted task performances with confidence intervals (margin of error calculations)
    - Review and print (or insert) Efficiency charts showing mean time per task together with min and max times for all participants

What it Does NOT Offer:

- Video data marking or management
- Automatic report generation

USING THE DATALOGGER

The Worksheets

The Usability DataLogger is essentially a collection of worksheets contained within a single Microsoft Excel file. Table 4 displays the complete set of worksheet tabs, each with its own description of the information contained on that sheet.

Table 4. List of Worksheets and their Descriptions

Worksheet name	Description
About	Title screen, credits, and basic introduction to tool
Admin	Test protocol data (participant details, task order, # of tasks...)
Profiles	Participant demographic details (age, gender, role/occupation, location…)
Tasks&Qs	Tasks and questions for inclusion in study
Pilot1, Pilot2	Data collection for pilot tests (results not compiled in charts)
P1…20	Data collection for participants 1-20 (task completion, time per task…)
Data(Observ)	Summary of individual observations of tasks, organized by task, formatted to print
Data(Qs)	Summary of answers to questions, organized by question, formatted to print
Data(Charts)	Automatic chart generation of effectiveness, efficiency and satisfaction
PrintTasks	Formatted tasks for a report table and/or a task booklet for the test
PrintQs	Formatted questions for a reference sheet during study
Satisfaction	Data source sheet for satisfaction instruments
DataSum	Data summary sheet used to populate charts worksheet
Reset	Options for resetting performance data OR all test related parameters and data

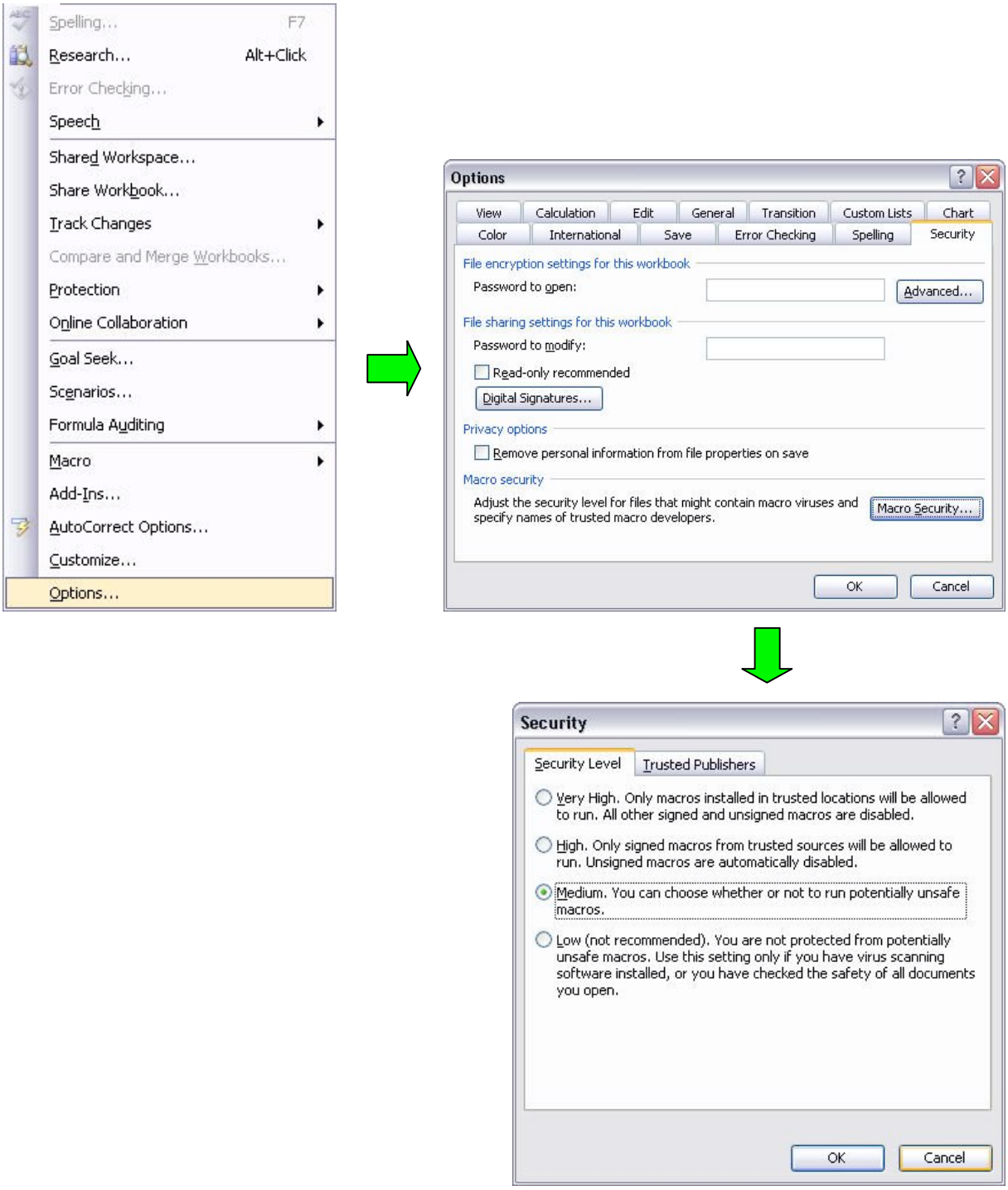
Opening the File

For PC users:
After double-clicking the DataLogger v4.2 file, you may receive a Macros Security message indicating that your system security will not permit you to run the Visual Basic macros embedded in the datalogger.

Figure 1: Macros Security Message

In this event, you may adjust the security settings inside your MS Windows settings to reduce the security level from High to Medium or Low. Select *Options* from the *Tools* menu in MS Excel. Select the *Security* tab and click *Macros Security*. Change the security level setting from *Very High* or *High* to *Medium*. Save your change and try reopening the Datalogger. From this point on, it should work the same for both PC and Macintosh systems.

Figure 2: Options & Security Settings



For Mac users:
After double-clicking the Datalogger v4.2 file, you will receive a Security Warning asking your permission to *Enable Macros*. Select *Enable Macros* in order for the various features of the DataLogger to work properly. Each time you use the logger, you will need to perform this step.

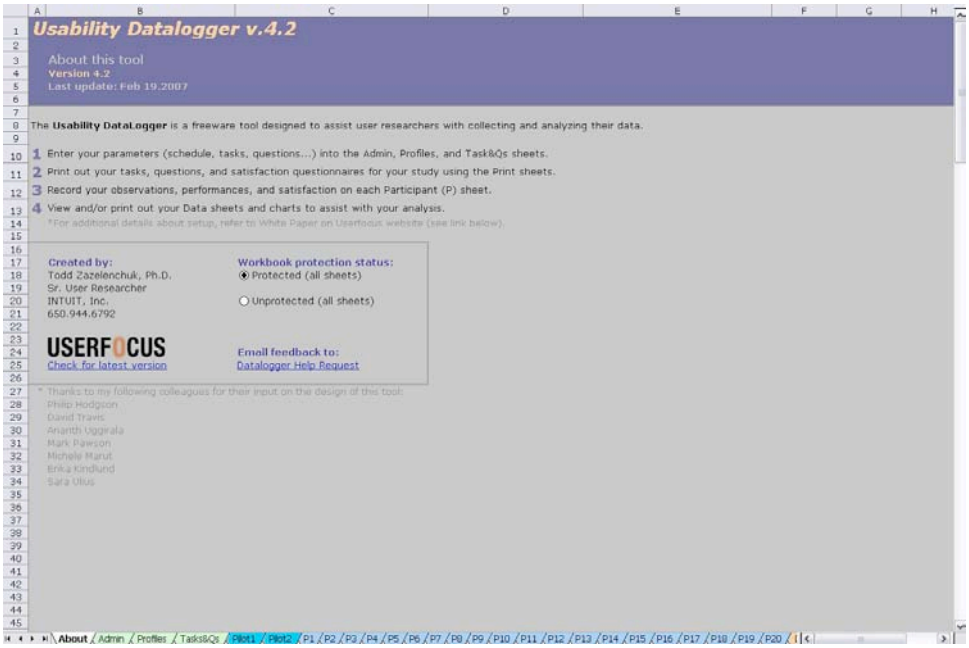
Figure 2: Security Warning

When the file opens, you will arrive at the *About* worksheet. On this sheet, you may check for the latest version on the Userfocus website. You may also protect or unprotect all sheets in the workbook. This is necessary if you wish you to make any formatting, formula, or Visual Basic macro changes to the file.

NOTE: the design of the DataLogger includes both white and grey background sections. When protection is ON, only white sections may be edited on the P worksheets. This allows data entry and test admin details to be entered without accidentally altering cell references and formulas. All grey sections are protected when protection is ON.

When protection is OFF, both white and grey sections may be edited. Columns and rows may be adjusted, formulas changed, new worksheets inserted, etc… On some sheets, grey areas remain unprotected to allow rows to be automatically resized.

Figure 3: About Sheet



Preparing Your Test

The *Admin* worksheet is used to enter the necessary test parameters and details prior to conducting a study. These details include: Project name, participant names, session dates and times.

Selecting the number of tasks and your desired task order per participant is also performed on this sheet. You may choose up to 20 tasks in total for your study. The default task order is *linear*, but

can be changed to *random* using the radio button series in the center of the worksheet. Should you need to manually adjust the order of tasks in the event that certain tasks need to be performed in a certain sequence, you may select *linear* and then manually edit the order as needed.

NOTE: You must finalize the order of your tasks before you begin collecting any data. Once you have entered a score for your first participant in the study, the DataLogger will warn you that changing your task order from that point on, will have adverse effects on your summarized data as your tasks and observations will no longer correspond properly.

You may also customize your scoring criteria for your study on this sheet. You may define up to 5 *menu labels* to be used to score task performances during the study. These labels will be available in a pulldown menu in the *Score* column of each participant worksheet. For each menu label, you should identify a corresponding *Pass/Fail* value to ensure that certain summary charts are displayed properly. You should also provide a *description* that corresponds to each label to serve as your defining criteria for applying the label to your observed task performances.

NOTE: Depending on your needs, you may choose to define fewer than 5 scoring labels. If you choose to define fewer than 5 labels, you should leave any undefined cells BLANK in order to maintain the integrity of the summary worksheets and charts.

You may also select from two available satisfaction questionnaires on the Admin worksheet. The System Usability Scale (SUS) is a well-known 10-item satisfaction instrument developed by Digital Equipment Corporation. The Perceived Ease of Use and Usefulness questionnaire is a 12 question survey based on Fred Davis's Technology Acceptance Model (TAM). For whichever questionnaire you select, the corresponding questions will appear on each participant worksheet. Results from the questionnaire are compiled and presented on the DataCharts worksheet.

Finally, at the bottom right of the worksheet, you may choose to edit the "Usability DataLogger v.4.2" name in order to better fit your organization. Your new name will appear at the top of each sheet in the file following the edit.

Figure 4: Admin Sheet

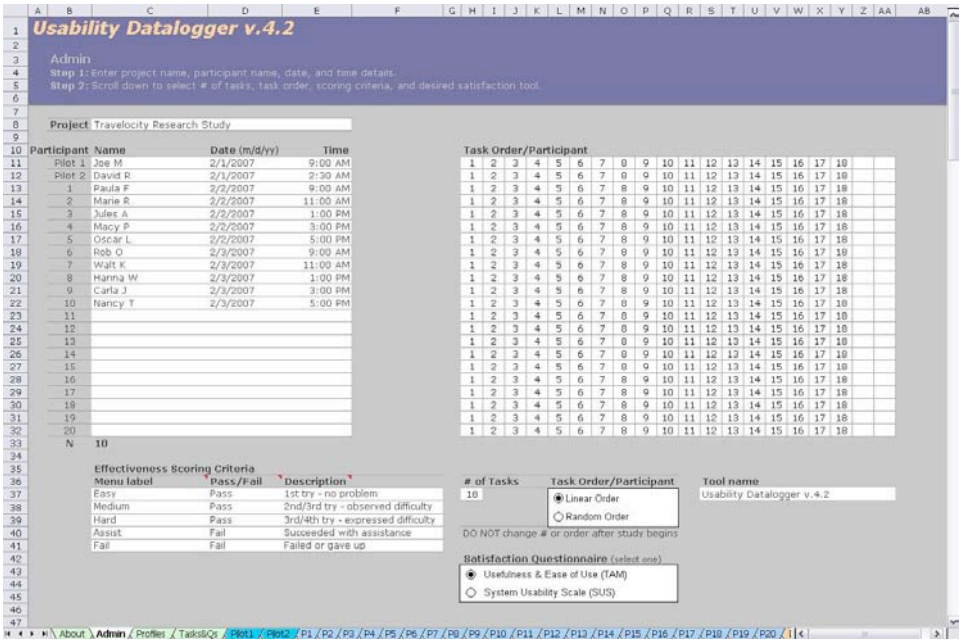
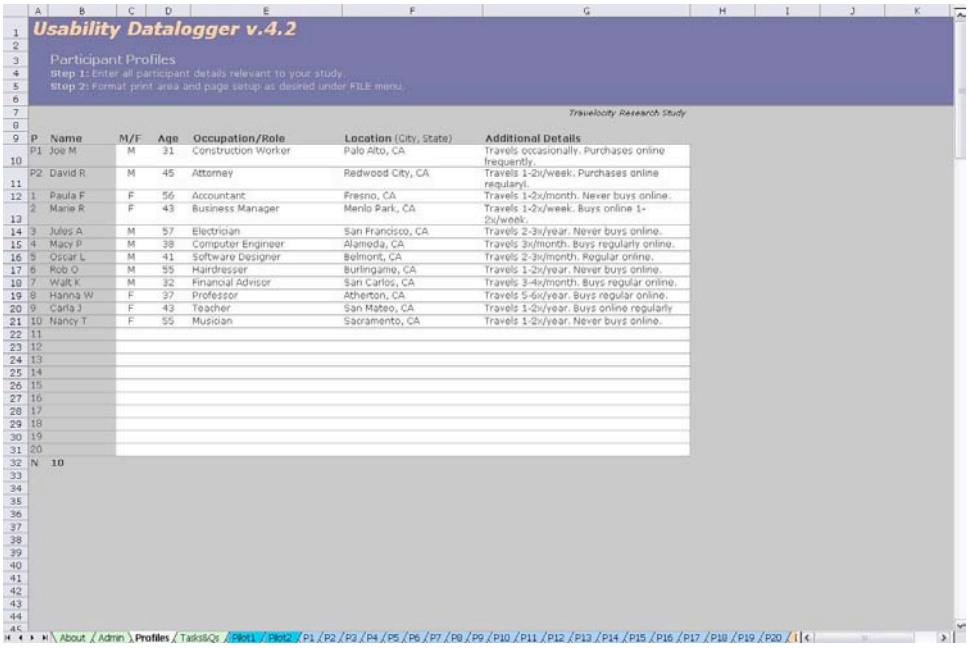


Figure 5: Profiles Sheet



Usability Datalogger v.4.2

Participant Profiles

Step 1: Enter all participant details relevant to your study.
Step 2: Format print area and page setup as desired under FILE menu.

Travelocity Research Study

P	Name	M/F	Age	Occupation/Role	Location (City, State)	Additional Details
P1	Joe M	M	31	Construction Worker	Palo Alto, CA	Travels occasionally. Purchases online frequently.
P2	David R	M	45	Attorney	Redwood City, CA	Travels 1-2x/week. Purchases online regularyl.
1	Paula F	F	56	Accountant	Fresno, CA	Travels 1-2x/month. Never buys online.
2	Marie R	F	43	Business Manager	Menlo Park, CA	Travels 1-2x/week. Buys online 1-2x/week.
3	Jules A	M	57	Electrician	San Francisco, CA	Travels 2-3x/year. Never buys online.
4	Macy P	M	38	Computer Engineer	Alameda, CA	Travels 3x/month. Buys regularly online.
5	Oscar L	M	41	Software Designer	Belmont, CA	Travels 2-3x/month. Regular online.
6	Rob Q	M	55	Hairdresser	Burlingame, CA	Travels 1-2x/year. Never buys online.
7	Walt K	M	32	Financial Advisor	San Carlos, CA	Travels 3-4x/month. Buys regular online.
8	Hanna W	F	37	Professor	Atherton, CA	Travels 5-6x/year. Buys regular online.
9	Carla J	F	43	Teacher	San Mateo, CA	Travels 1-2x/year. Buys online regularly
10	Nancy T	F	55	Musician	Sacramento, CA	Travels 1-2x/year. Never buys online.
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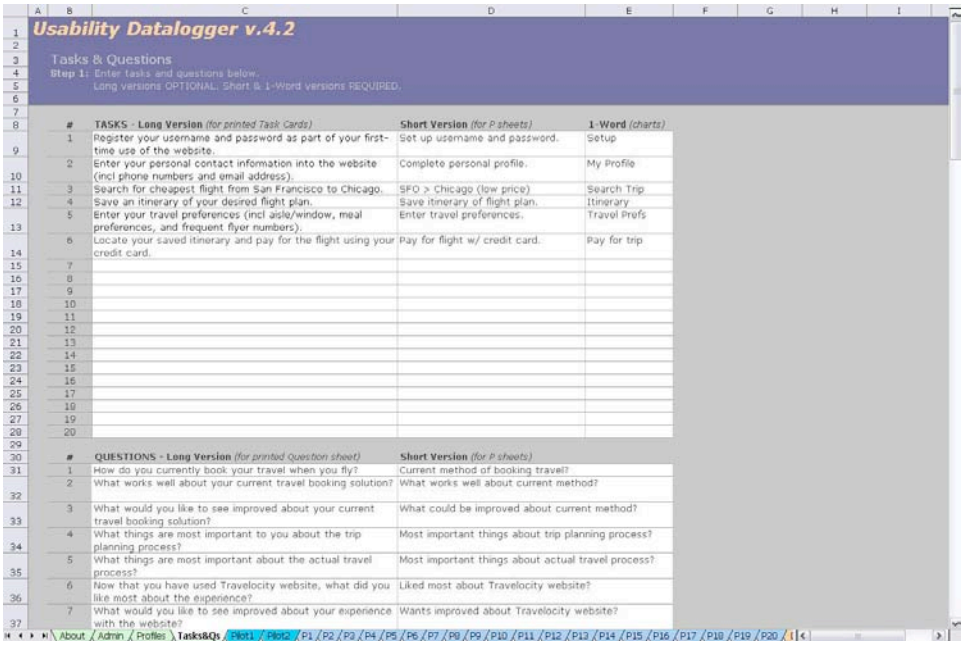
N	10					

About / Admin / Profiles / Tasks&Qs / Pilot1 / Pilot2 / P1 / P2 / P3 / P4 / P5 / P6 / P7 / P8 / P9 / P10 / P11 / P12 / P13 / P14 / P15 / P16 / P17 / P18 / P19 / P20

On the *Profiles* worksheet, participant names are automatically entered from the Admin sheet. You may add extra details for each participant including gender, age, occupation/role, location, and miscellaneous demographic details.

Figure 5: Task & Qs Sheet



Usability Datalogger v.4.2

Tasks & Questions

Step 1: Enter tasks and questions below.
Long versions OPTIONAL. Short & 1-Word versions REQUIRED.

#	TASKS - Long Version (for printed Task Cards)	Short Version (for P sheets)	1-Word (charts)
1	Register your username and password as part of your first-time use of the website.	Set up username and password.	Setup
2	Enter your personal contact information into the website (incl phone numbers and email address).	Complete personal profile.	My Profile
3	Search for cheapest flight from San Francisco to Chicago.	SFO > Chicago (low price)	Search Trip
4	Save an itinerary of your desired flight plan.	Save itinerary of flight plan.	Itinerary
5	Enter your travel preferences (incl aisle/window, meal preferences, and frequent flyer numbers).	Enter travel preferences.	Travel Prefs
6	Locate your saved itinerary and pay for the flight using your credit card.	Pay for flight w/ credit card.	Pay for trip
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#	QUESTIONS - Long Version (for printed Question sheet)	Short Version (for P sheets)
1	How do you currently book your travel when you fly?	Current method of booking travel?
2	What works well about your current travel booking solution?	What works well about current method?
3	What would you like to see improved about your current travel booking solution?	What could be improved about current method?
4	What things are most important to you about the trip planning process?	Most important things about trip planning process?
5	What things are most important about the actual travel process?	Most important things about actual travel process?
6	Now that you have used Travelocity website, what did you like most about the experience?	Liked most about Travelocity website?
7	What would you like to see improved about your experience with the website?	Wants improved about Travelocity website?

About / Admin / Profiles / Tasks&Qs / Pilot1 / Pilot2 / P1 / P2 / P3 / P4 / P5 / P6 / P7 / P8 / P9 / P10 / P11 / P12 / P13 / P14 / P15 / P16 / P17 / P18 / P19 / P20

On the *Task & Qs* worksheet, you may enter long, short, and 1-word versions of your tasks, along with interview questions for your research study.

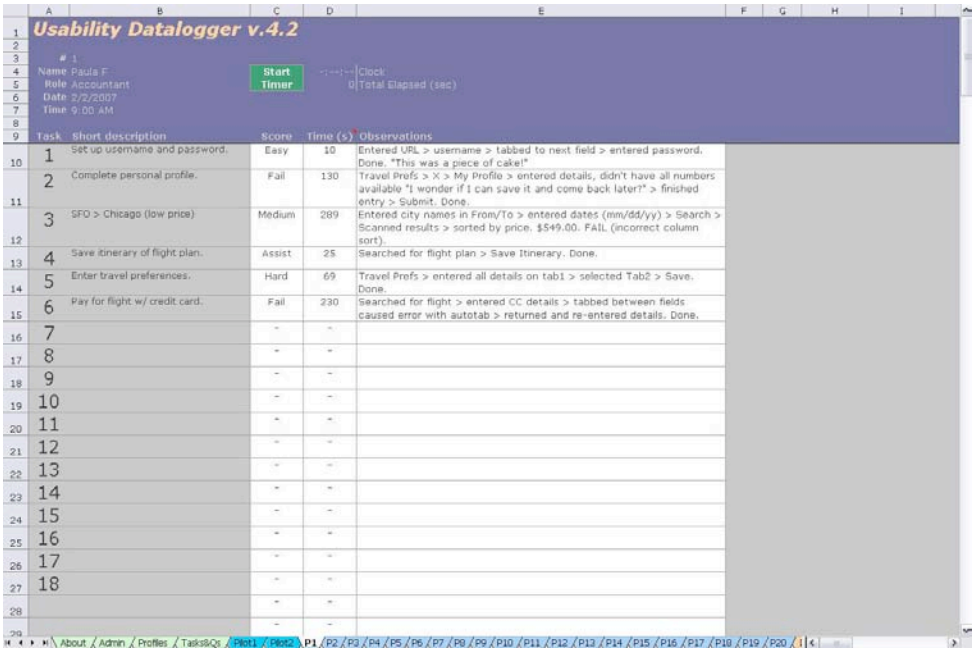
- The long version of tasks captures the complete version of each item as it is to be presented to the users, and is transferred to the *TaskPrintOut* worksheet for easy transfer into a final report and easy printing of task cards to be used in the test. If the *TaskPrintOut* is not required, the long version may be considered optional.
- The short version is an abbreviated version intended to capture the essence of the task and is used to populate the individual participant worksheets (P1-P20).
- The 1-word version is used to populate the task labels on all summary charts.

Recording an Individual's Performance

The *Participant* worksheets are used to record the data for each participant's session. On these worksheets, basic project and participant details, tasks, task order, pre-test and post-test questions are all pulled automatically from the *Admin* and *Tasks&Qs* worksheets. The researcher then records observations, time per task, and effectiveness for each task that the user performs in the white portion of the screen.

NOTE: Datalogger users should not enter time per task data into cells when the user fails the task. This will avoid including time details for failed performances in the summary charts for efficiency.

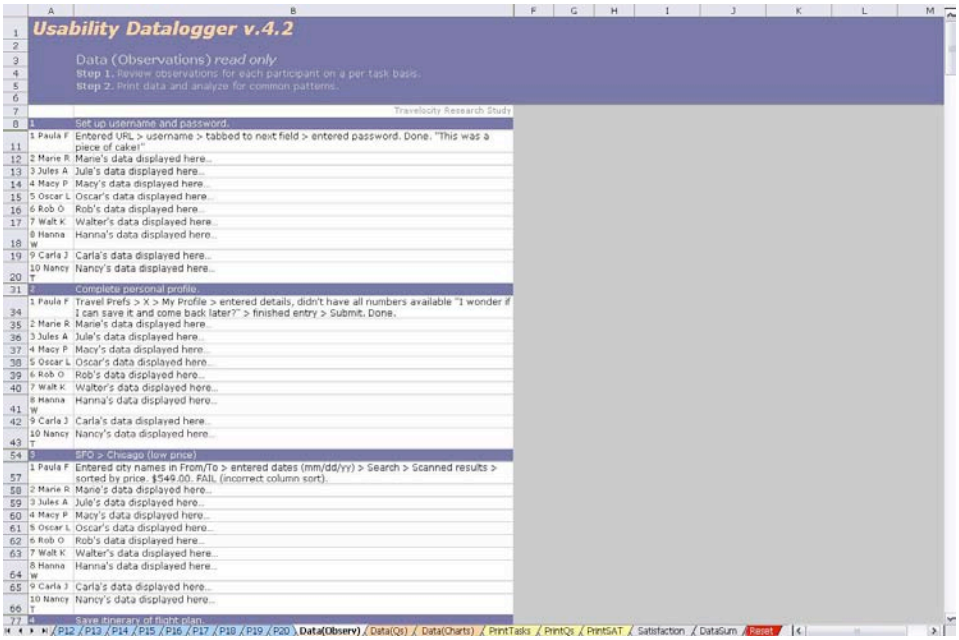
Figure 6: Participant Sheet

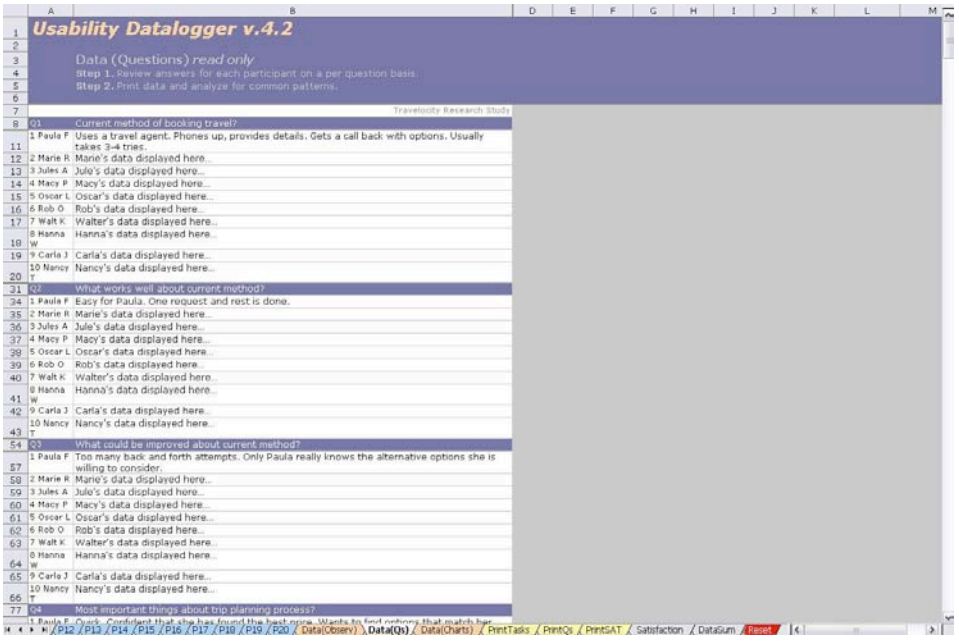


ANALYZING THE DATA

On the *Data(Observ)*, and *Data(Qs)* worksheets, the researcher is able to view a summary of these respective data organized by task or question. The sheet is formatted for easy printing and facilitates pattern recognition by grouping all related observations and responses together.

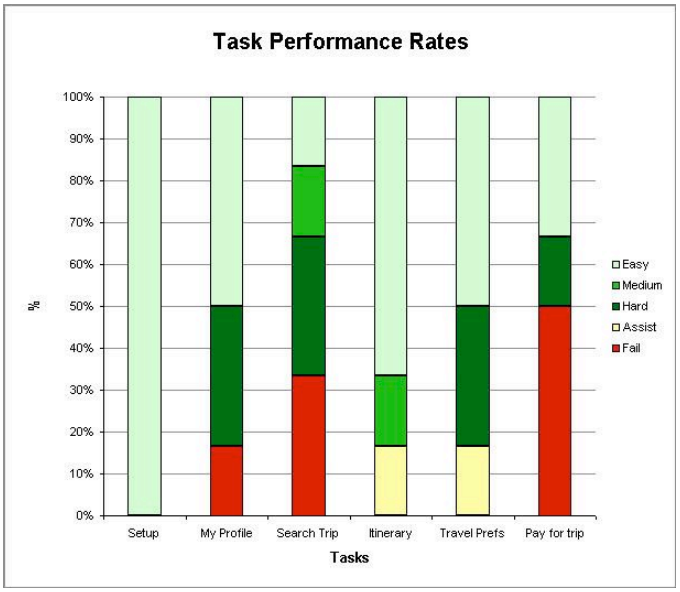
Figure 7: Data(Observations) & Data(Questions) Sheets

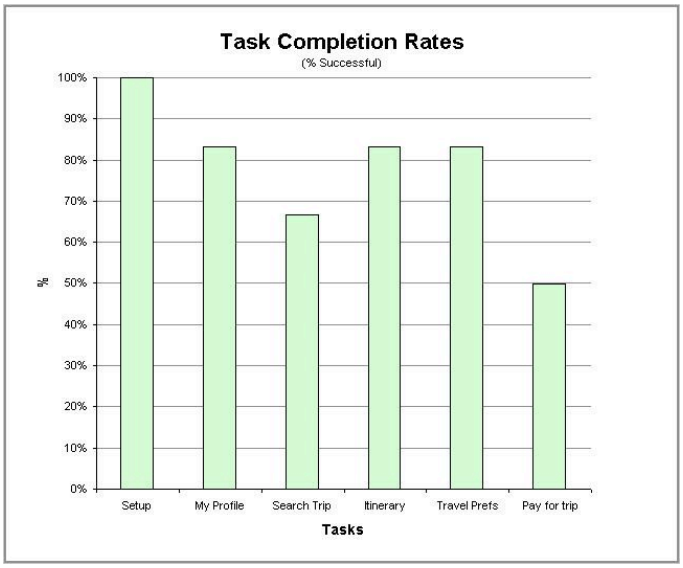




On the *Charts* worksheets, the researcher can view an automatically generated set of charts that display the overall effectiveness and efficiency measures for the tasks performed in the study, and the satisfaction scores as rated by users. These charts can be copied and pasted into final reports or tailored accordingly to meet specific needs the researcher may have.

Figure 8: Task Performance Charts





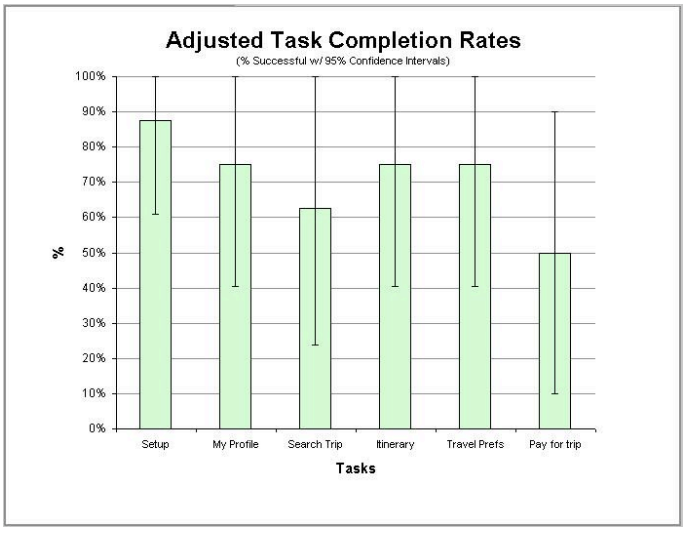


Figure 9: Time on Task w/ Max & Min Times Chart

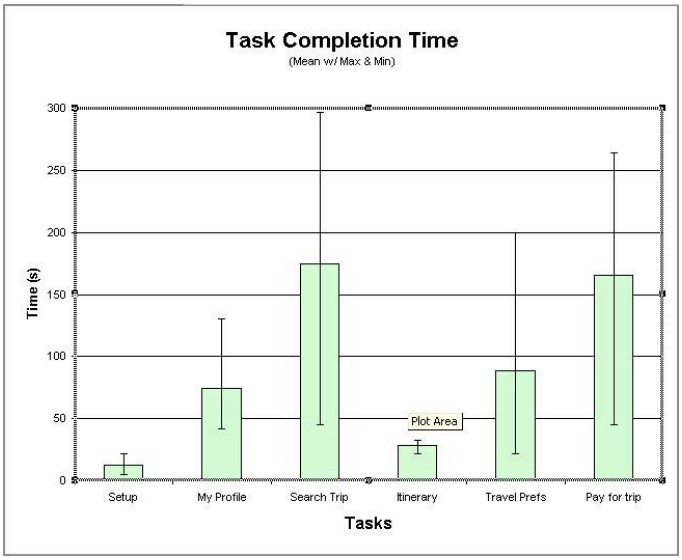


Figure 10: Satisfaction Chart for Perceived Ease of Use & Usefulness (Davis, 1989)

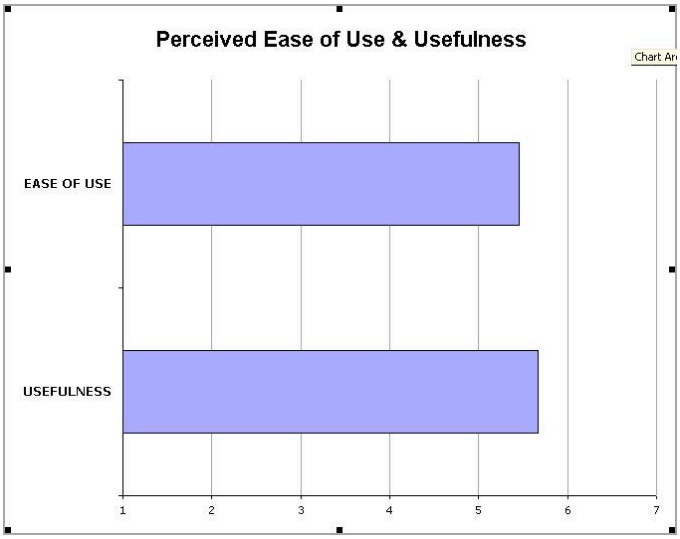


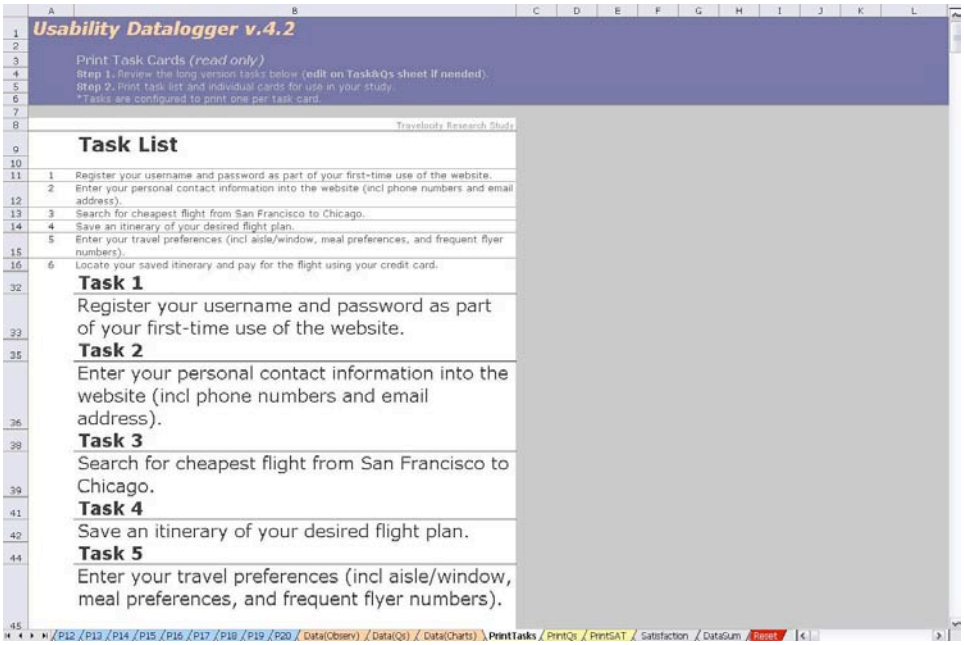
Figure 11: Histogram for Perceived Ease of Use & Usefulness (Davis, 1989)

Perceived EASE OF USE and USEFULNESS Histogram		Unlikely						Likely
	Mean	1	2	3	4	5	6	7
1 Using this product enables me to accomplish tasks more quickly.	6.3						≡	=
2 Using this product improves my current performance.	5.4				_	≡		=
3 Using this product increases my productivity.	5.7			_		=	_	≡
4 Using this product makes me more effective.	5.9					≡	=	=
5 Using this product makes it easier to do my work.	5.1				≡	_	=	_
6 I find this product useful.	5.6				=	_	=	=
7 Learning to operate this product was easy for me.	6.1				_	_	_	≡
8 I found it easy to get this product to do what I want it to do.	4.9		_		_	≡	_	_
9 My interaction with this product was clear and understandable.	5.7			_		_	≡	=
10 I found this product to be flexible to interact with.	5.1			_	_	≡		=
11 It was easy for me to become skillful at using the system.	4.7		_		=	_	≡	
12 I found the system easy to use.	6.1					_	≡	=
USEFULNESS	5.67							
EASE OF USE	5.45							

PRINTING YOUR TASKS

The *PrintTasks* worksheet is an optional sheet that allows you to print out a page of your finalized task set for reference purposes during a test. It also allows you to print a task package to be used in your actual study with one task printed per page. The example below shows the reference page at the top of the formatted section, followed by the individual task cards. The worksheet is formatted to print each section on its own page.

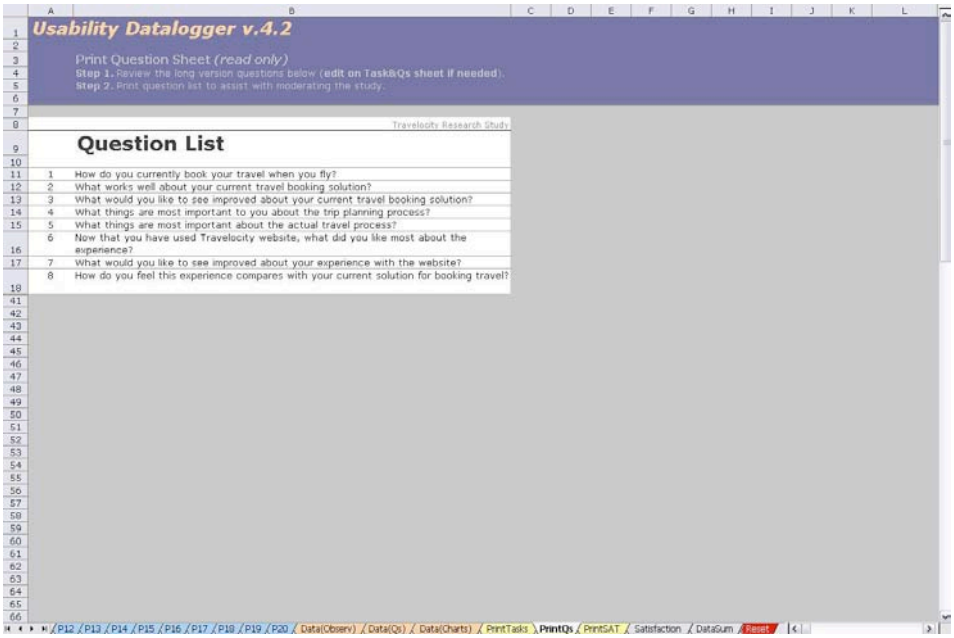
Figure 12: PrintTasks Sheet



PRINTING YOUR QUESTIONS

The *PrintQs* worksheet is an optional sheet that allows you to print out the long version of the questions entered on the Tasks&Qs worksheet.

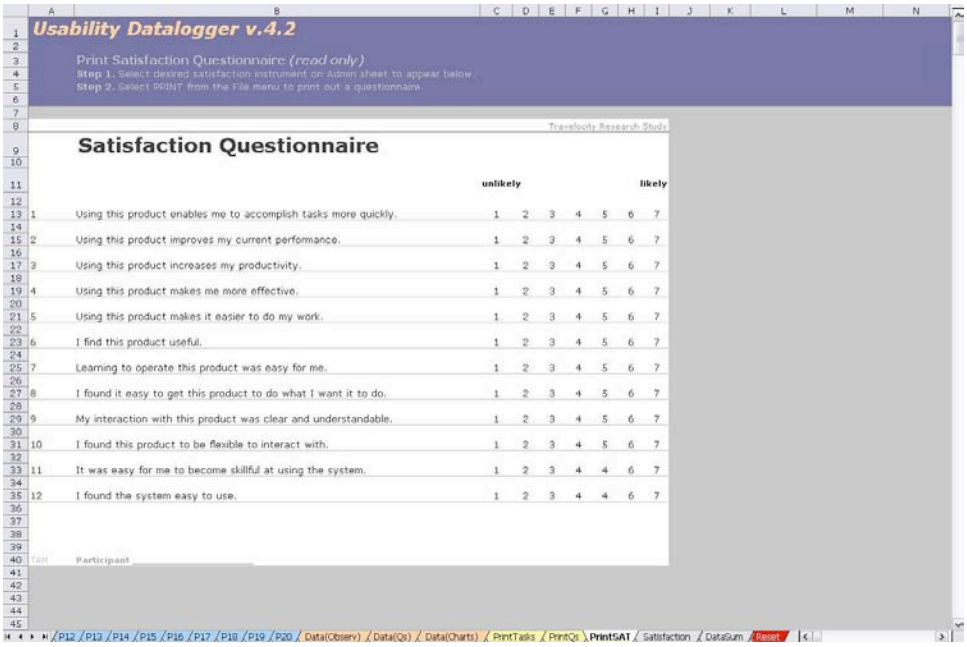
Figure 12: PrintQs Sheet



PRINTING YOUR SATISFACTION QUESTIONNAIRE

The *PrintSAT* worksheet is an optional sheet designed to let you print out a properly formatted satisfaction questionnaire for your participants to use. The questionnaire presented on this worksheet is determined by your original selection on the Admin worksheet.

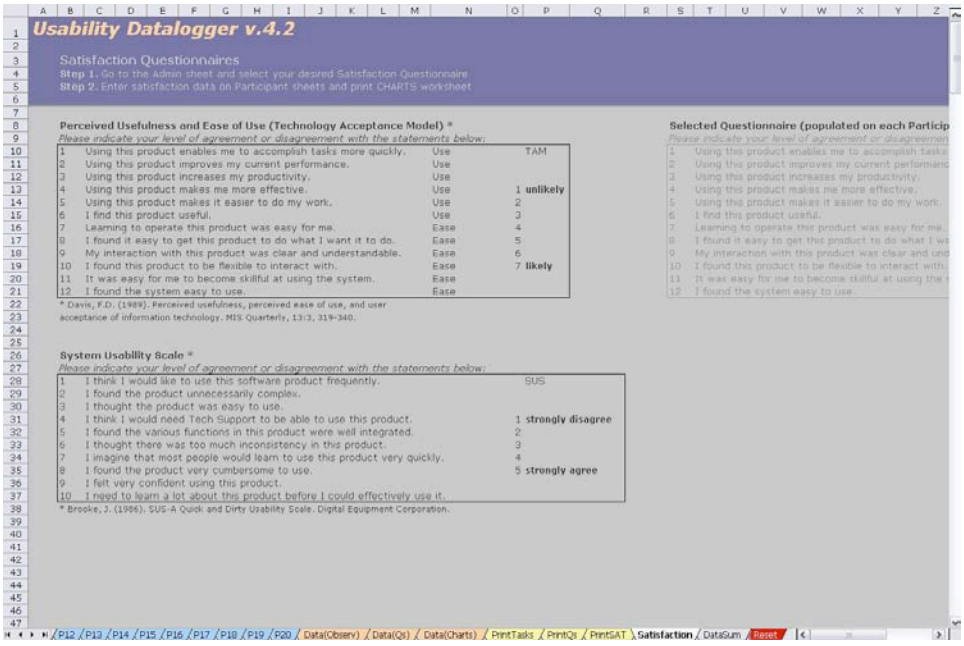
Figure 12: PrintSAT Sheet



SATISFACTION OPTIONS

The *Satisfaction* worksheet is a read-only worksheet in v.4.2 and contains the two versions of Satisfaction instruments available in the datalogger. Future versions may contain additional instruments.

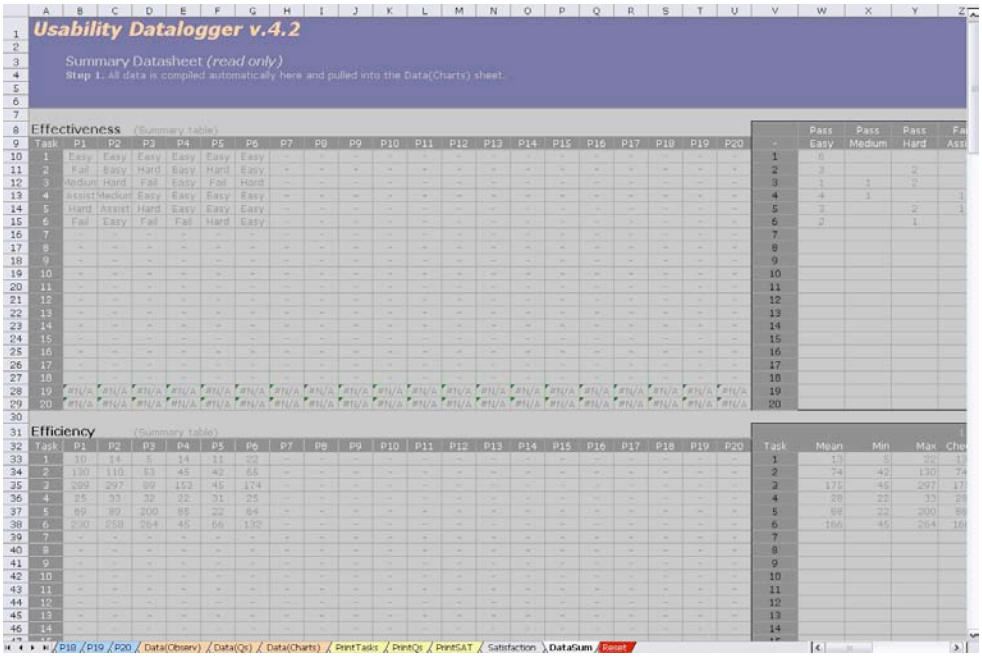
Figure 13: Satisfaction Sheet



SUMMING UP YOUR DATA

The *DataSum* worksheet is where all your quantitative data gets compiled. If the default version of the DataLogger meets your needs, you shouldn't have to do anything with this sheet. If you desire to customize your logging tool, however, you may find yourself needing to make changes to this sheet. If so, just unprotect the workbook on the *About* sheet and use the existing tables and cells as a reference for making adjustments or additions.

Figure 14: DataSum Sheet

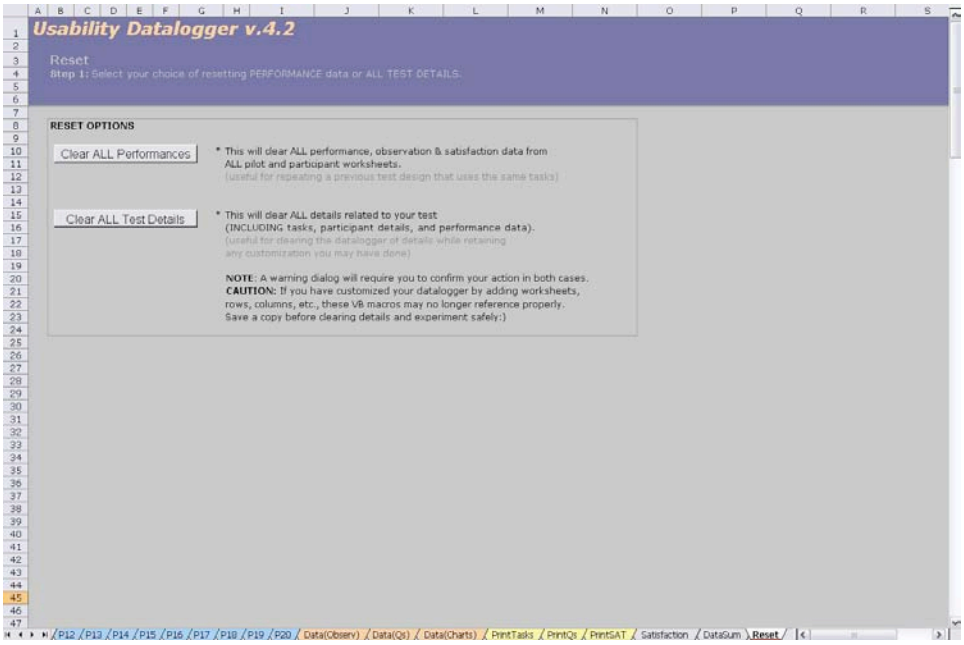


RESETTING YOUR WORKSHEET

The *Reset* worksheet allows you to reset your datalogger in two different ways:
1) Clear all Performance Data – This allows you clear all the scores, times, and observations recorded for a given study, while retaining your participant details, tasks and questions. This is useful when you would like to repeat a study using the same tasks and questions.

2) Clear all Test Details – This clears all scores, times, and observations, as well as the participant and task details.

Figure 15: Reset Sheet



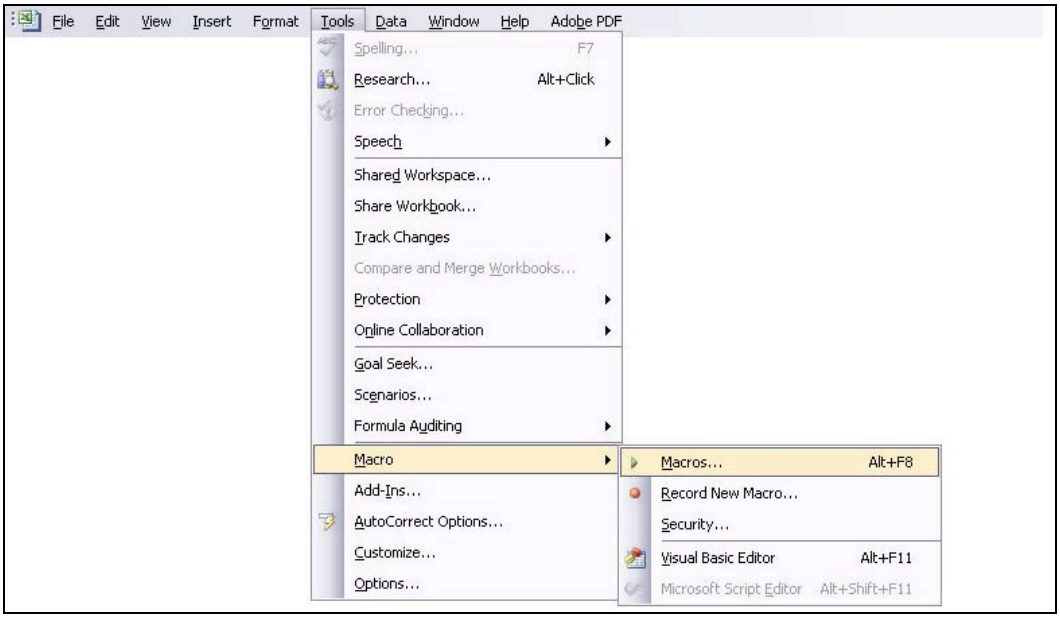
INSIDE THE DATALOGGER'S VISUAL BASIC MACROS

Entire books have been written on using Visual Basic (VB) and various scripts to achieve specific goals. The purpose of this section is only to help get you started locating and understanding the DataLogger's existing scripts. Additional VB learning may be necessary for you to extend the capabilities of the Usability DataLogger to meet your needs.

As with any scripting language, Visual Basic allows you to make use of a predefined vocabulary and syntax to construct your code. A script that you write for a given file is called a *macro* and allows you to automate or extend the standard features of a given application. In the Usability DataLogger, Visual Basic macros are used to display, start, stop, and reset a stopwatch timer into the tool. They are also used to protect and unprotect the workbook sheets, to automatically sequence the tasks in linear or random order, and to reset the DataLogger back to its default data state.

In Microsoft Excel, you can access your Visual Basic macros by selecting the *Tools* menu and choosing *Macros*.

Figure 16: Accessing Visual Basic Macros



Once selected, the *Macros* option presents you with a dialog box displaying the current list of macros and allows you to select and edit a desired macro.

Figure 17: List of Visual Basic Macros

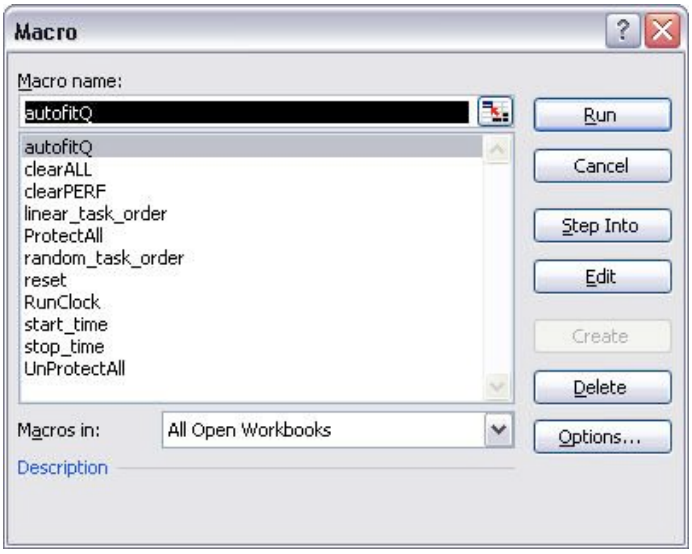


Figure 18: The Visual Basic macro scripts for the Usability DataLogger

```
Public totaltime As Variant
Public segmenttime As Variant
Public taskN As Variant
Dim RunWhen
```

```
Sub start_time()
If Range("c2").Value = "START" Then
segmenttime = 0
Range("c2").Value = ("")
Range("c4").Value = ("STOP")
Range("d2").Value = Format(Now(), "h:mm:ss")
Range("d3").Value = ("00:00:00")
Range("d4").Value = segmenttime

RunClock
```

```
Else: Beep
End If
End Sub
Public Sub RunClock()

Range("d3").Value = Format(Now(), "h:mm:ss")
RunWhen = Now + TimeSerial(0, 0, 1)
Application.OnTime RunWhen, "RunClock", , True

End Sub
```

```
Sub stop_time()
If Range("c4").Value = "STOP" Then
Range("c2").Value = ("START")
Range("c4").Value = ("")
Range("d3").Value = Format(Now(), "h:mm:ss")
segmenttime = (Abs(Range("d2") - Range("d3")))
Range("d4").Value = segmenttime
totaltime = totaltime + segmenttime
Range("d5").Value = totaltime

Application.OnTime RunWhen, "RunClock", , False

Else: Beep
End If
End Sub
```

```
Sub reset()
If Range("c2").Value = "START" Then
segmenttime = 0
totaltime = 0
Range("c4").Value = ("")
Range("d2").Value = ("00:00:00")
Range("d3").Value = ("00:00:00")
Range("d4").Value = segmenttime
Range("d5").Value = totaltime
Else: Beep
End If
End Sub
```

```
Sub autofitQ()
Application.ScreenUpdating = False          'turns sceenupdating off (to reduce to flicker during runtime)
   Rows("8:700").Select
   Selection.Rows.AutoFit
   Range("a800").Select
Application.ScreenUpdating = True           'turns sceenupdating on
End Sub
```

```
Sub random_task_order()
taskN = Range("h37")                        'set taskN variable to what user selects
                                            ' check to see if any data for Data(tasks) sheet (to avoid corrupting data file)
If Worksheets("DataSum").Range("ac32").Value = "0" Then

Proceed:                                    'label for identifying insertion point in macro to proceed with ordering after msgbox

Application.ScreenUpdating = False          'turns sceenupdating off (to reduce to flicker during runtime)

For i = 1 To 440                            ' clear all numbers across entire array of raw data table
Range("h53:aa74").Cells(i) = ""
Next i

For i = 1 To taskN                          ' enter random sequence of numbers across entire array of raw data table
Range("h53:aa53").Cells(i) = Rnd()
Range("h54:aa54").Cells(i) = Rnd()
Range("h55:aa55").Cells(i) = Rnd()
Range("h56:aa56").Cells(i) = Rnd()
Range("h57:aa57").Cells(i) = Rnd()
Range("h58:aa58").Cells(i) = Rnd()
Range("h59:aa59").Cells(i) = Rnd()
Range("h60:aa60").Cells(i) = Rnd()
Range("h61:aa61").Cells(i) = Rnd()
Range("h62:aa62").Cells(i) = Rnd()
Range("h63:aa63").Cells(i) = Rnd()
Range("h64:aa64").Cells(i) = Rnd()
Range("h65:aa65").Cells(i) = Rnd()
Range("h66:aa66").Cells(i) = Rnd()
Range("h67:aa67").Cells(i) = Rnd()
Range("h68:aa68").Cells(i) = Rnd()
Range("h69:aa69").Cells(i) = Rnd()
Range("h70:aa70").Cells(i) = Rnd()
Range("h71:aa71").Cells(i) = Rnd()
Range("h72:aa72").Cells(i) = Rnd()
Range("h73:aa73").Cells(i) = Rnd()
Range("h74:aa74").Cells(i) = Rnd()
Next i

Range("h77:aa98").Copy                      ' copy data from rank table and paste it in display table at top of worksheet
Range("h11:aa32").PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= False, Transpose:=False
```

```
Range("h37").Select                    'deselect range of cells
Application.CutCopyMode = False

'Range("r37").Value = 2                'set RANDOM radiobutton status to ON

Application.ScreenUpdating = True      'turns sceenupdating back on (off to reduce to flicker during runtime)

Else:
YesNo = MsgBox("You have entered data already for Participant 1. Changing task order now will distort your results. Do you want to continue?",
vbYesNo + vbExclamation, "Caution")
Select Case YesNo
Case vbYes
'If yes, return to label "Proceed" to complete task ordering
GoTo Proceed
Case vbNo
'If no, then task ordering is cancelled
'set RANDOM radiobutton status to OFF
Range("r37").Value = 1

End Select
End If
End Sub
```

```
Sub linear_task_order()

'set taskN variable to what user selects
taskN = Range("h37")

' check to see if any data for Data(tasks) sheet (to avoid corrupting data file)
If Worksheets("DataSum").Range("ac32").Value = "0" Then

'label for identifying insertion point in macro to proceed with ordering after msgbox
Proceed:

'turns sceenupdating off (to reduce to flicker during runtime)
Application.ScreenUpdating = False

' clear rows 1-20 to avoid residual values displayed when # of tasks is reduced
Range("h11:aa32") = ""

' enter linear sequence of 1-20 in each row of display table at top of worksheet
For i = 1 To taskN
Range("h11:aa11").Cells(i) = i
Range("h12:aa12").Cells(i) = i
Range("h13:aa13").Cells(i) = i
Range("h14:aa14").Cells(i) = i
Range("h15:aa15").Cells(i) = i
Range("h16:aa16").Cells(i) = i
Range("h17:aa17").Cells(i) = i
Range("h18:aa18").Cells(i) = i
Range("h19:aa19").Cells(i) = i
Range("h20:aa20").Cells(i) = i
Range("h21:aa21").Cells(i) = i
Range("h22:aa22").Cells(i) = i
Range("h23:aa23").Cells(i) = i
Range("h24:aa24").Cells(i) = i
Range("h25:aa25").Cells(i) = i
Range("h26:aa26").Cells(i) = i
Range("h27:aa27").Cells(i) = i
Range("h28:aa28").Cells(i) = i
Range("h29:aa29").Cells(i) = i
Range("h30:aa30").Cells(i) = i
Range("h31:aa31").Cells(i) = i
Range("h32:aa32").Cells(i) = i
Next i

'deselect range of cells
Range("h37").Select
Application.CutCopyMode = False

'set LINEAR radiobutton status to ON
'Range("r37").Value = 1

'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = True

Else:

YesNo = MsgBox("You have entered data already for Participant 1. Changing task order now will distort your results. Do you want to continue?",
vbYesNo + vbExclamation, "Caution")
Select Case YesNo
Case vbYes
'If yes, return to label "Proceed" to complete task ordering
GoTo Proceed
```

```
Case vbNo
'If no, then task ordering is cancelled
'set LINEAR radiobutton status to OFF
Range("r37").Value = 2

End Select
End If
End Sub
```

```
Sub ProtectAll()

'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = False

Dim myCount        'This line of code is optional
Dim i              'This line of code is optional
myCount = 26 'This line selects up to the summary sheets, allowing Autofit to work on unprotected cells
Sheets(1).Select    'This line of code selects the 1st sheet
For i = 1 To myCount
Password = "user"
ActiveSheet.Protect Password
If i = myCount Then
Sheets(1).Select
Beep
'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = True
End
End If
ActiveSheet.Next.Select
Next i

End Sub
```

```
Sub UnProtectAll()

'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = False

Dim myCount        'This line of code is optional
Dim i              'This line of code is optional
'myCount = Application.Sheets.Count 'This line selects all sheets
myCount = 26 'This line selects and unprotects up to the summary sheets
Sheets(1).Select    'This line of code selects the 1st sheet
For i = 1 To myCount
Password = "user"
ActiveSheet.Unprotect Password
If i = myCount Then
Sheets(1).Select
Beep
'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = True
End
End If
ActiveSheet.Next.Select
Next i
End Sub
```

```
Sub clearPERF()

YesNo = MsgBox("Are you sure you want to clear all performance, observation, and satisfaction data?", vbYesNo + vbExclamation, "Caution")
Select Case YesNo
Case vbYes
'If yes, continue with remainder of script to clear data
Case vbNo
'If no, then jump to cancel and exit script
GoTo Cancel
End Select

'turns sceenupdating off (to reduce to flicker during runtime)
Application.ScreenUpdating = False

Sheets("Pilot1").Select 'This line of code selects the Pilot1 worksheet
For i = 1 To 22

' clear all performance scores on each worksheet
Range("c10:c29") = "-"
Range("d10:e29") = ""
Range("e32:e61") = ""
Range("d64:d75") = "-"
Range("e64:e75") = ""

' select the first observation cell on each worksheet
Range("e10").Select

If i = 22 Then
Beep
Sheets("Pilot1").Select
'turns sceenupdating back on (off to reduce to flicker during runtime)
```

```
Application.ScreenUpdating = True
 End
End If
ActiveSheet.Next.Select
Next i

Cancel: 'jumps here if user cancels action

End Sub
```

```
Sub clearALL()

YesNo = MsgBox("Are you sure you want to clear all user data AND test details (tasks, questions, etc.)?", vbYesNo + vbExclamation, "Caution")
Select Case YesNo
Case vbYes
'If yes, continue with remainder of script to clear data
Case vbNo
'If no, then jump to cancel and exit script
GoTo Cancel
End Select

'turns sceenupdating off (to reduce to flicker during runtime)
Application.ScreenUpdating = False

'This line of code selects and clears data on the Admin worksheet
Sheets("Admin").Select
Range("c8") = ""
Range("c11:e32") = ""
Range("c8").Select  'selects the project name cell

Sheets("Profiles").Select 'This line of code selects and clears data on the Profiles worksheet
Range("c10:g31") = ""
Range("c10").Select  'selects the M/F cell

Sheets("Tasks&Qs").Select 'This line of code selects and clears data on the Tasks&Qs worksheet
Range("c9:e28") = "<>"
Range("c31:d60") = "<>"
Range("c9").Select  'selects the first task cell

'Data(Observ) and Data(Qs) not included due to sheet level macros. These cause screen flicker.
Sheets("Data(Charts)").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("PrintTasks").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("PrintQs").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1
Sheets("PrintSAT").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("Satisfaction").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("DataSum").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("Reset").Select
Range("a800").Select
   ActiveWindow.ScrollRow = 1
   ActiveWindow.ScrollColumn = 1

Sheets("Pilot1").Select 'This line of code selects the Pilot1 worksheet
For i = 1 To 22

' clear all performance scores on each worksheet
Range("c10:c29") = "-"
Range("d10:e29") = ""
Range("e32:e61") = ""
Range("d64:d75") = "-"
Range("e64:e75") = ""

' select the first observation cell on each worksheet
Range("e10").Select
```

```
If i = 22 Then
Beep
Sheets("About").Select
'turns sceenupdating back on (off to reduce to flicker during runtime)
Application.ScreenUpdating = True
 End
End If
ActiveSheet.Next.Select
Next i
Cancel: 'jumps here if user cancels action
End Sub
```

```
Sub sat_type_SUS()

'turns sceenupdating off (to reduce to flicker during runtime)
Application.ScreenUpdating = False

' go to SAT worksheet and clear previous values
Sheets("Satisfaction").Range("s10:ag21").Value = ""

' enter SUS items into SAT worksheet to be pulled into each participant worksheet
' copy data from SUS table and paste it in Selected Satisfaction Questionnaire table
Sheets("Satisfaction").Range("b28:q37").Copy
Sheets("Satisfaction").Range("s10").PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
        False, Transpose:=False
Sheets("Satisfaction").Select
Range("a1").Select
    ActiveWindow.ScrollRow = 1
    ActiveWindow.ScrollColumn = 1
    Application.CutCopyMode = False

Sheets("Admin").Select

'turns sceenupdating back on (off to reduce to flicker during runtime)
 Application.ScreenUpdating = True

End Sub
```

```
Sub sat_type_TAM()

'turns sceenupdating off (to reduce to flicker during runtime)
Application.ScreenUpdating = False

' go to SAT worksheet and clear previous values
Sheets("Satisfaction").Range("s10:ag21").Value = ""

' enter TAM items into SAT worksheet to be pulled into each participant worksheet
' copy data from SUS table and paste it in Selected Satisfaction Questionnaire table
Sheets("Satisfaction").Range("b10:p21").Copy
Sheets("Satisfaction").Range("s10").PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:=False, Transpose:=False
Sheets("Satisfaction").Select
Range("a1").Select
    ActiveWindow.ScrollRow = 1
    ActiveWindow.ScrollColumn = 1
    Application.CutCopyMode = False

Sheets("Admin").Select
'turns sceenupdating back on (off to reduce to flicker during runtime)
Application.ScreenUpdating = True

End Sub
```

```
Private Sub Worksheet_Activate()          'this macro is a worksheet level macro designed to automatically autofit rows of data
Dim I                                     'whenever the sheet is opened
Application.ScreenUpdating = False
    Rows("8:700").Select
    Selection.Rows.AutoFit
For i = 7 To 697
Rows(i).Hidden = Cells(i, "c").Value = "x"
Next i
Range("a800").Select
    ActiveWindow.ScrollRow = 1
    ActiveWindow.ScrollColumn = 1
Application.ScreenUpdating = True
End Sub
```

NOTE: One of the limitations discovered with a Visual Basic script in Microsoft Excel is its inability to visibly update while a given spreadsheet cell is in edit mode. In the case of the stopwatch timer, this means that the running clock is only appears to work when the cursor is not inserted into a cell. As soon as the user double clicks on a cell to edit text, the running clock continues to keep track of time, but the display is disabled, making it appear that the clock has been suspended.

Conclusion

Any usability study is only as good as the data that are collected and the method by which they are analyzed and interpreted. Several excellent commercial software applications have been developed over recent years to help support these activities. Microsoft Excel offers yet one more possibility for usability researchers to consider when it comes to collecting and organizing data for analysis. The Usability DataLogger represents one such Microsoft Excel-based tool that provides usability researchers with an inexpensive, customizable solution for collecting usability data.

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