Software Usability

Course notes for CSI 5122 - University of Ottawa

2023 Deck A:

Course Outline and Introductory Material

Timothy C. Lethbridge
<Timothy.Lethbridge@uottawa.ca>
http://www.eecs.uottawa.ca/~tcl/csi5122

Themes of the course

Main theme: User Experience (UX) of Software:

- Software usability engineering.
- How to **develop** software systems that are highly usable and enhance overall user experience
- **Evaluation** of and **experiments** with user experience
- Adapting the **software engineering process** to produce more usable software

Secondary theme: How to do good research in software engineering, HCI, User Experience and Usability

- Critical evaluation and writing a paper in the UX domain

This is *not* a pure Human-Computer Interaction (HCI) course

It is an 'applied HCI' course

- 'E' (engineering-focused) course in OCICS
- There are related A/S courses available at Carleton, taught by profs such as Robert Biddle and Sonia Chiasson

We will focus on engineering practicalities

- Certain other courses focus more on HCI theory

Background required

Being a grad student in CS, SE, Digital Transformation or a related subject should be enough

- All students in the course should have had some undergrad background or work experience in software development

No Usability/HCI course is assumed as background

- So far the topics of software usability or user experience are *unfortunately not required* in undergrad CS programs
- Those who have an HCI course such as UOttawa SEG3125 or other HCI background will have a small advantage

  —10-15% of the material may be review

Grading: See also Syllabus

25% Assignment 1 – Research paper – due Oct 10 noon

30% Assignment 2 – Evaluation or experiment – Nov 7 noon

20% Assignment 3 – Presentation (Oct 11-Nov 29) or blog post (Nov 21 at noon)

25% 3 quizzes (8/8/9% in class; you will need a laptop/pad)

Bonuses as follows (on overall class mark)

- Submitting work early (1% per 3 working days; max 6%),
- Choosing to do an experiment (3% if done properly)
- Choosing to do a presentation (2% if done by Oct 20; 1% if done later; maybe more … if we don't get enough).
- Up to 5% for the most informative presentations, and any experiment with publishable data if presented to the class

Penalties for late work

1% of the assignment grade for every working day it is late (but nothing allowed after Nov 29)

Exception 1: If you are doing an experiment or an evaluation with humans, I may negotiate a special later deadline for you after I review your plans

Exception 2: Presentations must be given the day they are scheduled unless you are sick

If you miss a quiz, I may interview you to test your knowledge

Learning about each other:

Who am I (Prof Tim Lethbridge)

- I have taught
  - —CS since 1986
  - —SE since 1990
  - —Usability at the undergrad/grad level since 1992

- Main current research topics
  - —Software Modeling (Umple) and complexity reduction
  - —Software engineering tools, including their usability
  - —Software Engineering Education
- Research projects with several companies over the years
- Worked at Nortel for 2 years in the 1980s

Who are you – Class interaction

Some of you tell me: Why are you interested in this topic

Some of you tell me: Experience doing User interface development or testing

TOPICS AND PEDAGOGICAL METHOD

Topics for the course 1

Not necessarily covered exactly in this sequence

What is usability and user experience?

- How do these compare with other qualities?

***Doing research* applied to UX and usability**

***Design* for usability and user experience**

- Task analysis
- Key heuristics in design
- Micro-interactions

Topics for the course 2

Evaluation **techniques**

- Heuristic Evaluation
- Cognitive walkthroughs
- Evaluating usability by analysis of videos of users as they think aloud while using a system
- Conducting formal experiments to validate usability

Topics for the course 3

***Internationalization* and localization**

Access for the *disabled*

Usability and UX in Software Engineering

- SE methods to improve usability
- Maturity of organizations in their UX work
- Economics of UX
  - —Justifying an investment in usability
- Measuring usability
  - —Setting realistic usability objectives

Other topics from papers and student presentations

Pedagogical method

I hope to lecture only about half the time

I want to have considerable discussion about particular

- Papers or reports I will ask you to read many weeks
- User interface case studies
- UX problems or design issues

I will ask students randomly by name to give opinions, so be prepared (answering well will count for attendance mark)

Some of you will do presentations on your research or evaluations

A first motivational example

Microsoft Excel

- Poor error message when it can't find an item

- http://tims-ideas.blogspot.com/2011/06/usability-blooper-microsoft-excel.html

TIPS ON ASSIGNMENT 1: RESEARCH PAPER

General Research Sources - 1

Google Scholar

- http://scholar.google.ca

Scopus (Specify University of Ottawa and log in to SSO)

- https://www.scopus.com

- Very good general meta-search for scientific information

- Example searches to try
  - —Use colour user interface
  - —Cognitive walkthrough
  - —Usability engineering

General Research Sources - 2

IEEE Xplore

- http://ieeexplore.ieee.org/Xplore/dynhome.jsp

ACM Digital library and giude to literature

- http://portal.acm.org/portal.cfm

Springerlink

- Access to Springer journals and Lecture Notes in Computer Science
- https://link.springer.com

Science Direct

- http://www.sciencedirect.com/

HCIBib

- http://hcibib.org/

Some Journals

ACM transactions on Computer-Human Interaction

- www.acm.org/tochi/

Human-Computer Interaction

- http://hci-journal.com

International Journal of Human Computer Studies

- https://www.sciencedirect.com/journal/international-journal-of-human-computer-studies

Other periodicals

ACM interactions

- Magazine style
- http://www.acm.org/interactions/

ACM SIGCHI Bulletin

- Columns, reports, etc.
- http://bulletin.sigchi.org/

Key conferences

CHI

- https://sigchi.org/conferences/

Interact

- https://www.interact2021.org

Key website for usability and UX: NNGroup

The Nielsen-Norman Group: Jakob Nielsen and Don Norman

- This will serve as the textbook for the course
- https://www.nngroup.com (Click on Articles)
  - —These articles can be references but are not peer reviewed, so they are 'grey literature': i.e. Can't be central references
  - —Also see: Don Norman's Essays http://www.jnd.org/dn.pubs.html

For coming weeks, as homework, look at:

- **Nielsen's Usability Heuristics**
  https://www.nngroup.com/articles/ten-usability-heuristics/
- Visibility of System Status (Heuristic 1)
  https://www.nngroup.com/articles/visibility-system-status/
- Flexibility and Efficiency of Use (Heuristic 7)
  https://www.nngroup.com/articles/flexibility-efficiency-heuristic/
- Help and Documentation (Heuristic 10)
  https://www.nngroup.com/articles/help-and-documentation/

Other websites for usability and UX

Usability First

- http://www.usabilityfirst.com/

User Experience Professionals Association

- https://uxpa.org

UX Planet

- https://uxplanet.org

Patent searches

- US patents
  - —http://patft.uspto.gov/
- Canadian patents
  - —https://www.ic.gc.ca/opic-cipo/cpd/eng/search/basic.html
- Do a search on “User interface”

Examples of topics for your research paper - 1

Usability/UX measurement and metrics

- E.g. Discuss different metrics used in different studies, and compare them

Measuring individual differences among users

Making software usable for the disabled

- Pick a type of disability and a class of application

Comparison of software UX research with ergonomics studies in other disciplines

Research paper topic ideas - 2

International standards for usability

- e.g. ISO 9241 series and ISO 2502x

How UX improvements have helped organizations financially or improved product sales

Specific UX design issues

- E.g. choice of colours, use of animations, design of carousels

Reliability and validity of usability testing

- If you do two similar studies, will you get the same results?
- How to address threats to validity

Research paper topic ideas - 3

Rapid (discount) approaches to usability

- Perhaps you could compare this to more expensive approaches

Ethics in usability testing

- What different approaches are taken in different places?
- What issues arise?

Effects of alternatives in UX experimental design

- How blocking (grouping participants) is done
- How studies have been analyzed statistically

Research paper topic ideas - 4

UX in a certain class of applications or tools

- Help systems
- Search tools
- A particular class of games
- Software IDEs
- Automotive dashboards
- Home appliances
- Video editing software
- Etc.

WHEN READING PAPERS, CONSIDER THREATS TO VALIDITY

No research is perfect

You should always consider factors that could mean that certain research results are less applicable

Always discuss threats to validity …

- When doing a literature review
- When writing your own experiment paper
- When presenting in class

Threats to validity - 1

Conclusion validity

- Factors leading you to incorrectly believe some conclusion
  - —Seeing things that aren't there due to bias
    - Working with only one group/type of participants
    - Participants learn from one step to the next
    - Many other bias sources
  - —Statistical errors, like doing many T-tests

- Factors leading you to not reach a conclusion you should reach
  - —Not finding the needle in the haystack
    - Not enough data
    - Not enough participants
    - Too much noise in the data
    - Not asking the right questions
    - Not using the right statistics

Threats to validity - 2

Internal validity - are the relationships *causal*

—Could something *other* than what you think be causing the results you see

Construct validity - did we measure what we wanted to measure?

—Using the wrong model (construct) or measurements

External validity - can we generalize the results?

—Are the results just true in this specific situation

Good website on threats to validity: Read it as homework

- http://www.socialresearchmethods.net/kb/introval.php

WRITING A GOOD RESEARCH PAPER

Writing a good research paper (for this course) - 1

Step 1: Have something to say

- Learn the relevant background
  - —Search and read/skim the literature
    - Follow the citations to see *later* papers that cite this
    - Look at the references to see *earlier* papers

- When discussing studies, summarize
  - —Method followed
  - —Hypotheses and research questions addressed/answered
  - —Key results (data, statistics)
  - —Threats to validity
  - —Key conclusions drawn from the results

Writing a good research paper - 2

Step 2: Develop a structure

- E.g.
  - —**Abstract** (write at end summarizing motivation, method, results, conclusions)
  - —**Introduction** (probably write at end))
  - —**Background / literature summary**
    - Avoid just 'parroting' what each paper says
  - —(Body -- if presenting your own research)
  - —**Results and discussion**
  - —**Conclusions and future work (write at end)**
  - —**References**

Writing a good research paper - 3

Step 3: Fill in details

- When you get stuck, work on a different section

Step 4: Review multiple times on different days

- Does it 'tell a story'?
- Are there details that could be left out?
- Can I synthesize to bring ideas together better?
- Are important elements missing?
- Is each sentence/paragraph well written?
- Have you used citations/references well?

- Ask somebody else to proofread

Some references on writing good papers

http://people.csail.mit.edu/mernst/advice/write-technical-paper.html

http://www.eg.bucknell.edu/~cs475/F97-S98/handbook/research-paper.html

http://www.sigplan.org/oopsla/oopsla96/how91.html

http://www.cs.cmu.edu/~jrs/sins.html

—Don't 'grandmother', i.e. tell people basic background they would know

—Don't say 'This paper is organized as follows …'