# User Interface Systems and Techniques

aka, Human-Computer Interaction Design CSE 331

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|---|---|
| Class Meetings | MW 12:45 p.m. - 2:00 p.m. |
| Office Hours | ericpsb.youcanbook.me |
| Location | Building C, Room 210 |
| Semester | Fall 2019 |
| Professor | Eric P. S. Baumer {ericpsb@lehigh.edu} |

> "*Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.*" – Association for Computing Machinery, Special Interest Group on Computer-Human Interaction, Curricula for Human-Computer Interaction

This course deals with the design and implementation of interfaces for human interaction with computing systems. The materials and activities cover four main focus areas:

- Design – Given a functionality specification for a system, how does one generate concepts for the way that users should interact with the system?
- Usability – What makes a system or an interface usable? How would you evaluate a design's usability?
- Implementation – Given an interface design, how does one translate that into an implemented, functioning system?
- Critique – Given an implemented interface, how can one assess its strengths and weaknesses without carrying out an empirical evaluation?

The above constitute the *learning objectives* for this course. That is, by the completion of this course, you should the skills necessary to answer each of the above questions.

## Course Philosophy

> "*I hear and I forget. I see and I remember. I do and I understand.*" – mixed origin

You cannot learn, let alone understand, interface design without doing it. This class will provide you with hands-on experience in designing, implementing, and evaluating an interface for a

computational system. Almost every class meeting will involve significant interaction.

## Assignments

All typed written assignments should be submitted in 10-12 point font, single column, single spaced, with 1” to 1.5” margins, in a legible and appropriate typeface of your choosing. Any references should be cited using APA format. Assignment lengths specified in word count are exclusive of figures, references, tables, captions, footnotes, etc. Assignment lengths specified in page count are all inclusive. These formatting requirements do not apply to hand-written assignments, such as the Design Workbooks.

### Design Workbooks

Lecture-based class days will begin and end with a hands-on exercise. Usually, these exercises will pertain directly to the assigned readings for the day. While completing the exercises, you may consult any notes you have taken, but you may *not* directly consult the readings themselves. Some of these assignments will involve writing, some of them will involve concept sketching.

You will need to purchase a standard size composition notebook in which to complete these exercises. Each day’s exercises will start on a new (right hand) page. At the end of class, your design workbooks will be collected for grading and feedback.

During the course of the semester, you will need to select **five (5)** days worth of these workbook assignments to be graded on a letter scale, according to the following rubric:

- A (95%): Thorough comprehension of material, strongly-motivated and clever design, and thorough use of readings.
- B (85%): Sufficient comprehension of the material and thoughtful design grounded in readings.
- C (75%): May be missing one or two minor points, use of readings may show misunderstanding and/or design may lack motivation.
- D (65%): Misses the central point of the prompt/activity, little to no use of readings in the design.
- F (50%): Off-topic, no response, or similar issues.
- A+ (100%): Truly outstanding, novel insights or designs that go beyond the material and exercises from class.

You must designate the workbook days that are to be graded for a letter and indicate them by writing **GRADE** at the top of the page for that day. Those workbook activities selected for a letter grade will receive detailed comments and feedback. The remainder will be graded simply for completion and will count toward your participation grade.

### Semester Project and Labs

You will complete a semester-long group project to design, implement, and evaluate an interface for a web-based photo-sharing application. Work on this project will be completed throughout the semester and submitted as a series of three separate milestones. The first milestone will involve engaging with users and require you to submit a design specification. The second milestone will involve you implementing that design. The third milestone will involve you running an evaluation of your implemented system. This will ensure that your work on the project is iterative, that each stage builds on the next, and that the work spreads out over the course of the semester.

Groups for this project will be self-selected using, in-part, an in-class speed networking exercise. Your group will collectively identify the particular users for whom you will design and the specific design methods you will use. You will have the option of using a backend that provides minimal photo-sharing functionality, or you may choose to implement your own backend.

For each of the first and third milestones, you and your group will submit a written report. For the second milestone, you and your group will submit your codebase for review. Finally, the results of your project will be presented during an in-class poster session on the last scheduled class meeting day. More details about the project, the milestones, and the grading rubrics for each will be available on CourseSite.

## Attendance

Attendance is **mandatory**. Class time will be spent engaging in a series of activities, discussions, critiques, and other exercises. As such, in-class activities are integral, both to your own and to others' learning, as well as fulfill a non-negligible portion of your grade.

Sometimes, though, life happens. In such instances, you will receive **two personal days** to use at your discretion during the semester. There is no need to notify the instructor, and no excuse or justification need be given. Your in-class participation grade that day will not count toward your total. If you miss additional days, those will be counted as a zero toward your in-class participation grade.

## Grading

You will receive a grade based on the following break down.

15% Attendance & Participation

15% Design Workbooks

60% Semester Project (20% for each of 3 milestones)

10% Poster Presentation

### Grading Scale

| | |
|---|---|
| 97% – 100% A+ | 77% – 79.9% C+ |
| 93% – 96.9% A | 73% – 76.9% C |
| 90% – 92.9% A- | 70% – 72.9% C- |
| 87% – 89.9% B+ | 67% – 69.9% D+ |
| 83% – 86.9% B | 63% – 66.9% D |
| 80% – 82.9% B- | 60% – 62.9% D- |
| | < 60% F |

## Policies

### Technology in Class

While in class, your attention should be on class. Please silence, disable, or turn off any device that makes noise.

Use of computational technology during class will vary, depending on the in-class activities. On some days, you will be asked not to use computational technology during class. On some days, you will be required to bring a personal computing device (e.g., a laptop computer), according to the schedule below. On remaining days, you will be given the choice as to whether to use computational technology as part of your learning process.

This policy is subject to revision, depending on student engagement over the course of the semester.

### Academic Integrity

> *"If I have seen further, it is by standing on the shoulders of giants"* (Isaac Newton, 1676).

In this class, you are both encouraged and will need to draw on the work and ideas of others. However, you must do so with appropriate acknowledgement. For scholarly writing, news media, books, or other publications, this usually means citation. In other cases, a footnote and/or an acknowledgement section may be more appropriate (for instance, see the footnote on the Project 1 specification).

Plagiarism will not be tolerated. If in doubt, ask the Professor or see Lehigh's plagiarism policies (available from http://library.lehigh.edu/content/plagiarism_policies). Consider, also, the following Lehigh Student Senate Statement on Academic Integrity.

> *"We, the Lehigh University Student Senate, as the standing representative body of all undergraduates, reaffirm the duty and obligation of students to meet and uphold the highest principles and values of personal, moral and ethical conduct. As partners in our educational community, both students and faculty share the responsibility for promoting*

*and helping to ensure an environment of academic integrity. As such, each student is expected to complete all academic course work in accordance to the standards set forth by the faculty and in compliance with the University's Code of Conduct."*

### ACCOMMODATIONS

Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors *as early in the semester as possible*. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at https://studentaffairs.lehigh.edu/disabilities.

### TEAM WORK

A significant portion of the work in this class will be completed in groups or teams. At the end of any group work, you will be asked to evaluate the other members of the teams in which you have worked. Individuals who receive a negative evaluation from *one* team member will receive a notification that a complaint was made (though not by whom). Individuals who receive a negative evaluation from *two* team members will receive a 10% deduction in their grade on the project. Individuals who receive a negative evaluation from *more than two* team members will receive a 50% reduction in their grade on the project. Individuals who receive positive comments from *every* group member will receive a 5% bonus on their project grade. Complex cases may involve external dispute resolution if necessary.

## DISSENT

In this class, you will be asked to critique other designer's work, including that of fellow classmates. Disagreements that arise in this process are both allowed and encouraged. However, disagreement must be voiced and conducted in a civil manner. Moreover, you should provide *constructive* critique. Saying that you do not like something does not help the designer. What can help is pointing out unfortunate, undesirable, or unintended consequences, as well as offering alternatives.

From the Lehigh Principles of our Equitable Community:

> *We recognize each person's right to think and speak as dictated by personal belief and to respectfully disagree with or counter another's point of view.*

Lehigh University endorses The Principles of Our Equitable Community. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom. See http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf

### Lehigh University Policy on Harassment and Non-Discrimination

Lehigh University upholds The Principles of Our Equitable Community and is committed to providing an educational, working, co-curricular, social, and living environment for all students, staff, faculty, trustees, contract workers, and visitors that is free from harassment and discrimination on the basis of age, color, disability, gender identity or expression, genetic information, marital or familial status, national or ethnic origin, race, religion, sex, sexual orientation, or veteran status. Such harassment or discrimination is unacceptable behavior and will not be tolerated. The University strongly encourages (and, depending upon the circumstances, may require) students, faculty, staff or visitors who experience or witness harassment or discrimination, or have information about harassment or discrimination in University programs or activities, to immediately report such conduct.

If you have questions about Lehigh's Policy on Harassment and Non-Discrimination or need to report harassment or discrimination, contact the Equal Opportunity Compliance Coordinator (Alumni Memorial Building / 610.758.3535 / eocc@lehigh.edu).

## Schedule

Readings listed on each day are to be done *before* that day. The astute reader will notice some days designated as [flex topic] days. These days serve two purposes on the schedule. First, they allow the instructor and the students to custom tailor the class to specific areas of interest that emerge over the course of the semester. Second, they ensure that the core material is covered in the event that any class meeting days need to be cancelled (e.g., for weather).

| Date | Topic & Readings | Assignments etc. |
|---|---|---|
| | **Unit α - Introduction** | |
| **Week 1** | | |
| M – 8/26 | What is Human-Computer Interaction? | Acquire a Composition Notebook |
| W | Historical Foundations<br>Vannevar Bush. 1945. As We May Think. *The Atlantic*. | |

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|

## UNIT 1 – USERS AND DESIGN

## WEEK 2

M – 9/2

### INTERVIEWING USERS

Robert S. Weiss. 1994. Interviewing. In *Learning from Strangers: The Art and Method of Qualitative Interview Studies*. The Free Press, New York, 61–119.

*Optional*:

Karen Holtzblatt and Hugh R. Beyer. Contextual Design. The Encyclopedia of Human-Computer Interaction. Retrieved from https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/contextual-design

W

### PARTICIPATORY DESIGN

Michael J. Muller and Sarah Kuhn. 1993. Participatory Design. *Communications of the ACM* 36, 4: 24–28. https://doi.org/10.1145/153571.255960

Michael J. Muller. 2001. Layered Participatory Analysis: New Developments in the CARD Technique. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 90–97. https://doi.org/10.1145/365024.365054

*Optional*:

Eevi E. Beck. 2002. P for Political: Participation is not enough. Scandinavian Journal of Information Systems 14, 1: 1.

## WEEK 3

M – 9/9

### ETHNOGRAPHY

Tony Salvador, Genevieve Bell, and Ken Anderson. 1999. Design Ethnography. *Design Management Journal (Former Series)* 10, 4: 35–41. https://doi.org/10.1111/j.1948-7169.1999.tb00274.x

*Optional*:

Paul Dourish. 2006. Implications for Design. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 541–550. https://doi.org/10.1145/1124772.1124855

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|
| W | CULTURAL PROBES<br>Bill Gaver, Tony Dunne, and Elena Pacenti. 1999. Cultural Probes. *interactions* 6, 1: 21–29. https://doi.org/10.1145/291224.291235<br>William W. Gaver, Andrew Boucher, Sarah Pennington, and Brendan Walker. 2004. Cultural probes and the value of uncertainty. *interactions* 11, 5: 53–56. https://doi.org/10.1145/1015530.1015555<br>*Optional*:<br>Kirsten Boehner, Janet Vertesi, Phoebe Sengers, and Paul Dourish. 2007. How HCI interprets the probes. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 1077–1086. https://doi.org/10.1145/1240624.1240789 | |
| **WEEK 4** | | |
| M – 9/16 | SURVEYS<br>Hendrik Müller, Aaron Sedley and Elizabeth Ferrall-Nunge. 2015. Survey Research in HCI. https://pdfs.semanticscholar.org/d142/c1b2488ea054112187b347e1a5fa83a3d54e.pdf<br>Work through Qualtrics Documentation/Tutorials (*read and do before class*):<br>https://www.qualtrics.com/support/survey-platform/survey-module/survey-module-overview/ | *Before Class*: Sign Up for Qualtrics (https://lehigh.qualtrics.com) |
| W | Speed Networking for Project Teams | |
| | **UNIT 2 – DESIGN AND IMPLEMENTATION** | |
| **WEEK 5** | | |
| M – 9/23 | TEAM MEETINGS<br>Meet with instructor to discuss project plan | |
| W | WEB UI WITH JQUERY<br>*Before Class*: Get a local web server running on your machine (see the Milestone 2 description for details) | Bring your laptop |

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|

## WEEK 6

M – 9/30

### SKETCHES AND PROTOTYPES

Bill Buxton. 2007. *Sketching User Experiences: Getting the Design Right and Getting the Right Design.* Morgan Kaufmann, San Francisco, CA. pp. 104-123.

Dan Nessler. 2016. A guide to paper prototyping & testing for web interfaces. *Digital Experience Design.* https://medium.com/digital-experience-design/a-guide-to-paper-prototyping-testing-for-web-interfaces-49e542ba765f

W

### INTERFACE DESIGN GUIDELINES

David Canfield Smith, Charles Irby, Ralph Kimball, Bill Verplank, and Eric Harslem. 1982. Designing the Star User Interface. *BYTE Magazine* 7, 4: 242–282.

Donald A. Norman. 1988. The Psychopathology of Everyday Things. in *The Design of Everyday Things* (Revised & Expanded Edition), 1-36. Basic Books: New York.

## WEEK 7

M – 10/7

### FITTS'S LAW

Pual M. Fitts. 1954. The Information Capacity of the Human Motor System in Controlling the Amplitude of Movement. Journal of Experimental Psychology 47, 381–391.

I. Scott MacKenzie and William Buxton. 1992. Extending Fitts' Law to Two-dimensional Tasks. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 219–226. https://doi.org/10.1145/142750.142794

*Optional*:

Ken Goldberg, Siamak Faridani, and Ron Alterovitz. 2015. Two Large Open-Access Datasets for Fitts' Law of Human Motion and a Succinct Derivation of the Square-Root Variant. *IEEE Transactions on Human-Machine Systems* 45, 1: 62–73. https://doi.org/10.1109/THMS.2014.2360281

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|
| W | LIMITATION AND NEGATION<br>[flex topic]<br>James Pierce and Eric Paulos. 2014. Some Variations on a Counterfunctional Digital Camera. In *Proceedings of the ACM Conference on Designing Interactive Systems (DIS)*, 131–140. https://doi.org/10.1145/2598510.2602968<br>*Optional*:<br>Eric P. S. Baumer and M. Six Silberman. 2011. When the Implication Is Not to Design (Technology). In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 2271–2274. https://doi.org/10.1145/1978942.1979275 | Milestone 1 Due on Friday, October 11 by 12:45 p.m. |
| **WEEK 8** | | |
| M – 10/14 | No Class Meeting – Pacing Break | |
| W | TEAM MEETINGS<br>Meet with instructor to discuss Milestone 1 feedback | |
| | **UNIT 3 – EVALUATION** | |
| **WEEK 9** | | |

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|
| M – 10/21 | USABILITY EVALUATION<br>Assistant Secretary for Public Affairs. 2013. Planning a Usability Test. *usability.gov*. Retrieved from https://www.usability.gov/how-to-and-tools/methods/planning-usability-testing.html<br>Assistant Secretary for Public Affairs. 2014. Running a Usability Test. *usability.gov*. Retrieved from https://www.usability.gov/how-to-and-tools/methods/running-usability-tests.html<br>*Optional*:<br>John Brooke. 1996. SUS: A "Quick and Dirty" Usability Scale. In *Usability Evaluation In Industry*, Patrick W. Jordan, Bruce Thomas, Ian L. McClelland and Bernard A. Weerdmeester (eds.). Taylor & Francis, London, pp. 189–194.<br>Sandra G. Hart and Staveland. 1988. Development of NASA-TLX (Task Load Index): Results of Empirical and Theoretical Research. *Advances in Psychology* 52: 139–183. https://doi.org/10.1016/S0166-4115(08)62386-9 | |
| W | DESIGNING EXPERIMENTS<br>David W. Martin. 2008. How to Do Experiments. in *Doing Psychology Experiments*. Thomson Wadsworth, Belmont, CA, pp. 25-35 [***stop** at the heading **Statistical Regression***] | |
| **WEEK 10** | | |
| M – 10/28 | [Prof. Baumer away] | |
| W | LOG DATA ANALYSIS<br>Susan Dumais, Robin Jeffries, Daniel M. Russell, Diane Tang, and Jaime Teevan. 2014. Understanding User Behavior Through Log Data and Analysis. In Ways of Knowing in HCI, Judith S. Olson and Wendy A. Kellogg (eds.). Springer New York, New York, NY, 349–372. https://doi.org/10.1007/978-1-4939-0378-8_14 [***start** at the heading **Collecting, Cleaning, and Using Log Data***] | Bring Your Laptop |
| **WEEK 11** | | |

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|
| M – 11/4 | TEAM MEETINGS<br>Instructor code review | |
| W | TEAM MEETINGS<br>Instructor code review | |
| **WEEK 12** | | |
| M – 11/11 | [Prof. Baumer away] | |
| W | [Prof. Baumer away] | Submit Evaluation Plan |
| **WEEK 13** | | |
| M – 11/18 | TEAM MEETINGS<br>Instructor feedback on evaluation plan | |
| W | USER EXPERIENCE<br>[flex topic]<br>Virpi Roto, Effie Law, Arnold Vermeeren, and Jettie Hoonhout. 2011. User Experience White Paper: Bringing clarity to the concept of user experience. Retrieved from http://www.allaboutux.org/files/UX-WhitePaper.pdf<br>Virpi Roto, Effie Law, Marianna Obrist, Arnold Vermeeren, and Kaisa Väänänen-Vainio-Mattila. User eXperience Evaluation: Which Method to Choose? Retrieved from http://www.allaboutux.org/files/UX-evaluation-methods-CourseMaterial.pdf [**begin at p. 27**]<br>*Optional*:<br>Saul Greenberg and Bill Buxton. 2008. Usability Evaluation Considered Harmful (Some of the Time). In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 111–120. Retrieved from http://dl.acm.org/citation.cfm?id=1357074 | |
| **WEEK 14** | | |

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
|---|---|---|
| M – 11/25 | CLASS AS LAB<br>In-class Usability Evaluation | Milestone 2 Due |
| W | No Class – Thanksgiving Break | |

## UNIT Ω – EPILOGUE

### WEEK 15

M – 12/2

FRONTIERS

*Choose and read **One** of the following:*

Hiroshi Ishii and Brygg Ullmer. 1997. Tangible Bits: Towards Seamless Interfaces Between People, Bits and Atoms. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 234–241. https://doi.org/10.1145/258549.258715

Thad Starner, Steve Mann, Bradley Rhodes, Jeffrey Levine, Jennifer Healey, Dana Kirsch, Rosalind W. Picard, and Alex Pentland. 1997. Augmented Reality Through Wearable Computing. *Presence: Teleoperators and Virtual Environments* 6, 4: 396–398.

Mark Weiser. 1991. The Computer for the 21st Century. *Scientific American* 265, 3: 94–104.

*Optional*:

Genevieve Bell and Paul Dourish. 2007. Yesterday's tomorrows: notes on ubiquitous computing's dominant vision. *Personal and Ubiquitous Computing* 11, 2: 133–143. https://doi.org/10.1007/s00779-006-0071-x

| DATE | TOPIC & READINGS | ASSIGNMENTS ETC. |
| --- | --- | --- |
| W | Final Project Presentations | In-class poster session<br>Milestone 3 **Due** Online Wednesday, December 11 at 11:59 p.m. |