User Experience and Interaction Design (TDDE36)
12 ECTS Credits: Study Guide VT 2018

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Syllabus

https://liu.se/en/studieinfo/programkurs/tdde36/125977

Contents

Intended Learning Outcomes

This course is about how to study and evaluate user experience (UX), and how to conduct human-centred design of interactive products and services (interaction design). The overarching aim of the course is that the participant will to develop knowledge in basic user experience research and evaluation methods (qualitative and quantitative), as well as interaction design methods.

The student shall after the course be able to:

- Use and account for basic qualitative user research methods (e.g. interviews, observation, and thematic analysis). The goal is examined in UPG1 (group and individual parts).
- Use and account for basic quantitative user experience testing methods (e.g. task success, time, self-report questionnaires), including analysis of the results using descriptive statistics. The goal is examined in UPG2 (group and individual parts).
- Ideate and sketch interaction design concept proposals, assess them, and make a convincing argument for one proposal based on user research results. The goal is examined in UPG3 (group and individual parts).
- Sketch, develop and present interaction design prototypes. The goal is examined in UPG4 (group and individual parts).
- Conduct and account for a user experience evaluation of interaction design prototypes. The goal is examined in UPG5 (group and individual parts).
- Assess user research and evaluations with respect to scientific criteria. The goal is examined in UPG1 and UPG2 (group parts).
- Review interaction design projects with respect to societal and ethical aspects, as for example research ethics, gender, and sustainability. The goal is examined in UPG1, UPG2, and UPG5 (group part).

Course Contents

Skills: Conducting an interaction design process with customer and user perspectives. Designing well-functioning interactive products and services. Researching and evaluating user experience.

Subjects: Fundamental concepts in human–computer interaction. Design principles and guidelines for user interfaces. Prototyping of interactive products and services. User research methods. Design methods. Different kinds of user interfaces. User experience and usability evaluation methods.

Technologies: Prototyping tools for development of interactive products and services. Interaction technologies.

Course Evaluation from Last Year

The course is new so there is no course evaluation from last year.

Working and Teaching Methods

Lectures introduce or broaden the perspectives given through the readings and seminars. They describe what, why and how of a certain topic. Smaller exercises are also conducted at some lectures.

Presentations have compulsory attendance and are held as critique sessions with two project teams at the time (except for the final presentation which is in full class). Critique sessions are conducted around a show-and-tell about produced materials. It is important to give constructive critique on the others work. Two groups have presentation at the same time so that learning may occur between groups. For the presentation, every group has 10 minutes for presentation and 5 minutes for critique.

Teaching sessions focus on exercises that are prepared by the lecturer.

Supervisions focus on what has been done, in relation to what is expected by the examiner, and what the next steps should be. Prepare questions that you may have for the teacher. We expect all students to attend supervision sessions, and if someone repeatedly is missing we will consider that an indication that something is wrong in the project team.

Group work in the design project work is done in groups of approximately five students. It includes collaboration with different user groups (i.e. third stream activities). There is time in the time table marked as group work (Swe. grupparbete, GU) (without teacher and without a lecture hall) for the groups to use as they please.

Individual work is required in reading up on how to do things in the group work. There are also individual parts of all five assignment, in the form of a take home exam.

Examination

There are five assignments (UPG1–5) in the course and every assignment has one group part and one individual part. The group parts form together a project with five phases. The individual parts form together a take home exam.

Grading

The final course grades are calculated as the *mean* of the grades for the four examination assignments. Every assignment has a group part that is awarded pass or fail, and an individual part that is graded U,3, 4, 5. The individual part decides the grade on the assignment, but the group part need to be passed as well. The round-to-nearest with round half up rule is applied (for example, 3.5 is rounded up to 4) in the calculation of course grades.

In the group parts, the grades are based on the work performed by the group, but the examination is individual. This means that individual students may receive a different grade than the rest of the group if there are reasons for that. Such reasons could for example be that the group members have different ambition levels, or if there are large differences in how much work that different group members have done. Individual supplementary examination assignments can also be given by the examiner. The group members need to tell the examiner if there are reasons for different grades in a group. More precise grading criteria are specified in below for each assignment.

You could potentially ship in an infinite number of hours on each assignment, but you should not. Make a time budget and stick to it. The examination is adjusted according to what is possible to do given your time constraints.

Required Attendance

Presentations are part of the examination and have compulsory attendance, but there are a few valid reasons for missing a presentation. You must then notify your

supervisor in advance about why you cannot attend. The supplementary task is to write a description of what you personally did in the group work, and a reflection on lessons learned from the group work (about 800 words). The supplementary tasks should be delivered to your supervisor as soon as possible, but at the latest by the supplementary deadline.

Deadlines

The *group assignments'* deadlines for deliverables at 17:00 on the following dates:

- Assignment 1 and 2: 2018-02-23
- Assignment 3: 2018-03-23
- Assignment 4:2018-05-04
- Assignment 5: 2018-05-23.

The *individual assignments* have a deadline at the end of the course:

- All individual assignments: 2018-06-02.

There are two supplementary deadlines for *re-submissions*:

- All assignments: 2018-09-01
- All assignments: 2018-11-02

Students that miss the last deadline for re-submission cannot supplement or resubmit, but must do the assignments for the following year's course. Students can try for higher grade by handing in material at the deadline for re-submissions. No assignments are graded between deadlines. *Please note:* Re-submissions are made by e-mail to the examiner and not through Lisam.

Conduct

The following set of rules applies to the assignments in this course. It is a slightly modified version of IDA's general rules for labs:

- The assignments are in a group or individually, according to the instructions given for the course. However, examination is always individual.
- It is not allowed to hand in solutions copied from other students, or from elsewhere, even though modifications have been made. If unauthorized copying or other forms of cheating is suspected, the teacher is required to make a report to the University Disciplinary Board.
- You should be able to explain the details of the assignment. It is also possible that you may have to explain why you have chosen a specific solution. This applies to everyone in a group.
- If you anticipate that you cannot meet a deadline, contact your teacher. You may get some support and possibly a deadline at a later date. It is always better to discuss problems than to cheat.
- If you do not follow the university and a course examination rules, and try to cheat, by for example plagiarizing or using unauthorized assistance, then it may result in a complaint to the University Disciplinary Board. The consequences of cheating can be a warning or suspension from studies.
- Policy for presentation. A definite end date, deadline, generally apply to the submission of assignments in the course. This deadline may be during the course or at the end. If presentation is not done in time, you may have to do a new set of assignments the next time the course is offered.

Group Assignments: The Project

The five group assignments make up a project with five phases with compulsory oral presentations during the course. There will be about 5 students in every group. You will have to read the assigned course reading to in advance to be able to complete the group assignments. Group assignments are graded Fail or Pass.

Start reading the literature as soon as the course starts to avoid making unnecessary mistakes. You need to read up and attend lectures to fully understand how to do the assignments.

UPG1 and UPG2 Qualitative User Research and Quantitative UX Testing (Group)

Duration: Week 3 to week 8.
Presentation date: February 22 or 23, 2018. Grading (pass/fail) depend on how well the students consider, execute, and present both the qualitative research methods (UPG1) and the quantitative research methods (UPG2). Information produced in the research should facilitate you in framing a fruitful design challenge for your project.

1. Start: Choose an interactive system that you would like to re-design. It should be used by students and/or employees at the university. Budget and time plan 64 work hours on UPG1 and UPG2 for every group member, not including reading the course literature for the assignment. Assign roles and tasks to the group members.

   Assigned readings: Blandford (n.d.), Tullis and Albert (2013, Ch. 1–6) AND Cairns (n.d.).

2. Plan: Follow the guidelines on for planning, sampling, and recruitment (Blandford, n.d.; Tullis and Albert, 2013, Ch. 3). Start recruiting users early since it takes more time than you would expect.

   a. Plan the quantitative user experience test to measure suitable usability and user experience variables (e.g. metrics like degree and rate of task success, time on task, self-report questionnaires) (Tullis and Albert (2013, Ch. 3–6).

   b. Plan the qualitative study with the purpose of gaining insights about the users:

      i. Who are the users?
         (1) What are their roles?
         (2) What characterise them?
         (3) What do they know?
      ii. What are their goals and tasks?
         (1) Why do they use the system?
         (2) What they do with it?
         (3) How do they use it (by what means and what steps)?
      iii. What are their user experiences?
         (1) What is important for them?
         (2) How do they feel about it?
         (3) What do their experiences of the system mean for them?
         (4) What are their pain points?
         (5) What possibilities of improvement do they see?
      iv. What are their contexts of use?
         (1) When is it used?
         (2) Where is it used?

3. Execute: It can be beneficial to plan your study so that you gather qualitative and quantitative data at the same time. For example, for each participant, start with semi-structured interview about the situation of use (qualitative method). Continue with a usability test of the system (quantitative method), while making observations (qualitative method). Then distribute a post-test

questionnaire (quantitative), and make a semi-structured post-test interview about the user experience (qualitative).

   a. Qualitative: Conduct at least one interview or observation session per group member. Analyse your qualitative data using thematic analysis. Follow the guidelines by Blandford (n.d.) for gathering and analysing data.

   b. Quantitative: Test the usability and user experience of the system with at least one user per group member, and gather data on your chosen metrics. Use descriptive statistics to analyse quantitative results. Follow guidelines by Tullis and Albert (2013).

4. Review: Assess your user research with respect to criteria for quality in qualitative research (Blandford, n.d.), and the different forms of validity in quantitative research (Cairns, n.d.). Consider also research ethics.

5. Document: Write a report in Swedish or English. Use the Research Report Template at Lisam.

6. Present: Prepare and give a 10-minute presentation where you describe the system, the qualitative insights about the use situation, and the quantitative measurement of UX and usability. It should be in English if there are exchange students participating, and otherwise in Swedish.

7. Submit: Upload your presentation material (e.g. the slides) in PDF on Lisam. File naming convention: `group#-coursecode-year-upg#.pdf` (e.g. `group3-tdde36-2018-upg1-2.pdf`).

UPG3 Interaction Concept Design (Group)

Duration: Week 9 to week 12.
Presentation date: t.b.a. in TimeEdit (second half of March). Grading (pass/fail) depends on how well the concept design is considered, executed, and presented. The problem should be framed from wide perspectives with many design ideas generated. Essential and important aspects should be picked up in designing. Many elements of exploration and judgment should be observed. The chosen concept should have potential to resolve the identified crux.

1. Prepare: Budget and time plan 48 work hours on the assignment for every group member, not including reading the course literature for the assignment. Assign roles and tasks to the group members.

   Assigned readings: Arvola (2014, Ch. 1–3), Saffer (2009, Ch. 1–6), OR Preece, Rogers, & Sharp (2015, 2016, Ch. 9–11.).

2. Execute:

   a. Create personas and scenarios describing the current situation for the users, based on your research results from UPG1 and UPG2.

   b. Set up design objectives in the form of effect goals, UX goals, and product goals.

   c. Ideate and sketch out a wide variety of design concepts that are not mere modifications to the existing system, but rather complete re-inventions of it. Make rough and simple sketched concept storyboards for at least one concept per group member.

   d. Evaluate the sketched concept storyboards using a Pugh-chart.

   e. Develop a concept proposal in a more presentable storyboard. Make sure to decide what the value the concept proposes or crux it addresses.

3. Present: Prepare and give a 10-minute presentation where you show your:

   a. Primary and secondary personas

   b. Scenarios of current situation

   c. Main different design concepts in sketches

   d. Concept selection with motivations supported by a Pugh chart

   e. Storyboard that present the value proposition or crux of the selected concept

   f. Most important requirements (eg. functions, data, qualities, constraints)

   It should be in English if there are exchange students participating, and otherwise in Swedish.

4. Review: Consider the critique from peers and teachers at the presentation session and revise your concept if necessary.

5. Submit: Upload your presentation material (e.g. the slides) in PDF on Lisam. File naming convention: `group#-coursecode-year-upg#.pdf` (e.g. `group3-tdde36-2018-upg3.pdf`).

UPG4 Interaction Design Prototyping (Group)

Duration: Week 13 to week 18.
Presentation date: t.b.a. in TimeEdit (beginning of May). Grading (pass/fail) depends on how well the prototyping is considered, executed, and presented. Many variations of solutions and parts of solutions should be considered. The design solution should address the identified problem. It should not be too simple, yet not unnecessarily complicated.

1. Prepare: Budget and time plan 48 work hours on the assignment for every group member, not including reading the literature for the assignment. Assign roles and tasks to the group members.

   Assigned readings: Arvola (2014, Ch. 4–5), Saffer (2009, Ch. 7–8), OR Preece, Rogers, & Sharp (2015, 2016, Ch. 2–6, 12–14.).

2. Execute:

   a. Sketch out and explore alternative user interface designs. Use wireflows (wireframes in interaction flows).

   b. Build a paper prototype that covers the 3–5 most important tasks that your design should support. Make it look sketchy, without polished finish. Some of your test users may be non-Swedish speaking. If that is the case, then the prototype needs to have a user interface in English.

   c. Test the paper prototype at the designated teaching sessions (Swe. lektion) with another group of students. Prepare and conduct a formative usability test. Prepare for pre-test questions, task scenarios, observation protocol, and post-test questions). For the observation protocol, take inspiration from the note-taker's guide at usability.gov. The following groups are test users for each other:

      i. Group 12 and 1

      ii. Group 2 and 3

      iii. Group 4 and 5

      iv. Group 6 and 7

      v. Group 8 and 9

      vi. Group 10 and 11.

   d. Revise your design and your requirements based on your formative usability test results.

   e. Detail the look and feel of your design. Consider the user interface guidelines for the chosen platform:

      i. MacOS

      ii. Universal Windows Platform (UWP)

iii. Android

iv. iOS.

f. Build an interactive computer prototype using Adobe User Experience CC, Axure RP, or Atomic.io. You may choose another prototyping tool if you can motivate the choice (there are many). Several tools have student licenses or free trials. The prototype should cover the 3–5 most important tasks that your design should support. It should have high fidelity in visual design and interaction.

3. Present: Prepare and give a 10-minute presentation where you show your:

   a. Main different user interface ideas in sketches

   b. Paper prototype

   c. Formative test method and results

   d. Computer prototype.

   It should be in English if there are exchange students participating, and otherwise in Swedish.

4. Review: Consider the critique from peers and teachers at the presentation session and revise your prototype if necessary.

5. Submit: Upload your presentation material (e.g. the slides) in PDF on Lisam. File naming convention: `group#-coursecode-year-upg#.pdf` (e.g. `group3-tdde36-2018-upg4.pdf`).

UPG5 Evaluation of Prototype (Group)

Duration: Week 19 to week 21.
Presentation date: t.b.a. in TimeEdit (at the end of May). Grading (pass/fail) depends on how well the prototype evaluation, project description, and review is considered, executed, and presented. The final presented prototype should be well thought through and resolve identified issues. Design features should fit together as a composition.

1. Prepare: Budget and time plan 32 work hours on the assignment for every group member, not including reading. Assign roles and tasks to the group members.

2. Assigned readings: Raghavan & Pargman (2017), and Marsden & Haag (2016). Material on usability testing from UPG1, UPG2, and UPG4.

3. Execute:

    a. Recruit representative users for the final usability test. One user per group member is the minimum. Recruiting users takes more time than you may think; start contacting people early.

    b. Use your experiences from UPG1, UPG2 and UPG4 to prepare a user experience evaluation of the interactive computer prototype.

    c. Account for the evaluation in a written test report. Use the template called Informal Usability Test Report.

    d. Make changes to your design based on the test results

    e. Describe your entire project (UPG1–5) using the template called Design Project Description.

4. Present: The presentations will be in full class. Prepare and give a 10-minute presentation where you:

    a. Tell the audience about your entire project

    b. Show materials produced during the design process

    c. Show your final design

    d. Highlight challenges you ran into and lessons learned during the course.

    It should be in English if there are exchange students participating, and otherwise in Swedish.

5. Review: Read the paper on sustainability in human-computer interaction (Raghavan & Pargman, 2017), and the paper on gender in interaction design (Marsden & Haag, 2016). Discuss the following questions in your groups and submit simple meeting notes from your discussion (one page for sustainability and one page for gender. It can be a bullet list of what you talked about.

    a. Questions for discussion on sustainability:

i. What is sustainability in human-computer interaction? Are there different ways of conceptualising the concept of sustainability?

ii. In what ways do your project contribute to sustainable development? In what ways does it not contribute?

iii. Would the proposed interactive system be worthwhile, considering it from the perspective of sustainability?

b. Questions for discussion on gender:

i. What are the issues of gender, heteronormativity, and intersectionality that are relevant in your project?

ii. Are your perceptions of the users in your project stereotypical?

iii. How could you avoid stereotyping the users?

iv. To what degree does your design work depend on normative structures, and should you try to change them by means of our design?

v. Should you, or should you not, try to change the power structures between stakeholders and users by means of your design work?

6. Submit: The test report and the review report is submitted in PDF, and the design project description is submitted in Word-format. All submissions are made on Lisam. File naming convention: `group#-coursecode-year-upg#-part.fileformat` (e.g. `group3-tdde36-2018-upg5-test.pdf, group3-tdde36-2018-upg5-review.pdf, group3-tdde36-2018-upg5-project.docx`).

Individual Assignments: The Take Home Exam

The individual assignments make up a take home exam with five parts handed in at the end of the course. The exam periods are intended to be used for individual assignments. Each part is answered in 500–1000 words and is supplemented by images where appropriate. You are expected to put in less than one day of work on each individual assignment (reading not included). Individual assignments are graded Fail, 3, 4, or 5. You need to get at least 3 on all five individual assignments.

Formalities: Start every new UPG with a new page and write your name and LiU-ID on every page. Give references to the course literature using the **Harvard-system** to show your understanding of the readings.

Grading: 3 points gives the grade 3 on an assignment, 4 points gives grade 4, and 5 points awards the grade 5. Course grade is calculated as the mean of the five individual assignments, if you have been awarded a passing grade on group assignments.

Submission: Submit your take home exam in PDF on Lisam. File naming convention: `LiUID-coursecode-year-individual.pdf` (e.g. `matar63-tdde36-2018-individual.pdf`).

UPG1 Qualitative User Research (Individual)

Do this assignment during the first exam period of the spring semester.

- Part A. Find a setting to observe without interruption for 20–25 minutes. You should not participate in any activities during the observation. Record everything that you can see, hear, smell, taste and feel about the setting (i.e. the physical surroundings) and the interaction (i.e. the conversations and the nonverbal behaviours) that take place. Draw a line in the middle of your observation notes and record observations on one side of the line, and your thoughts, feelings, and ideas about what is happening on the other. Write up your notes on the computer. (2 points)
- Part B. Relate your experiences of Part A to what Blandford (n.d.) write about techniques for data gathering. (2 points)
- Part C: Relate your experiences of Part A to what Blandford (n.d.) write about assessing and ensuring quality in qualitative research. (1 point)

UPG2 Quantitative UX Testing and Descriptive Statistics (Individual)

Do this assignment during the first exam period of the spring semester.

- Part A: What are the most important parts/aspects of testing and measuring user experience, based on your reading of Tullis and Albert (2013)? (2 points)
- Part B: Relate your answer in Part A to Cairns (n.d.) description of different forms of validity. (2 points)
- Part C: Given your replay in Part A and B – What metrics would you use, and how would you ensure validity if you were to evaluate a coffee machine at an office? Motivate your answer. (1 point)

UPG3 Interaction Concept Design (Individual)

Do this assignment during the first or second exam period of the spring semester.

- Part A: Sketch quickly (scribble sketch for max. one hour) about 10 alternative concepts for the interaction with a coffee machine. Assess the alternatives using pro et contra (+/-) lists, and choose one alternative (or a synthesis of several) to continue working on. Scribble sketch about 10 sketches with variations of detailed interaction flows for the chosen alternative. Make one or several presentation drawings that explain your final design. Your proposal should be sound in relation to your problem framing. (2 points)
- Part B: Explain why and how your solution came about, and evaluate how far your solution satisfied potential needs Relate your explanation to the most central methods for developing design concept proposals based your reading of the course literature (i.e. Arvola, 2014; Saffer, 2009; or Preece et al., 2015, 2016). (2 points)
- Part C: Argue the case for why your design ideas are new and creative. (1 point)

UPG4 Interaction Design Prototyping (Individual)

Do this assignment during the second exam period of the spring semester.

- Part A: Sketch quickly an app to order coffee at a cafe of your choice, and build a paper prototype of your design. Test your paper prototype with one user. Describe step-by-step how you did the prototype (illustrate with photos), how you tested it, and what happened in the test. (3 points)
- Part B: Discuss your procedure in Part A in relation to methods described in the course literature (e.g. Arvola, 2014; Saffer, 2009; Preece et al., 2015, 2016). (1 point)
- Part C: Discuss what lessons you have learned from the course for how to build prototypes in future projects. (1 point)

UPG5 Evaluation of Prototype (Individual)

Do this assignment during the second exam period of the spring semester.

- Part A: Make a usability evaluation plan of a prototype of an app for ordering coffee delivered by a flying drone. Base your plan on your reading of Arvola (2014), Preece et al. (2015, 2016) and/or Tullis and Albert. (2 point)
- Part B: What would be the research ethics you would need to consider the in the evaluation of the drone coffee delivery service. (2 points)
- Part C: What are your lessons learned about the evaluation of prototypes that you bring from this course to future projects? (1 point)

Feedback

Formative feedback on design process and design product is given orally during supervisions and presentations. Feedback on written reports are given in writing. Feedback on the take home exam is limited and of a summary rather than formative nature.

Course Literature (Mandatory)

Blandford, A. (n.d.). Semi-structured qualitative studies. In In *The Encyclopedia of Human-Computer Interaction, 2nd Ed.*. The Interaction Design Foundation. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/semi-structured-qualitative-studies (accessed 2017-12-04)

Cairns, P. (n.d.). Experimental Methods in Human-Computer Interaction. In *The Encyclopedia of Human-Computer Interaction, 2nd Ed.*. The Interaction Design Foundation. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/experimental-methods-in-human-computer-interaction (accessed 2017-12-04).

Marsden, N., & Haag, M. (2016). Stereotypes and Politics: Reflections on Personas. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*, (pp. 4017-4031). New York, NY: ACM. DOI: http://dx.doi.org/10.1145/2858036.2858151 (accessed 2016-08-10).

Raghavan, B., & Pargman, D. (2017). Means and Ends in Human-Computer Interaction: Sustainability through Disintermediation. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)* (pp. 786-796). New York: ACM. DOI: https://doi.org/10.1145/3025453.3025542 (accessed 2017-08-01).

Tullis, T., & Albert, W. (2013). Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics, 2nd Ed. Amsterdam: Morgan Kaufmann.

Choose also one of the four following books as your main book on interaction design:

Arvola, M. (2014). Interaktionsdesign och UX: Om att skapa goda användarupplevelser. Lund: Studentlitteratur.

Saffer, D. (2009). Designing for Interaction: Creating Innovative Applications and Devices, 2nd Ed.. Berkeley: New Riders.

Preece, J., Rogers, Y., & Shrap, H. (2015).Interaction Design: Beyond Human-Computer Interaction, 4th Ed.. Chichester: John Wiley & Sons

Preece, J., Rogers, Y., & Shrap, H. (2016).Interaktionsdesign: bortom människa-dator-interaktion. Lund: Studentlitteratur.

Reference Literature (Non-mandatory)

Buxton, B. (2007). Sketching User Experiences: Getting the Design Right and the Right Design. Amsterdam: Morgan Kaufmann.

Goodwin, K. (2009). Designing for the Digital Age: How to Create Human-Centered Products and Services. Indianapolis: Wiley.

Greenberg, S., Carpendale, S., Marquardt, N., & Buxton, B. (2011). *Sketching User Experiences: The Workbook*. Amsterdam: Morgan Kaufmann.
Johnson, J. (2010). Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules. Amsterdam: Morgan Kaufmann.
Krug, S. (2014). Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability. Berkeley: New Riders.
Löwgren, J., & Stolterman, E. (2004) *Design av informationsteknik: Materialet utan egenskaper*. Lund: Studentlitteratur. (English version: Thoughtful Interaction Design, MIT Press, 2007)
Norman, D.A. (2013). The Design of Everyday Things: Revised and Expanded Edition. New York: Basic Books.
Rettig, M. (1994). Prototyping for tiny fingers. *Communications of the ACM, 37*, (4), 21-27. http://doi.acm.org/10.1145/175276.175288 (accessed 2017-12-04).
Tidwell, J. (2011). Designing Interfaces: Patterns for Effective Interaction Design, 2nd Ed. O'Reilly.

Teachers

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