

PolyXpress Usability Testing

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Abstract

This paper investigates different usability testing methods, and details a final usability testing procedure for the PolyXpress application. Usability testing varies greatly and depends on the size, scope, and budget of a project. Jakob Nielsen, a usability expert, says usability testing generally involves finding test users, asking the users to perform representative tasks with the design, and observing/documenting what happens. There are three main types of usability testing methods: traditional, discount, and going-out-of-business. The methods range in scale, complexity, and cost. This paper specifically details the unique combination of the three main methods that should be used as the usability testing procedure for PolyXpress. PolyXpress usability testing should consist of recruiting five to fifteen test users, who are lead by a facilitator reading from a script, and should be documented using a GoPro camera with a Head Strap Mount, screen capture video using Display Recorder, and written notes. This paper also includes a list of recommendations for PolyXpress from preliminary usability testing.

1. Introduction

Usability researchers or designers do not universally recognize one usability testing method. Usability testing procedures vary greatly and depend on the size, scope, and budget of a project. Many consider usability testing an important step in the design process because of the benefits it yields. Testing helps designers determine whether their product is easy to use. If a design is difficult to navigate and learn, contains errors, or does not clearly display its purpose, users will have lower satisfaction and will probably not use the design. Testing also helps designers see their work with fresh eyes (Krug 2006). Not everyone thinks the same or knows the same information. The only way to know if a design is working is to test it.

Yet, usability testing is not always a part of the design process because it can be expensive and time consuming. Projects with limited resources commonly do not perform any testing, or if they do it is usually too little too late. Over the years, usability testing methods have evolved to increase efficiency and effectiveness so limited projects can accommodate testing. In general usability testing involves three steps:

1. Find users
2. Ask the users to perform representative tasks with the design
3. Observe and document what happens (Nielsen 2012).

The purpose of this paper is to compare usability testing methods to find and implement the least expensive and most efficient method for PolyXpress. The study specifically compares traditional, discount, and going-out-of-business usability testing methods, and details a final recommended procedure with implementation analysis for PolyXpress.

2. Background

The Background section of this paper contains information to explain what usability testing is and why it is important, the basic principles of usability, and the PolyXpress application.

2.1 *What is usability testing and why is it important?*

Usability testing, put simply, “assesses how easy user interfaces are to use” (Nielsen 2012). There are five elements to usability (Nielsen 2012):

1. Learnability—is it easy for users to learn basic tasks during their first encounter with a design?
2. Efficiency—how quickly can users perform tasks?
3. Memorability—is it easy for users to re-establish proficiency with a design after a period of not using it?
4. Error reduction—how many errors do users make and where?
5. Satisfaction—is the design pleasant to use?

Usability testing can be performed on any design involving user interaction. Typically usability testing is performed on websites and software, including mobile applications. In a usability test, a user is shown something—like an iPhone app—and asked to either figure out what it is, or to try and use it to do a typical task (Krug 2006). It is about learning whether a design works and how to improve it. In general usability testing involves three steps:

1. Find users
2. Ask the users to perform representative tasks with the design
3. Observe and document what happens (Nielsen 2012).

Usability testing is considered an iterative process because it should be done more than once. A design should be created, tested, fixed, then tested and fixed again (and again, and again). But, testing once is much better than never testing because testing always works and feedback, no matter how little, is valuable (Krug 2006). Improvements and adjustments can always be made within a design.

There are three main types of usability testing methods:

1. Traditional
2. Discount
3. Going-out-of-business.

Traditional usability testing is the oldest and most formal. It was originally practiced as a strict elaborate science to achieve statistically significant results, and is very expensive to execute due to its thoroughness and detail. Discount usability testing was created and explored to reduce the cost of testing while maintaining effectiveness. Discount testing is relatively cheaper than traditional testing, yet produces similar results. Going-out-of-business usability testing is the most casual, and could also be called do-it-yourself usability testing. It allows for testing with very limited resources. Figure 1 summarizes the differences between the three methods.

Figure 1. Summary of the Three Main Usability Testing Methods (Krug 2006; Nielsen 2009)

Three Usability Testing Methods			
	Traditional	Discount	Going-out-of-business
Creator		Jakob Nielsen, Bruce Tognazzini	Steve Krug
Number of users	8 or more	5	3-4
Recruiting effort	Carefully selected to match target audience	Representative users	Anyone
Where to test?	Usability lab with observation room and one-way mirror	An office room with video camera	An office room
Who does the test?	An experienced usability professional	An experienced usability professional	Anyone, preferably someone patient
Advanced planning	Tests scheduled far in advanced because must reserve lab and make arrangements with test users	Tests scheduled in advanced	Tests are arranged, but with minimal planning
Preparation	Very detailed test procedure	Detailed test procedure	Decide quickly what to test
What/When do you test?	Test once when the design is near complete, unless budget allows for more testing	More than once, and as many as the budget allows	Run many small tests continually throughout development
Cost	\$20,000-\$50,000	\$5,000-\$15,000	\$0-\$300
What happens after?	An extensive, detailed, written report	Written report	Observers type up a page of notes

Usability testing is important because it helps designers determine whether their product is easy to use. If a design is difficult to navigate or learn, contains errors, or does not clearly display its purpose, users will have lower satisfaction and will probably not use the design. Usability testing reveals opportunities to increase the five elements of usability (learnability, efficiency, memorability, error reduction, and satisfaction).

Usability testing also helps designers see their work with fresh eyes (Krug 2006). Not everyone thinks the same or knows the same information. The only way to know if a design is working is to test it. Steve Krug compares usability testing to having friends visit from out of town. “Inevitably, as you make the tourist rounds with them, you see things about your home town that you usually don’t notice because you’re so used to them” (Krug 2006).

2.2 What are the basic principles of usability?

There are several basic principles of usability, and almost every professional usability researcher has their own set of guidelines. Together Jakob Nielsen's 10 Heuristics and Bruce Tognazzini's 16 Principles provide a comprehensive list. The two lists overlap. And, both are centered on human-computer interaction, but can be applied to PolyXpress. Figure 2 displays Jakob Nielsen's 10 Heuristics, and Figure 3 displays Bruce Tognazzini's 16 Principles.

Figure 2. Summary of Jakob Nielsen's 10 Heuristics (Nielsen 1995)

Jakob Nielsen's 10 Heuristics		
	Heuristic	Description
1.	Match the real world	Use common words, not technical jargon
2.	Consistency and standards	Similar things should look and act similar. Different things should look different.
3.	Help and documentation	Help should be searchable, context-sensitive, task-oriented, concrete, and short.
4.	User control and freedom	Provide the user with the ability to undo and cancel operations.
5.	Visibility of system status	Keep the user informed of the system state. For example cursor change, selection highlight, status bar.
6.	Flexibility and efficiency	Provide easy to learn shortcuts for frequently used commands. For example keyboard shortcuts, bookmarks, and history logs.
7.	Error prevention	Selection is less error prone than typing
8.	Recognition, not recall	Users should not have to memorize information and instead all needed information should be visible.
9.	Error reporting, diagnosis, recovery	Error messages should be precise, constructive, and polite.
10.	Aesthetic and minimalist design	Less is more. Omit unneeded information, features, and graphics.

Figure 3. Summary of Bruce Tognazzini's 16 Principles (Tognazzini)

Bruce Tognazzini's 16 Principles		
	Principle	Description
1.	Anticipation	Anticipate the user's wants and needs. Do not expect users to search for information or tools. Instead provide users the proper information and tools for each task.
2.	Autonomy	Provide the user reasonable autonomy, by allowing freedom within boundaries. This is obtained by keeping users informed and aware with up-to-date information. For example an email box can be switched to show number of unread emails.
3.	Color blindness	Whenever information is conveyed with color always provide a secondary cue because not all people have color displays and not all people can see color (10% of men are colorblind).
4.	Consistency	Make objects consistent with their behavior. Make objects that act differently look differently.
5.	Defaults	Defaults should be quick and easy to change
6.	Efficiency of user	Users are more efficient when they spend less time "figuring out". Make decisions clear for quick processing time. Also, keep the user occupied because idle time is wasted time.
7.	Explorable interfaces	"Give users well-marked roads and landmarks, then let them shift into four-wheel drive." Provide users stable visual elements. For example the search bar always remains in top right corner. Make actions reversible and provide "undo".
8.	Fitt's Law	"The time to acquire a target is a function of the distance to and size of the target." Big buttons are faster and small buttons are slower because they require more accuracy and precision.
9.	Human-interface objects	Human-interface objects are similar to real world objects in that they can be seen, heard, touched, and are familiar. For example computer documents, folders, and trashcans.
10.	Latency reduction	Either hide or acknowledge waiting. Hide waiting with multitasking. Acknowledge button clicks immediately with auditory and visual feedback. Display an hourglass or loading bar when a user must wait for an action.
11.	Learnability	Reduce the learning curve as much as possible.
12.	Use of metaphors	Good metaphors will enable users to instantly grasp a concept. Metaphors usually evoke familiarity, with a twist.
13.	Protect users' work	Ensure users never lose their work due to an error.
14.	Readability	Text should be easy to read. Black text on a white background. Clear large fonts.
15.	Track state	Protect the user from restoring the state of their last session and keep histories of the user's previous choices. For example save printer settings.
16.	Visible navigation	Provide a visual of the user's location within a system to help them from becoming lost. For example provide a breadcrumb trail or highlight location in a navigation bar.

2.3 What is the PolyXpress application?

The PolyXpress application is a “platform for creating and experiencing interactive stories” (Haungs). Using geolocation, the app takes the user on a real world journey to interact with the environment while multimedia stories unfold on a mobile device, like an iPhone. The concept of PolyXpress is similar to geocaching. Geocaching is an outdoor recreational activity, in which participants use geographic coordinates and riddles to locate “caches” anywhere in the world. A typical cache is a small container housing trinkets for trade and a logbook. In PolyXpress, participants use the map to locate pinned geographic locations. When participants physically reach pinned locations, multimedia stories—in the form of images, text, music, and videos—become available on their mobile devices. PolyXpress could be used for telling several different kinds of stories, from campus and museum tours to fictional adventure quests. A picture of the PolyXpress map can be seen in Figure 4 below, and Figure 5 shows the homepage.

The PolyXpress application consists of a story player, an authoring tool, and a cloud service. It is currently being created by Dr. Michael Haungs in the Computer Science and Liberal Arts and Engineering Studies departments at California Polytechnic State University in San Luis Obispo. Currently there is little to no budget for PolyXpress usability testing.

Figure 4. PolyXpress Map Interface

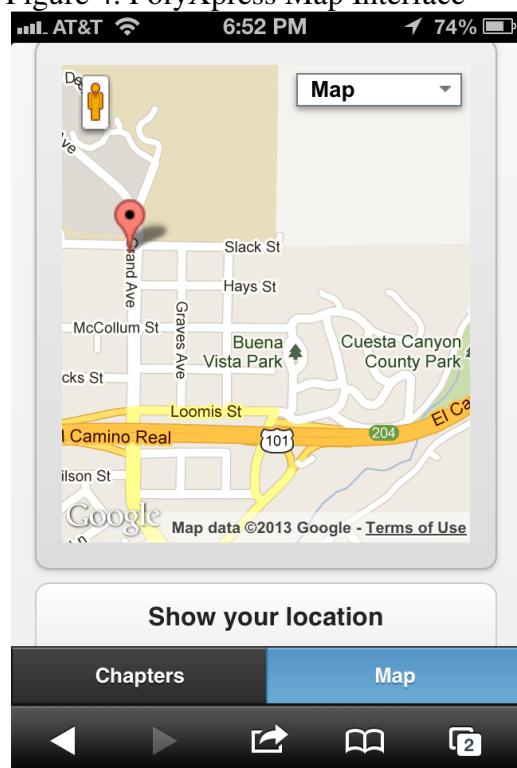
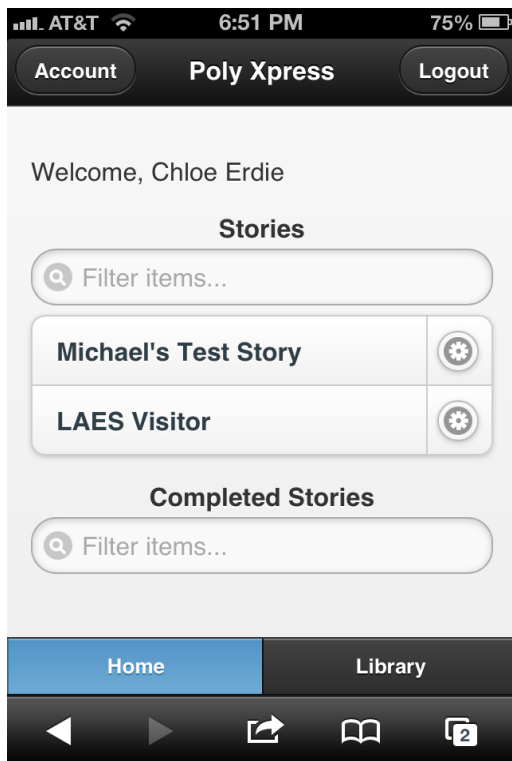


Figure 5. PolyXpress Homepage Interface



3. Deliverable

The report itself and accompanying digital files are the deliverable. The purpose of this paper is to compare usability testing methods to find the least expensive and most efficient method for the PolyXpress application. The study specifically compares traditional, discount, and going-out-of-business usability testing methods, and details a final recommended procedure with implementation analysis for PolyXpress.

4. Design

In general usability testing involves three steps:

1. Find users
2. Ask the users to perform representative tasks with the design
3. Observe and document what happens (Nielsen 2012).

4.1 Find Users

The Find Users section explains who can be a test user, how they are recruited, and how many should be recruited for PolyXpress usability testing.

4.1.1 Who can be a usability test user and how are they recruited?

Ideally usability test users should accurately represent the design's targeted audience. In traditional testing, user recruiting is a very precise and extensive process. For example, requirements as specific as "male accountants between the ages of 25 and 30 with one to three years of computer experience who have recently purchased expensive shoes" are pursued (Krug 2006).

"The best-kept secret of usability testing is the extent to which *it doesn't much matter who you test*" (Krug 2006). As long as test participants have used the Internet or mobile applications enough to know the basics, they are qualified going-out-of-business usability test users (Krug 2006). It is usually not good to design for a narrow target audience because everyone appreciates clarity. "Experts are rarely insulted by something that is clear enough for beginners" (Krug 2006).

There are exceptions for choosing test users, though. If your design is going to be mainly used by one type of user, like mostly women or teenagers, then recruit from that group (Krug 2006). And, if your design requires specific knowledge, like professional terminology or jargon, then recruit people with that knowledge for at least one round of tests (Krug 2006).

Users should be offered a reasonable incentive. Typical stipends for one-hour test sessions range from \$50 for average users to several hundred dollars for professionals with specific knowledge (Krug 2006). Steve Krug recommends offering people "a little more than the going rate, since (a) it makes it clear that [you] value their opinion, and (b) people tend to show up on time, eager to participate" (Krug 2006). The invitation should be kept simple to keep the idea of testing simple in the minds of potential participants, and to avoid discussing the design beforehand (Krug 2006). The invitation should not give too much away because it could skew the test. If users are asked to figure out what a design is, their first look should be their starting point—not someone else's description of what the design is.

4.1.2 Who can be a PolyXpress usability test user and how should they be recruited?

The audience for the PolyXpress is very broad. PolyXpress is for creating and experiencing interactive stories, and different stories could apply to different audiences. Anyone can be considered a potential user, so anyone can be a PolyXpress usability test user.

PolyXpress is being created by Dr. Michael Haungs in the Computer Science and Liberal Arts and Engineering Studies departments at California Polytechnic State University in San Luis Obispo. The Cal Poly University community will be the project's initial testing pool and students should serve as participants.

Following Steve Krug's advice, the average user should be compensated with a \$50 stipend. Currently there is little to no budget for PolyXpress usability testing, so compensation for one test user at \$50 is too expensive—let alone compensation for five users at \$250. A typical university student incentive is food. Cal Poly clubs lure students to meetings by promising a free meal, as seen in Figure 6 below. Chipotle burritos cost about \$7 each (Chipotle 2013). Pizza from Ciao, one of the restaurants on Cal Poly's campus, costs \$2.50 per slice (Ciao 2013).

Figure 6. Typical Cal Poly Club Announcements Offering Free Meals for Participation



PolyXpress participation can also be compensated with a sweet treat like candy. At Target, a pack of assorted chocolates cost about \$10. Candy is the cheaper option than Chipotle or pizza, and is the most feasible compensation for PolyXpress usability testing.

Figure 7. Cost of Candy from Target



An invitation for PolyXpress usability testing should read:

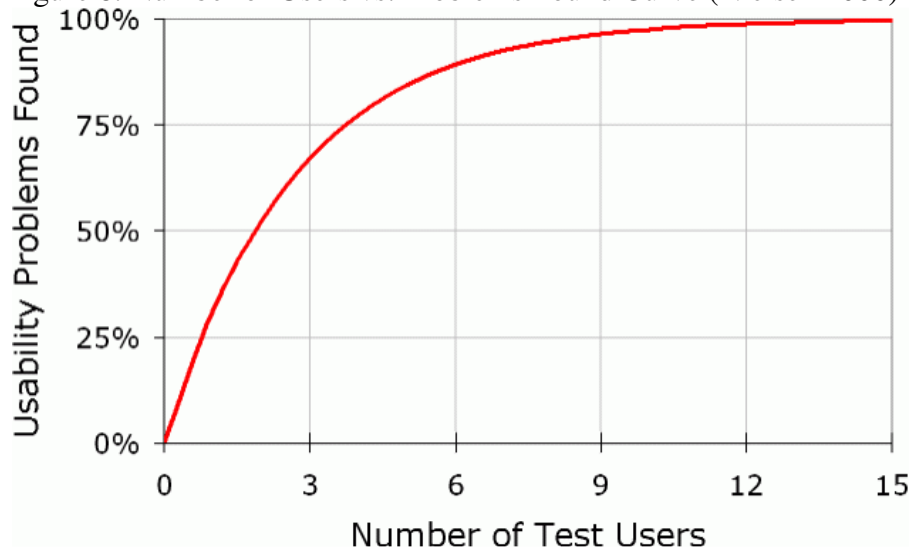
“A mobile application is currently being created by a team on campus. We are looking for people to look at the app and give some feedback. It’s very easy, and will only take a half hour. For your help we are offering study snacks (as much candy as you can grab!).”

4.1.3 How many usability test users are necessary?

In traditional usability testing, a lot of users must be tested for results to be considered statistically significant. Significance is generally achieved with a sample size of thirty, but cost usually reduces the number to around eight users (Krug 2006).

Jakob Nielsen has proven only five users are needed for successful discount usability testing. After the fifth user, the percentage of usability problems found only differs slightly with additional tests (Nielsen 2000). In Figure 8, on average three users find almost 75% of problems, five users find around 90% of problems, and fifteen users find 100% of problems. It takes an additional ten users to find the last 10% usability problems. It is economical yet still effective to stop at five users.

Figure 8. Number of Users vs. Problems Found Curve (Nielsen 2000)



4.1.4 How many usability test users should be recruited for PolyXpress?

At least five users, and at most fifteen, should be recruited for PolyXpress usability testing.

4.2 Ask the Users to Perform Representative Tasks with the Design

The Ask the Users to Perform Representative Tasks with the Design section explains the role of the facilitator and test script for PolyXpress usability testing.

4.2.1 How are users asked to perform representative tasks?

A facilitator, who reads from a script, asks test users to perform tasks. It is the facilitator's responsibility to tell the users what to do, to encourage them to think out loud, to listen, and help (Krug 2000). Following a script creates uniformity between the different test sessions and users because every user receives the same direction. It is important for facilitators to not give hints and to keep instructions simple, so results reflect reality.

4.2.2 What script should be used for PolyXpress usability testing?

The PolyXpress Usability Testing Script is attached in the Appendix and is adapted from Steve Krug's sample script (Krug 2010). The script should be read word-for-word. It includes checklists and directions for the facilitator. For example, the script tells the facilitator to let the test user look at PolyXpress' homepage and give their interpretation for 1 to 2 minutes. The PolyXpress Usability Testing Recording Consent Form was also created and is attached in the Appendix.

4.3 Observe and Document What Happens

The Observe and Document What Happens section details how usability tests are documented and how PolyXpress usability testing should be documented with notes, camera recordings, and screen capture video.

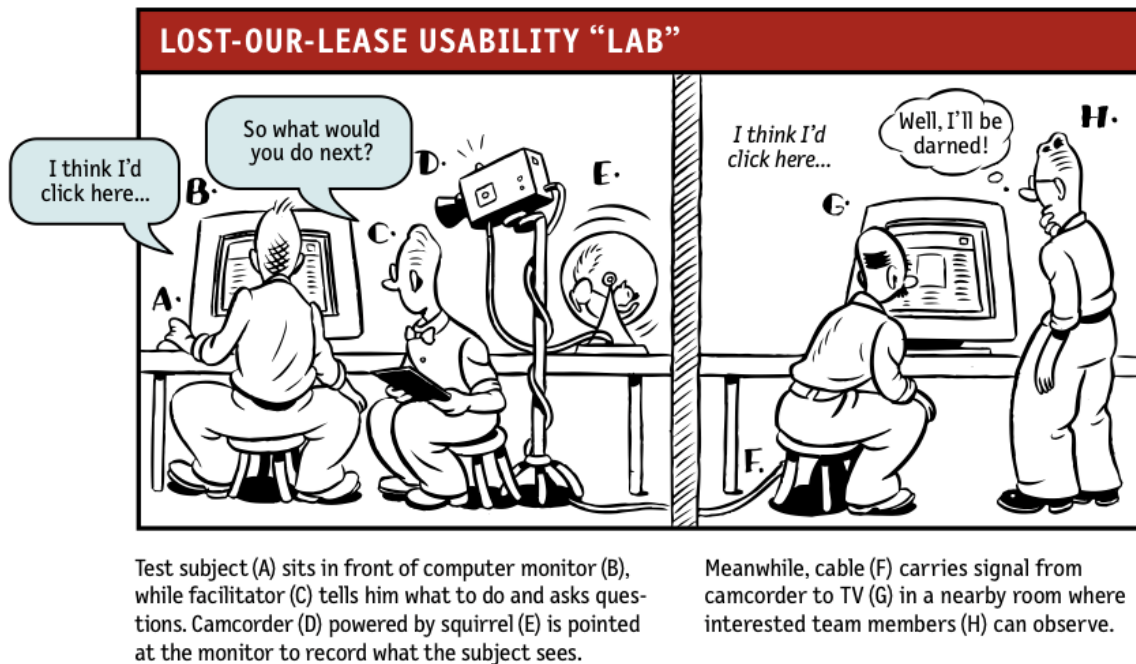
4.3.1 How are usability tests documented?

Usability tests are documented with notes, video camera recordings, and screen capture video. The most useful information is the handwritten notes collected by the test facilitator and any observers during testing. There are several questions to be answered during testing (Krug 2006):

- Does the user get it?
- Do they know what the purpose of the design is?
- Can they find where to start?
- Can the user navigate the design?
- Are there any “head slappers”—or things that were overlooked but have an easy fix?
- Are there any “shocks”—or things that were overlooked but will be difficult to fix?
- Has the user suggested any solutions or inspiration?
- Is there anything the user has expressed passion for?
- Have they said phrases like, “This is exactly what I’ve been looking for!” and what were they referring to when they said them?

After testing, all notes are typed up and synthesized. In traditional usability testing, a comprehensive and highly detailed report is written. In discount usability testing, a smaller report is written. And in going-out-of-business usability testing, a one-page summary is written. Video camera recordings and screen capture video are used to document the test users’ interaction with the design. Typical usability tests take place in a usability lab or office and have a similar setup (minus the squirrel) to Figure 9. Digital film is very valuable because it is easy to store, review and share.

Figure 9. Lost-our-lease (Going-out-of-business) Usability Lab Cartoon (Krug 2006)



4.3.2 How should PolyXpress usability testing be documented?

PolyXpress usability testing should be documented with notes, video camera recordings, and screen capture video.

During testing all facilitators should be accompanied by at least one observer to take notes. To assure handwritten notes are meaningful, all observers should use an observer note sheet with questions. The PolyXpress Usability Testing Observer Note Sheet is in the Appendix.

The PolyXpress application cannot be tested in a usability lab or office space. PolyXpress uses geolocation to take the user on a journey to interact with the environment while multimedia stories unfold on a mobile device. Certain parts of a story are only available in specific geographic locations. Testing must take place on the go, and so must documentation.

Video camera recording should be done using a GoPro camera. GoPros are small, versatile and wearable digital cameras/camcorders, which were created for adventure and extreme sport photography/film. The Liberal Arts and Engineering Studies department owns two GoPro Hero 3 Black Edition cameras, costing \$399.99 each (GoPro 2013a).

Figure 10. GoPro Hero 3 Black Edition (GoPro 2013a)



GoPro Hero 3 Black Edition specifications include:

- Professional 4K cinema 15 fps/2.7K cinema 30 fps/1440p 48 fps/1080p 60 fps/960p 100 fps/720p 120 fps and more video capture
- Wi-Fi built-in
- GoPro app compatible (GoPro 2013a).

The GoPro Hero 3 Black Edition uses a Micro SD memory card. A San Disk Ultra 64GB Micro SD card with adapter costs \$50.47 (Amazon 2013). The GoPro application is available for free at the Apple App Store, Google Play, and Windows Phone. The GoPro app acts as a full control camera remote and includes video preview for easy filming access. Figure 11 shows the GoPro settings control within the GoPro app.

Figure 11. GroPro App Settings Interface



There are several different mounting accessories for securing a GoPro to capture unique footage. The Head Strap Mount should be used for PolyXpress usability testing because it positions the camera to see the direct view of the user. The footage will document exactly what the user is seeing during testing, whether they are looking at the application or looking around the environment. The GoPro Head Strap Mount costs \$14.99 (GoPro 2013b).

Figure 12. GoPro Head Strap Mount (GoPro 2013b)

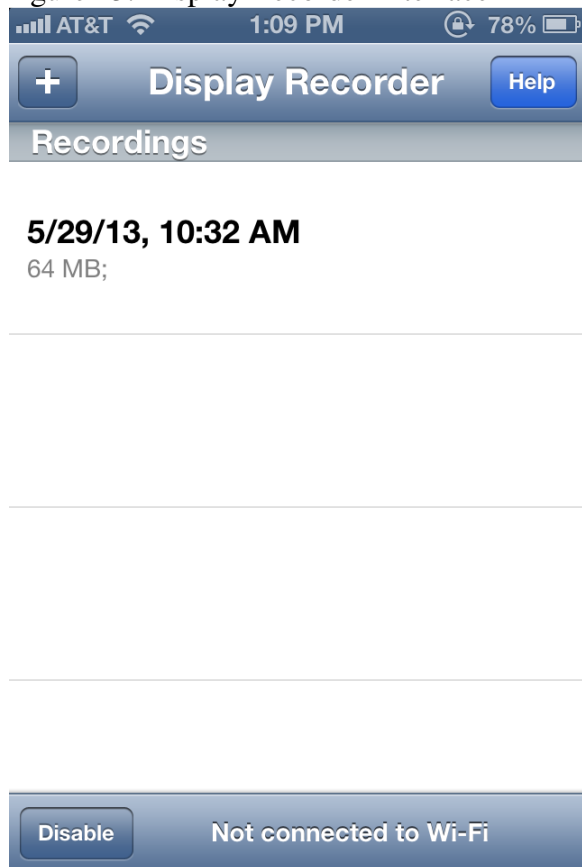


Screen capture video will document the users' interaction with PolyXpress, and can be done using Camtasia, Screencast Video Recorder, or Display Recorder. Camtasia is computer software for creating video tutorials and presentations. Screen capture video can be recorded, customized, edited and shared with Camtasia (Camtasia 2013). The software is very flexible and gives several recording options. Any application can appear in the recording, and one can jump from one application to another without interrupting the recording process (Camtasia 2013). Camtasia is a computer application only, so PolyXpress usability testing would also have to occur on a computer to use Camtasia screen capture video. Using a computer would be doable. A small laptop could be carried around and run PolyXpress, but this would not be realistic. A computer does not function like an iPhone or mobile device—the intended mode of PolyXpress. Also, Camtasia costs \$99 (Camtasia 2013). A free trial is available for 30 days, which would save money but would not be long term. Screencast Video Recorder is an app for Android 2.2+ phones (Screencast Video Recorder 2013). It is available on Google play for \$3.99 and captures the “phone screen at high frame rates into a high quality MPEG4 video with audio” (Screencast Video Recorder 2013). Using Screencast Video Recorder would be realistic for PolyXpress usability testing since it can be used on a mobile device, but currently PolyXpress only has iPhones available for testing. Display Recorder is a screen capture video application for iPhones. It is available from Cydia for \$4.99 (Display Recorder 2013). Display Recorder specifications include:

- Records direct to H.264 or MJPG/AVI
- App and website to manage recordings
- Records phone microphone audio option
- On-device YouTube uploading
- Adjustable quality settings (Display Recorder 2013).

Display Recorder does not record system audio (Display Recorder 2013). It is supported on iPhones with iOS 6.1, but since the application is available on Cydia it must be used on a jail broken phone (Display Recorder 2013). Jail breaking removes limitations on Apple devices to permit the download of applications not available in the Apple App Store. Jail breaking is dangerous and could lead to problems like program instability, dropped phone calls, security vulnerability, and the shortening of battery life. Jail breaking also violates the iOS license agreement and Apple has the right to deny service to jail broken devices. Using Display Recorder is the most feasible option for PolyXpress usability testing because it is inexpensive and the project has an available jail broken iPhone 4.

Figure 13. Display Recorder Interface



Screen capture and GoPro video should be edited together side-by-side using video editing software, like iMovie, and saved logically. Also, the observer note sheets should be typed up and saved with the videos. File names should be consistent and follow this format: PUTTestUserLastNameDate (PUTErDie06072013).

4.4 PolyXpress Usability Testing Materials and Total Cost

The total cost of PolyXpress usability testing, from scratch, is about \$80 and is detailed in Figure 14 below.

Figure 14. PolyXpress Usability Testing Cost Summary

PolyXpress Usability Testing Materials and Cost	
Material	Cost
Compensation Candy	\$10
GoPro Hero 3 Black Edition	Already owned by LAES
GoPro Head Strap Mount	\$15
GoPro App	Free
SanDisk 64GB MicroSD Memory Card	\$50
Display Recorder	\$5
Script	Free
Observer Note Sheet	Free
Recording Consent Form	Free
Testing phone	Already owned by LAES
Facilitator phone	Already owned by LAES
Total	\$80

4.5 PolyXpress Usability Testing Procedure

The full PolyXpress Usability Testing Procedure is attached in the Appendix, and is a step-by-step document for preparing, testing, compiling, and reviewing materials and information. It has step descriptions and checklists for organization.

5. Implementation

PolyXpress usability testing was scheduled for May 29th and 30th. Coincidentally, during this time PolyXpress was not working properly—404 Error. A practice test was run anyway, and only a small part of the app was experienced.

Figure 15. PolyXpress Usability Testing During May 29, 2013



6. Analysis

Several problems and recommendations have resulted from PolyXpress usability testing within the following categories:

6.1 General

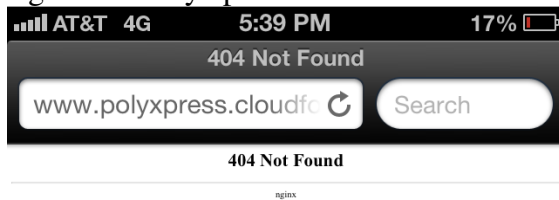
- Currently when a user uses PolyXpress, they constantly look at their phones when walking and this makes them less aware of the environment. Adaptability to user's environment is a key feature of a good user interface. Poor adaptability in PolyXpress can be fixed by signaling a new event with a ping or vibration, like a text message, so users do not have to pay so much attention to the app.

Figure 16. PolyXpress Usability Team Glued to Phones



- And because the user constantly keeps app open, it goes to sleep after a while. It is frustrating to keep reopening app and should be fixed.
- 404 Error prevented testing.

Figure 17. PolyXpress 404 Error



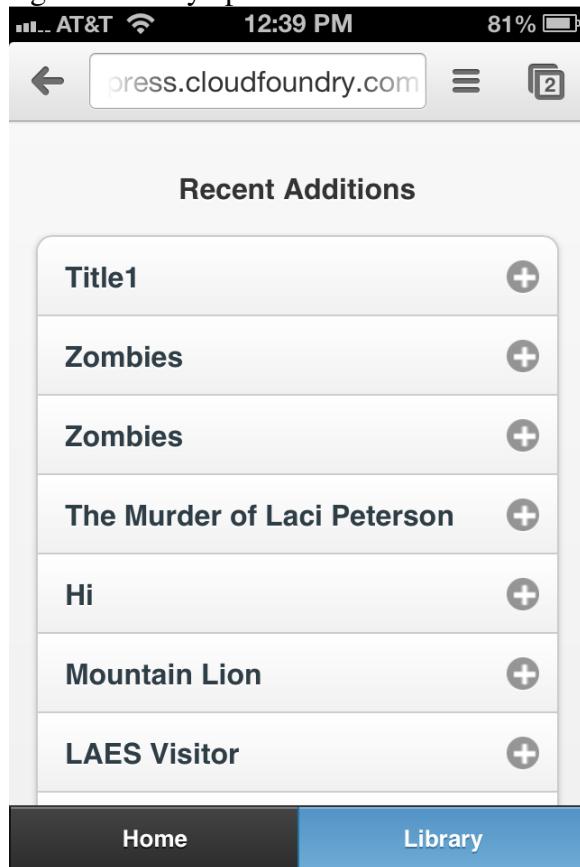
6.2 Home Page

- Unfamiliar users are not sure what the purpose of PolyXpress is or where to start. The app needs to have concise guidelines or “about” information on the home page.

6.3 Event/Chapter/Story

- When the event page is blank it is unclear to inexperienced users, and could be interpreted as a problem with the PolyXpress. It can be fixed with text, such as “Use map to explore other locations”.
- When a user selects a recently added story, the title disappears from the recently added menu and is moved to your list of stories. There is no indication of where the story has gone. Providing feedback, such as a check mark, would make it clearer that the story was added to the home page.

Figure 18. PolyXpress Recent Additions Interface



- Event/Chapter/Story titles are cut off and cannot be read if they too long. There should be character limitations to ensure users know this when inputting titles.
- Events come to different users in different locations, and there should be more uniformity.
- The new event pop up alert disappears after the user clicks ok. It would be more convenient if there were an option to go to event.
- Event video was off center and cut off with no option to scroll.

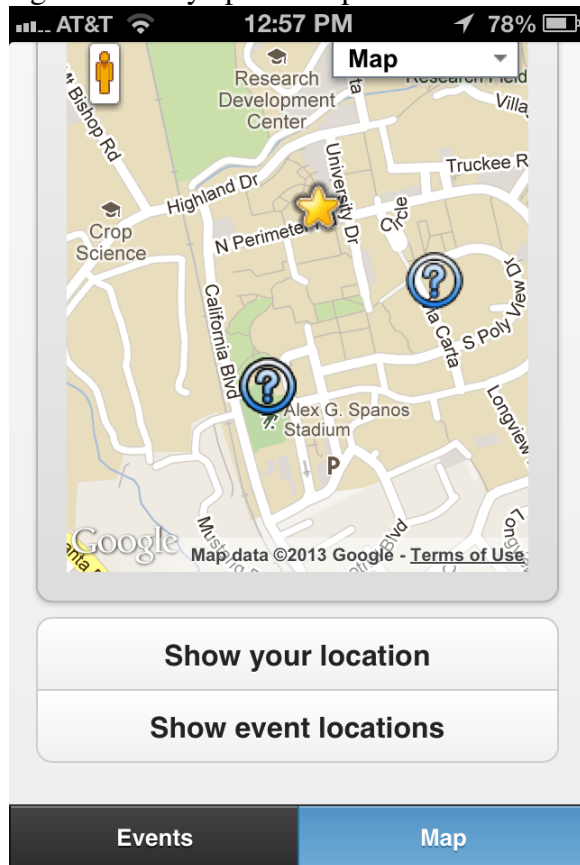
6.4 Map

- The star as the symbol for user location is not clear to inexperienced users. The star is not a bad option, but a better symbol would be a person icon or the user's Facebook profile picture.
- The star sometimes is in the wrong location, and it would be difficult to navigate in an unfamiliar environment.
- It is not clear that the "Show Event Location" and "Show Player Location" buttons are working because there is no feedback. The map will sometimes move, but it is unclear

what the movement is based on. Without appropriate feedback users may be frustrated. With the addition of shading, like the app's other buttons, it will become clearer.

- It is not clear that one is supposed to walk towards the question marks, indicating events, and prompting may be needed. This could be fixed with guidelines on the home page.

Figure 19. PolyXpress Map Interface



7. Related Work

The article, *New Techniques for Usability Evaluation of Mobile Systems* by Jesper Kjeldskov and Jan Stage, was published in International Journal of Human Computer Studies in 2004 (Kjeldkov and Stage 2004). The article presents and analyzes six techniques for performing usability testing on mobile human-computer systems in a laboratory setting. Kjeldskov and Stage believe “field-based evaluations seem like an appealing, or indispensable, approach for evaluating the usability of a mobile system...yet evaluating usability in the field is not easy” (Kjeldkov and Stage 2004). In mobile usability testing, it is “complicated to establish realistic studies that capture key situations”; difficult to observe and apply think-aloud techniques, and unknown variables in the environment could affect results (Kjeldkov and Stage 2004). The six techniques tested “had some similarities to testing in the pedestrian street, but none of them turned out to be completely comparable to that form of field-evaluation” (Kjeldkov and Stage 2004). Kjeldskov and Stage conclude that there are several factors that separate mobile computer systems from traditional desktop applications, including “the social, physical, and temporal context of mobile system use”, and “further research and experiments are needed to develop new and refine existing ideas and techniques” (Kjeldkov and Stage 2004).

Kjeldskov and Stages’ work differs from PolyXpress usability testing in that it focuses on creating a laboratory usability testing setup. PolyXpress usability testing focuses on creating a mobile usability test setup to match the realistic use of PolyXpress. Also, Kjeldskov and Stage’s work is outdated, or ahead of its time. *New Techniques for Usability Evaluation of Mobile Systems* was published in 2004 (Kjeldkov and Stage 2004). Since then several versions of the iPhone have been released and have revolutionized mobile computer systems.

8. Conclusion

PolyXpress usability testing should consist of recruiting five to fifteen test users, who are lead by a facilitator reading from a script, and should be documented using a GoPro camera with a Head Strap Mount, screen capture video using Display Recorder, and written notes. The overall usability testing procedure involves preparing test materials, finding test users, asking the users to perform tasks with the design by following a detailed script, documenting the testing sessions, compiling documentation, and reviewing documentation for problems that must be addressed.

Preliminary PolyXpress usability testing has revealed several problems, which should be addressed to improve the app. If a design is difficult to navigate or learn, contains errors, or does not clearly display its purpose, users will have lower satisfaction and will probably not use the design. The PolyXpress application should undergo several rounds of usability testing to increase its chance of success.

9. Future Work

If there was another year to work on PolyXpress usability testing the project should include testing future versions of the PolyXpress mobile player, extending the scope to include testing the authoring tool, and attempting to contact a professional usability testing researcher for extra input. Usability testing is considered an iterative process because it is not something that should be done only once. A design should be created, tested, fixed, then tested and fixed again (and again). This project only focused on the mobile player aspect of PolyXpress. In the future the authoring tool should also undergo usability testing. Contacting and interviewing a professional usability testing researcher could be a great learning source for a student. Mentors could provide tips and suggestions never realized in academia, and verify work.

This report can live on and be used as a starting point for future projects similar to PolyXpress usability testing. Reinventing the wheel is wasteful, and hopefully this report will provide others valuable information.

Appendix:
PolyXpress Usability Testing
Script

☐ All testing materials are prepared

Hi, _____. My name is _____, and I'm going to be walking you through this session today.

Before we begin, I have some information for you, and I'm going to read it to make sure that I cover everything.

You probably already have a good idea of why we asked you here, but let me go over it briefly. We're asking people to try using an app that a team at Cal Poly is working on so they can see whether it works as intended. The session should take about a half hour.

The first thing I want to make clear right away is that we're testing the *app*, not you. You can't do anything wrong here. In fact, this is probably the one place today where you don't have to worry about making mistakes.

As you use the app, I'm going to ask you as much as possible to try to think out loud: to say what you're looking at, what you're trying to do, and what you're thinking. This will be a big help to us.

Also, please don't worry that you're going to hurt the team's feelings. We're doing this to improve the app, so we need to hear your honest reactions.

If you have any questions as we go along, just ask them. I may not be able to answer them right away, since we're interested in how people do when they don't have someone sitting next to them to help. But if you still have any questions when we're done I'll try to answer them then. And if you need to take a break at any point, just let me know.

You may have noticed the camera. With your permission, we're going to have you wear it to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the site, and it won't be seen

by anyone except the people working on this project. And it helps me, because I don't have to take as many notes.

If you would, I'm going to ask you to sign a simple permission form for us. It just says that we have your permission to record you, and that the recording will only be seen by the people working on the project.

- ☐ Give them a recording consent form and a pen
- ☐ Start the timer (set for 30 minutes) on facilitator phone
- ☐ Start the GoPro
- ☐ Set up the camera on the user

Do you have any questions so far?

Ok, _____, before we look at the app I'd like to ask you just a few quick questions.

First, what is your major and year?

What kind of phone do you have?

Do you have any favorite apps?

Ok, great. We're done with the questions, and we can start looking at things.

- ☐ Start Display Recorder on testing phone
- ☐ Login to PolyXpress and go to home screen
- ☐ Give them the testing phone

First, I'm going to ask you to look at this page and tell me what you make of it: what strikes you about it, what can you do here, and what it's for. Just look around and do a little narrative.

- ☐ Allow this to continue for 1 to 2 minutes

Thanks. Now I'm going to ask you to use the app.

And again, as much as possible, it will help us if you can try to think out loud.

Please open "The Burt Bundy Story". Read the information as you go along and tell me what you think.

- ☐ Allow the user to proceed until you don't feel like it's producing any value or the user becomes very frustrated
- ☐ Continue until times runs out, and stop the timer

Thanks, that was very helpful.

Do you have any questions for me, now that we're done?

- ☐ Give them their compensation
- ☐ Stop Display Recorder and save the file as PUTTestUserLastNameDate
- ☐ Stop the GoPro
- ☐ Thank them again!

**PolyXpress Usability Testing
Recording Consent Form**

Thank you for participating in our usability research!

We will be recording your session to allow PolyXpress team members who are unable to be here today to observe your session and benefit from your comments.

Please read the statement below and sign where indicated.

I understand that my usability test session will be recorded.

I grant PolyXpress permission to use this recording for internal use only for the purpose of improving the designs being tested.

Signature: _____

Print your name: _____

Date: _____

**PolyXpress Usability Testing
Observer Note Sheet**

Date: _____ Observer Name: _____ Test User Name: _____

Please write down your observations on this sheet (front and back) during testing. The questions are here to help you, and you do not have to answer them. Note as much as you can because everything is helpful! Turn in sheet to facilitator when complete.

Does the user get it? Do they know what the purpose of the app is?

Can the user navigate the app?

Are there any “head slappers”—or things that were overlooked but have an easy fix?

Are there any “shocks”—or things that were overlooked but will be difficult to fix?

Has the user suggested any solutions or inspiration?

Is there anything the user has expressed passion for? Have they said phrases like, “This is exactly what I’ve been looking for!” and what were they referring to when they said them?

PolyXpress Usability Testing Procedure

Prepare

1. Gather all materials.

- ☐ Testing phone
- ☐ Facilitator phone
- ☐ Script
- ☐ A recording consent form for each test user
- ☐ A note sheet for each observer
- ☐ GoPro Hero 3 Black Edition camera
- ☐ 64 GB MicroSD memory card
- ☐ GoPro Head Strap Mount
- ☐ GoPro app downloaded to facilitator phone
- ☐ Display Recorder app downloaded to testing phone
- ☐ Compensation candy
- ☐ Pen for test users to fill out Recording Consent Form

2. Find 5 to 15 test users

“A mobile application is currently being created by a team on campus. We are looking for people to look at the app and give some feedback. It’s very easy, and will only take a half hour. For your help we are offering study snacks (as much candy as you can grab!).”

3. Create testing schedule and arrange who is going to facilitate, observe, and be the test user.

4. Prepare materials.

- ☐ Charge facilitator phone
- ☐ Charge testing phone
- ☐ Charge GoPro camera
- ☐ Clear MicroSD memory card

5. Run a practice test.

Test

6. Use PolyXpress usability testing script to perform arranged tests.

Compile

7. Import all video files.

8. Edit video files together in split screen format.

Steps to Achieve Split Screen Using iMovie

1. Go to iMovie, Preferences, then check “Show Advanced Tools”.

2. Drag the GoPro video into iMovie.
 3. Then, drag the Display Recorder video on top of the GoPro video.
 4. Select “Side by Side”.
9. Save video files as PUTTestUserLastNameVideoDate. For example, PUTErDieVideo06072013.
10. Type up all handwritten observer note sheets.
11. Save note files as PUTTestUserLastNameNoteDate. For example, PUTErDieNote06072013.
- Review***
12. Review test session files and breakdown PolyXpress problems into categories—general, home page, event/chapter/story, map, plus any other appropriate category.

Source Links:

64GB Micro SD Card:

http://www.amazon.com/SanDisk-MicroSDXC-Memory-Adapter-SDSDQU-064G-AFFP-A/dp/B009QZH6JS/ref=sr_1_2?ie=UTF8&qid=1370547090&sr=8-2&keywords=gopro+sd+card

Display Recorder:

<http://rpetri.ch/cydia/displayrecorder/>

GoPro App:

<http://gopro.com/software-app/gopro-app>

GoPro Head Strap Mount:

<http://gopro.com/camera-mounts/head-strap-mount>

GoPro Hero 3 Black Edition:

<http://gopro.com/cameras/hd-hero3-black-edition>

GoPro Hero 3 Black Edition Manual:

http://gopro.com/wp-content/uploads/2012/10/HD3_UM_Black_ENG_FINAL_Web.pdf

PolyXpress:

polyxpress.cloudfoundry.com

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