CPSC 444 Project Milestone III:
Prototyping & Experiment Design
Feb 5, 2019

Overview

You have approximately **3.5** weeks to complete this milestone. See course schedule for exact dates.

Summary of Milestone III Deliverables

See the project page for instructions on formatting and updating your blog.

1. **Blog Update #3 - Low-fidelity Prototyping & Cognitive Walkthrough, Proposed Experiment Goals**

   a. Further updated task examples (no word limit)

   b. Low-fidelity prototype(s) demonstration.

   c. Additional information about the prototype(s) (up to 450 words)

   d. Walkthrough report (up to 450 words)

   e. Proposed goal(s) of experiment for part B (up to 300 words)

2. **Blog Update #4 - Experiment Design**

   a. Revised goal(s) of experiment (up to 300 words)

   b. Experiment method (up to 1500 words)

   c. Supplementary experiment materials (no limit)
      - list of links to PDFs of your materials

3. **Blog Update #5 – Medium Fidelity Prototyping**

   a. Rationale of prototyping approach (up to 450 words)

   b. Prototype demonstration (no limit)

4. **Piazza post – Individual Statements of Contribution**

After Submission

Mandatory attendance at design reviews with course staff in the workshops following blog post due dates– see course schedule.

Interaction Between Parts A, B, & C

Note that there is a relatively high degree of interaction between parts A, B, and C in this stage of the project. While they are presented sequentially in this document, you *will likely need* to begin work on the experiment design before you can finalize your low-fi prototype(s), and you *will certainly need* to be well into the experiment design before you can finalize your med-fi prototype(s). This means that many of the steps will need to be done in parallel, and you should have started on all three parts before submitting the first blog post.

For example, one possibility is that if you have two sketches (i.e., design alternatives) for your system concept that seem equally promising, you may want to design an experiment that will test which is better. To do this, however, you would need to develop two low-fi prototypes (one for each sketch/approach) and then two medium-fi prototypes.

A. Low-Fidelity Prototyping

Step 1: Develop Low-Fidelity Prototype(s)

Discuss and choose the most promising of your interface sketches from Milestone II. In combination with your task examples and prioritized requirements from that milestone, *develop one low-fidelity prototype* that demonstrates how the interface fulfills the requirements. You will use this prototype in the next step to walkthrough your design to uncover usability bugs**.**

You may use the *low-fidelity technique of your choice* (e.g. storyboards, or the prototype construction approach used in PICTIVE – for an overview of some techniques, see http://grouplab.cpsc.ucalgary.ca/saul/681/1998/prototyping/survey.html#lo-fi).

> *If two sketches seem equally promising, consider developing two prototypes to compare in your experiment (Part B).* In order to go this route, you need to seriously consider the workload involved in developing both alternatives (Part C). It only makes sense if the two approaches are relatively similar or if the designs are relatively small in scope. Seek input on this from course staff before going this route.

Your prototype should illustrate how your system would appear to the user. You should not be concentrating on prettiness or completeness; rather, you are trying to show the overall interaction style and to indicate the scope of your system. Your prototype should contain the core views that illustrate how the system will work as a whole, with emphasis on the parts you are focusing on, including the interactions based upon the key tasks.

The low-fi prototype can be hand-drawn, scanned, drawn on a computer, etc. Whatever approach you take, consider clarity, ease of development, and efficient use of your time. (Note that prototypes created on the computer can sometimes take more time than hand-drawn ones. Groups tend to focus more on lower-level details and precision when using the computer than they do when drawing by hand.)

Prototype Scope: When deciding how far to take this:

- Consider what this low-fi prototype is to be used for. *Do no more, no less than needed*.

- Only if your interface is going to be very simple does this and your med-fi prototype need to be comprehensive (i.e., show/implement all features). In many cases you will choose a subset of functionality to prototype for this course. However, *you should choose this subset carefully*, and justify it briefly in the report.

The low-fi prototype does not need to capture every little detail, but it *should capture the details that will dominate the experience of using it*.

Blog Update #3a – Further Updated Task Examples: If you have revised your task examples since Milestone II, include them here with a summary of revisions. If your task examples have not changed, then state this, and explain where to find them (e.g., link to MSII versions). Task examples can be included on a separate page and linked to if you prefer.

Blog Update #3b - Low-Fidelity Prototype(s) Demonstration: Document your prototype(s) using media of your choice. This illustration should document the main components of your design and show how the prototype supports your task examples. E.g., you could create a narrated video demonstrating how a user completes those tasks with the prototype(s). If using photos, or something else, include annotations and labels as appropriate to ensure the demonstration is easy to understand.

There is no specific length limit for part #3b. However, *please avoid excessive length and concentrate on conveying key aspects*. If in doubt, consult course staff.

Blog Update #3c – Additional Information about Prototype(s): Identify which of the task examples you have chosen to support in your design. (Generally, your prototype should support at least 2 of your task examples.) Justify the scope of your prototype(s), as well as the major design decisions you made, e.g., if you have two different designs, you should explain the reasons for the differing approaches. Include any additional information that didn't make it into your demonstration in part 3b, but you think is critical for course staff to understand the design.

Step 2: Walkthrough

Test the low-fi prototype for usability bugs (problems, faults, weaknesses) by performing a brief *cognitive walkthrough* using the task examples supported by your prototype. (See http://en.wikipedia.org/wiki/Cognitive_walkthrough and http://prior.sigchi.org/chi95/Electronic/documnts/tutors/jr_bdy.htm if you are unfamiliar with this usability inspection method.) Note in the latter reference that it says: "The walkthrough is typically performed by the interface designer and a group of his or her peers." Consider having one or more of your team members perform the walkthrough together with two or more classmates from another team.

You do not need to modify your low-fi prototype in response to any problems you found. However, you should roll these observations into your medium fidelity prototype for Part C.

Blog Update #3c - Walkthrough Report: Briefly summarize what you learned in your walkthrough, good and bad. Then very briefly address each task example in a separate paragraph. If you found nothing wrong for a given task, (i.e., your interface is perfect) then outline the ways in which it was perfect (e.g. "Our cognitive walkthrough showed that users can do X, Y, and Z without errors or confusion.").

B. Experiment Design

By now, you have one design approach (or possibly two), which you've subjected to a *qualitative* walkthrough analysis. It's time to determine using a *quantitative* controlled manner whether this approach is effective.

The goal of this part is to map out a plan to rigorously test your prototype. It is necessary to do this before you actually implement your medium-fidelity prototype to ensure that it will support the evaluation.

Step 3: Establish Goal(s) of Experiment

Assess the *key usability challenges or uncertainties* of your design approach. What needs to be answered to help establish whether this is a good design approach? Use the insights gained during the cognitive walkthrough to inform your reflection, as well as any other input you have obtained (e.g. by discussing with other teams).

If you have developed two prototypes, or there is a competitor system for certain tasks that your system supports, the main goal is likely to determine which of the two systems is most effective overall (or for given tasks). This represents a classic evaluation of Design A vs. Design B.

Another possible goal is whether users will be able to do a certain task within a threshold amount of time, or within a threshold number of errors. The goal in this case would be to test the task against a reasonable usability requirement target. This approach is covered in Section 10.8 of the Experiments in Support of Design chapter. Note that if you take this approach, you need to clearly justify the usability requirement target.

> **Blog Update #3e – Proposed goal(s) of experiment:** Make a comprehensive list, then rank items by (a) importance and (b) your ability to test them within the scope of 444. Then clearly identify which of the goals you will address in your evaluation. As a guideline, you should have 1 substantial goal or up to 3 smaller goals.

Step 4: Design the Experiment

Now it is time to actually design the experiment that will evaluate your system. This will require a lot of effort, much more than the informal evaluations you have conducted to date.

Determine your hypotheses. These are very specific instantiations of some of your evaluation goals. They need to be testable. You will likely have 2 to 4 hypotheses.

Consider your intended subjects, and how you will recruit them. One possibility may be that you believe demographics will impact the usability of your system and so you may want subjects in two different demographic groups (i.e., this will be an independent variable in your experiment). One example of this is novice and expert users.

Determine the method you will use to test your hypotheses. This forms the bulk of the experiment design and includes your independent and dependent variables, the formal experimental design (e.g., a 2 x 3 mixed factorial design, more specifically a 2 levels of expertise (between subjects) x 3 interfaces (within subjects) design), the experimental tasks that your subjects will carry out, specific details on how you will measure the dependent variables, and the statistical analysis you expect to carry out.

Create any study instruments you will need, including questionnaires, interview questions, observation sheets, and the script you will follow so that all subjects get identical instructions.

Note that one requirement for your experiment is that you use video as a data collection mechanism. Video analysis is extraordinarily time consuming; thus, none of your dependent measures should rely on doing detailed video analysis. Rather, you may want to use video to review key interaction moments caught on video. In addition, for Milestone IV you will produce a video of your course project that will likely include snippets of video data collected during your experiment.

Every experiment has limitations. You need to carefully think through the limitations of your chosen design, in particular with respect to different kinds of validity that were discussed in class.

Note: designing an experiment is an art that takes iteration. It is highly recommended that you get started on this step as early as possible, i.e. before Blog #3 is due, and solicit feedback from the course staff to help you evolve your experiment design.

Blog Update #4a – Revised goal(s) of experiment: If you updated your experiment goals between Blogs #3 and #4, you should include your revised goals as the first part of this blog post. If you did not make any changes, say so.

Blog Update #4b Experiment method: detailed description of the following components:

- Participants – describe participants, including total number expected and recruiting approach

- Conditions – briefly describe what will be compared in the experiment (drop this section if only comparing performance against threshold)

- Tasks – briefly describe tasks to give the gist of what participants are expected to do, point to appendices for detailed task descriptions

- Design – formal experimental design

- Procedure – describe the sequence of activities each subject is expected to follow

- Apparatus – describe the physical setup for the experiment (use photos to illustrate if appropriate)

- Independent and dependent variables – includes exactly how you intend to measure each dependent variable

- Hypotheses – remember to state these in terms of the independent and dependent variables

- Planned statistical analyses

- Expected limitations of the planned experiment

Blog Update #4c – Supplemental experiment materials:

- In this section, include a list of links to each of your study instruments (e.g. PDFs)

- If you need more space to clarify the tasks, such as showing screen captures of your system, or a competitor's system against which you will be evaluating your system, put this in a new PDF for 'Task Details' and include this as an additional link.

IMPORTANT: In terms of the level of detail required for the above deliverables, you should be able to give a classmate from another team your experiment description and materials and they should be able to carry out your experiment.

C. Medium-Fidelity Prototyping

Step 5: Plan the Prototype

Decide on scope and emphasis of the medium-fidelity prototype(s), based on the needs of the evaluation you have decided to do. All project teams will build (at least) one interactive prototype.

How many prototypes? All projects will include a fully- or semi-functional, coded simulation of the system. For some projects, it may be helpful to also build a very simple non-functional physical mockup so that users can understand the system's form factor. Overall effort should be based on the size of your team.

The functional prototype(s) you build will generally be some combination of *horizontal and vertical*:

- **Horizontal**: include all the main components of your interface, but only at a high level. This gives the illusion of a fully functional prototype, which breaks down almost immediately with exploration.

- **Vertical:** select some of the primary tasks and make sure that a substantial part of the functionality required for those tasks is supported, i.e., the subject can use the prototype to complete those tasks. The completion may be restricted to very specific inputs, which you specify. 'Substantial part' would include, for a GUI example: screens, error messages, handling of unexpected input, defaults, robustness, etc. You may program in 'stubs' for sub-tasks you are not implementing at this time (e.g., certain actions may return some kind of 'Under development' message).

Note that a prototype is rarely either horizontal or vertical, but rather some combination of the two. You need to have a sufficient vertical component that, at an absolute minimum, subjects can complete one task. Likewise, you need to have a sufficient horizontal component to provide some indication of what the envisioned system/interface would look like as a whole.

The point here is that except for a quite simple interface, *we do not expect you to implement everything*. Figuring out the scope (both horizontal and vertical) is an art. Give it careful consideration and solicit input from your TA early on.

Examples of the questions you must answer at this point include:

1. How much *horizontal* and *vertical*?

2. What *(simulated) functionality* must it contain? What can be Wizard-of-Oz'd (i.e., faked)? How specifically, from a technical standpoint, do you plan on doing the faking? The goal should be that the subjects are as unaware as possible that the system is not fully implemented.

3. How important is *appearance*?

4. If your interface includes physical (non-graphical) elements, is it useful and/or feasible to augment your functional prototype with *form mockups*?

5. Finally, *decide which prototyping tools to use*. Most likely you will want to use one of the tools available in X360 (this includes all software available on the general CS ugrad lab machines as well software only available in X360: https://www.cs.ubc.ca/our-department/facilities/hci-learning-studio/resources). Use a combination of your group's skills / comfort level, and the requirements for the prototype to make this choice. IF YOU ARE EXPECTING TO USE A LANGUAGE or TOOL NOT INSTALLED ON x360 COMPUTERS and THAT IS NOT OTHERWISE EASILY AVAILABLE, CONTACT COURSE STAFF FIRST.

The goal is to get the *most useful evaluative results with the least amount of production effort*. *Less is good!* But, choose wisely where to direct your effort.

Step 6: Implement the Medium Fidelity Prototype

Embody your design(s) in a *medium fidelity interactive prototype(s);* and if appropriate, a non-functioning supporting prototype as well. Note that we do expect the total prototyping effort involved to be fairly uniform across projects (normalized by team size); so if you are only building one, the expectations for its level of function will be a bit higher.

Blog Update #5a - Rationale of Medium Fidelity Prototyping Approach: Briefly summarize your reasoning for choosing your prototype approach (i.e. address each of the questions stated in step 5).

Blog Update #5b - Prototype Demonstrations: Document your *final interface prototype implementation,* using screenshots/screen capture, photos, or the equivalent for your project. Include *explanatory/descriptive captions for figures, or narration for video,* as appropriate. Where appropriate, justify design elements with respect to what you have learned about human abilities and limitations.

There is no specific word limit for part #5b. However, *please avoid excessive length and concentrate on conveying key aspects*. If in doubt, consult course staff.

Medium Fidelity Prototype Live Demonstration: You will demonstrate your prototype to the course staff during a design review immediately after the final blog post for Milestone III is due. As always, full, on-time attendance of all team members is mandatory.

E. Statements of Contributions

Step 7: Document individual contributions to the milestone

Team members each *briefly* document with a piazza "group" post (i.e., visible only to their team members and the course-staff in that group) their individual contributions to the milestone. These are not to be written or edited by any one other than the team member him/herself. This should include a bulleted list of contributions. Example contributions include: "co-lead on drafting first set of focal points", "actively participated in a 2-hour analysis session (affinity diagraming)", "primary interviewer for one participant, and did transcription."

Marking

In addition to the usual criteria, for the **prototypes** and their **documentation and demonstration** (both in blog posts and at the MS III design review) you will be specifically evaluated on:

- clarity and thoroughness of documentation (i.e. can the course staff reasonably evaluate the prototypes – this means that narration is clear, images are captioned, etc.)
- quality of user interaction
- appropriateness & completeness of prototypes (e.g., to effectively perform evaluations)
- novelty & ingenuity
- organization & preparation for demo
- handling of questions at demo

Tentative High-Level Marking Scheme

    A. Blog #3: Low-fi prototyping, walkthrough, goals   20%

    B. Blog #4: Experiment design: 40%

    C. Blog #5: Medium fidelity prototyping: 40%

Milestone III Design Review

Course staff will conduct a design review with each team at a workshop session shortly after Blog #3 is due, and then again after the remainder of the milestone is due. The intent of the design reviews are for course staff to provide feedback to the team about their progress, and discuss the plan for proceeding to the next project stage. For the second design review for this milestone, this will also give the course staff an opportunity to interact with the medium fidelity prototype.