INFO H564
Prototyping for Interactive Systems

Department of Human-Centered Computing
Indiana University School of Informatics and Computing, Indianapolis
Spring 2015

Section no.:   10991 (on-campus)
Credit hours: 3
Time: Wednesday 10:00am–12:40pm
Location: IT 357, Informatics & Communications Technology Complex [map]
First class: January 14, 2015

Instructor: Stephen Voida, Ph.D. in Computer Science, Assistant Professor
Office hours: Wednesdays, 3:00–4:00pm and by appointment
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Prerequisites: None

COURSE DESCRIPTION

The course covers methodologies for designing and prototyping graphic user interfaces, including rapid (paper) and dynamic (interactive) prototypes. Principles of design research and visual communication are discussed in the context of interaction design, cognition and user behavior, as well as usability testing techniques for concept validation.

Prerequisite(s): *None*.

Required Text(s):

Title: *Sketching user experiences: The workbook*
Author(s):   Greenberg, S., Carpendale, S., Marquardt, N., & Buxton, B.
Year: 2011
Publisher: Morgan Kaufmann
Book site: http://sketchbook.cpsc.ucalgary.ca/
ISBN: 978-0123819598

Title: *Paper prototyping: The fast and easy way to design and refine user interfaces*
Author(s):   Snyder, C.
Year: 2003
Publisher: Morgan Kaufmann
Book site: http://www.paperprototyping.com/
ISBN: 978-1558608702

Other Required Course Materials/Supplies:
(a full list, examples, and recommended sources will be provided in class)

- Mini Inventor's Kit for Redboard (https://www.sparkfun.com/products/13160) or an equivalent, Arduino-based project learning kit
  (*please check with instructor prior to acquiring an alternative product*)

Additional Readings:

Texts for this course will also include conference and journal publications that are all available online via university site licenses and/or posted to the course management website (check the "Resources" page). You will need to be logged in to the university network or connected via vpn.iu.edu to access site-licensed articles for free.

EXPANDED COURSE DESCRIPTION

Overview: This course is about the application of prototyping in the context of user-centered design (UCD). Emphasis will be placed on the prototyping process, which includes: applying good design, product conceptualization, user modeling and product validation through product testing.

Interaction design will be a key factor for creating successful prototypes, i.e., about the modeling of the user's experience and creating the most effective, efficient and comfortable experience for the user.

Theory and Practice: There will be considerable reading and practice every week. Theory plays an important part to establish an understanding of knowledge of the interrelated aspects of process and product development. Practice will include weekly assignments and in-class exercises used broaden the understanding from the reading.

Design: Prototyping is about the visual representations of complex systems and interaction models that meet high levels of design and usability. Drawing is important to do this successfully. Prototyping is not about perfecting one's drawing skills *per se*, but the intellectual and physical freedom to express ideas on paper instantly, easily, and spontaneously. Regarding generating visualizations of ideas, computer graphic software is still rather primitive compared to the directness of pen and paper. Hence, to better express visual concepts through images, it is recommended that students use any extra time available to study books, magazines, and web sites on design. This helps to continually provide a visual vocabulary of good design. Also, if time allows, students should try to keep a daily drawing dairy or notebook. They may want to draw both objects and figures. The key is to become comfortable with the drawing process in which mental images and concepts are translated into visual form.

Prototyping Tools: Beside the theoretical background of this course, we will cover a range of tools for making static and dynamic prototypes. The various pros and cons of available software will be discussed, but class time will not be spent learning new computer-aided tools.

Prototyping Terminology: It should be noted that the range of literature that discuss prototyping, in some cases use different terms to describe the various aspects of the process. There is a general agreement and use of most of the terms, but in some cases

professionals are rather relaxed about the exact usage of terms. For example, all practitioners will agree on the general meaning of a dynamic prototype as a working model. However, whether it would be considered as the basis for a finished product is another matter. Some firms only use Flash or Director to make their dynamic prototypes representing systems that would eventually be programmed in C++ or Java. So, company policy, budget, and skill-set of the designer have much to do with the final output.

Not Software Centered: Because this course is NOT software-centered, all students should attempt to learn the mechanics of the dynamic prototyping tools. Software demos will be provided if needed. Those who already know how to use these tools have an advantage. It is, however, recommended that students attempt to broaden their skill-set by learning these digital prototyping tools on their own. Common software used as prototyping tools include: Flash, DreamWeaver (HTML), Visio, Visual Basic, Photoshop, Fireworks, and even PowerPoint. Examples of prototyping specific software include: Axure, Balsamiq, Omnigraffle, and GoMockingbird.

COURSE OBJECTIVES / OUTCOMES

The learning outcomes of this course will include that each student acquiring the ability to explain terms and apply concepts related to the following range of prototyping topics:
1. Prototyping: terminology
2. Prototyping: paper and dynamic techniques
3. A user-centered approach as applied to prototyping
4. User needs / requirements and product assessments
5. Design research processes and the lifecycle of interaction design
6. Various design research theories and methods
7. Interface design concepts and techniques
8. Product design evaluation and usability testing methods

Students will be able explain, recognize, and apply with considerable depth:
1. Knowledge about prototyping related to:
   a. Prototyping terms and principles
   b. A user-centered approach to prototyping and interaction design
   c. Interface design principles and processes
   d. Design theory and methods
   e. A user-centered approach to interaction design that will include:
      i. Analyzing user needs and requirements
      ii. Creating interface designs and related prototypes
      iii. Adapting specific product evaluation/testing methods
2. Methods of product design and development related to:
   a. Producing prototypes based on user assessments
   b. Applying prototype principles and a user-centered approach to interaction design
   c. Apply evaluation and usability testing methods to prototypes to validate design decisions

ASSESSMENT & EVALUATION

Sketching/prototyping exercises — 5 (WS)	25%
Midterm project (MP)	20%
Final project (FP)	35%
Class Participation—attendance in class, attention and constructive participation in crits, engaged involvement in class discussions (CP)	20%

Grades for the sketching/prototyping exercises and class participation will be recorded as individual grades; the midterm assignment and final project will receive team grades (modulated based on peer evaluation/contribution reports that you will submit as part of each group/team deliverable).

Grading Scale:

A+   97 – 100   Outstanding achievement, given at the instructor's discretion
A   93 – 96.99   Excellent achievement
A–   90 – 92.99   Very good work
B+   87 – 89.99   Good work
B   83 – 86.99   Marginal work
B–   80 – 82.99   Very marginal work
C+   77 – 79.99   Unacceptable work (Core course must be repeated)
C   73 – 76.99   Unacceptable work (Core course must be repeated)
C–   70 – 72.99   Unacceptable work (Elective or core course must be repeated)
D+   67 – 69.99   Unacceptable work (Elective or core course must be repeated)
D   63 – 66.99   Unacceptable work (Elective or core course must be repeated)
D–   60 – 62.99   Unacceptable work (Elective or core course must be repeated)
F   Below 60   Unacceptable work (Elective or core course must be repeated)

Policies for Attendance & Assignment/Project Deadlines

9. *Responsibility for due dates and related materials*: All weekly due assignments are the students' responsibility. If class is missed, the student is still responsible for the assignment, as well as to find out what was covered in class, e.g., any new assignments or variations to an existing assignment. ALL assignment deadlines are outlined in the syllabus or syllabus supplemental documents provided on OnCourse/Canvas. The instructor will only give one reminder of these dates. In the end, each student is responsible for the deadline. Also, weekly assignment deadlines should be adhered to, to insure fairness to all students. For the purpose of maintaining an equal and fair evaluation of each student's work, no student will receive special treatment. As a result, the following rules will apply to this course:
    a. *All assignments must be ready* to hand in or email at the designated time and place as stated on the assignment sheet, as communicated via email, or on the syllabus.
    b. *All assignments handed in late will be reduced 10% for every day late* (24 hours from the due date and time). For example, if the assignment is due at

6:00pm on the due date and it is time stamped 6:01pm, your grade on the assignment will be reduced automatically by 10%. If the class meets in the classroom, students must be ready to hand the assignment in at the start of class time.

10. *NOTE: Due dates for the online section will be a few days behind the in-class syllabus.* This is to account for the time delay in upload presentations and online students having a few days to listen. Due dates will be shifted to the weekend AFTER that of the on-campus section.

Incompletes:

The instructor may assign an Incomplete (I) grade only if at least 75% of the required coursework has been completed at passing quality and holding you to previously established time limits would result in unjust hardship to you. All unfinished work must be completed by the date set by the instructor. Left unchanged, an Incomplete automatically becomes an F after one year. http://registrar.iupui.edu/incomp.html

Points To Note for Success:

1. Rigor: This course will move along at a quick pace, being organized around a collection of weekly chapter readings and design exercises related to HCI theory and application. Though this course is an introduction to the HCI for graduates, it attempts to become as specific as possible about the major models and concepts of interaction design.

2. Accountability: Assignments and projects are not merely for learning but also a test of your character whereby diligence and accountability are required.

3. Cooperation and Communication: Cooperation with the instructor is vital for maintaining a high degree of productivity and harmony in weekly assignments and during class time. Oral and written communication is an important part of this course. We will have weekly open discussion sessions and project reports provide a way to explain in detail the theoretical and practical aspects of the project.

4. Creativity: This course demands not only a weekly response to assignments, but also some degree of creativity in product design and concept development. This is actually one of the more exciting and dynamic aspects of the course, where students have a chance to develop products where they can apply much of the theory gained during the weekly assignments.

ASSIGNMENTS:

Sketching/Prototyping Exercises:

For the first half of the term, students will be introduced to a wide variety of sketching and prototyping techniques. Nearly every lecture meeting will include a hands-on "studio" session focused on developing students' skills with a particular class of design techniques, as well as making them aware of how these techniques might be used to communicate particular aspects of a design.

Following each of these skill-development–focused weeks, students will be expected to complete an individual sketching or prototyping exercise, which will give the hands-on experience applying a sketching or prototyping technique. (Some exercises may be completed in a small group of 2–4 students.)

The deliverables from these exercises will be due at the beginning of the first class meeting after they are assigned. They will be evaluated primarily on the creativity of thinking represented and the communicative effectiveness of the deliverable; less focus will be placed on the artistic merit of the submissions.

Midterm Assignment and Final Project:

Students will also complete two in-depth design projects over the course of the term. Each of these group assignments will allow students to draw on multiple sketching and prototyping techniques to more fully communicate an interactive system design.

Students will work in teams of 3–5 students to develop sketches and prototypes representing a novel interactive computing technology or environment that addresses some well-identified user need. For the midterm project, the nature and scope of this technology will be specified as part of the assignment; for the final project, students will be free to propose a more open-ended project that best suits the research interests and prototyping skills of the group members. The final project will also require students to conduct early-stage users evaluations of these sketches and prototypes with representative users and incorporate these users' feedback into successive iterations of the design(s).

Class Participation:

I expect students to be appropriately prepared for each lecture meeting, to attend all lectures on time, and to conduct themselves in a professional manner. Your class participation will be evaluated based on your successful completion of the following criteria:

- In-class (or online) prototyping exercises as assigned
- Responsiveness and knowledge of reading materials during open discussions
- Evidence of active preparation in team and/or class or online discussions.
- Evidence of active preparation in team projects and report development.
- Class attendance and promptness to class time (on campus section).
- Attitude and investment in the course as a whole.
- Responsiveness to forums (online and on campus)

Reading and Class Discussions

We will cover several sections from the course texts each week, in addition to supplemental readings in human–computer interaction. Each student should not only read *but arrive at a competent understanding of the materials*. Multiple measures will be used to assess learning competency from the weekly readings:

1. Weekly discussions, directed by specific questions, will be given in an open class discussion format, either in class or in an online chat forum. During this time the instructor will challenge student comprehension, while adding practical applications to the theoretical content.

2. In-class projects will be used to challenge student comprehension, while adding

practical applications of the techniques discussed.

3.   Quizzes *may* be given to assess learning and comprehension, as well as to determine if students are doing the reading.

The purpose of class lectures/discussions is to provide an overview of the chapter and to help provide insight into the course theory. Questions generated by the students during the class discussion are necessary to provide more depth in some of the more problematic areas of theory and application. Each week, students must:

1.   Come prepared to discuss the reading assignment.

2.   Provide questions that can help the class into the content of the chapter, e.g., questions that are derived from a students' perplexity, confusion, or lack of clarity regarding some theory or practice. They may also challenge the class with a problem derived from the theory. The student should direct the class to that point in the text that addresses the issue at hand.

Design Crits

During the course, students will have multiple opportunities to present and elicit peer feedback on their sketches and prototypes—based on both the weekly sketching/prototyping exercises and their midterm and final projects. A significant portion of each student's class participation grade will be determined by their performance in these critique sessions, which will be held at the beginning of class during most weeks of the term. When assigned to have their own work reviewed, students are expected to be prepared to provide a brief, professional presentation of their sketches and/or prototypes and to help guide the discussion. Students are also expected to provide *thoughtful*, *respectful*, and *constructive* comments when evaluating others' work.

Only the following are acceptable excuses for absences: death in the immediate family (e.g. mother, father, spouse, child, or sibling), hospitalization or serious illness; jury duty; court ordered summons; religious holiday; university/school coordinated athletic or scholastic activities; an unanticipated event that would cause attendance to result in substantial hardship to one's self or immediate family. Absences must be explained to the satisfaction of the instructor, who will decide whether omitted work may be made up. To protect your privacy, doctor's excuses should exclude the nature of the condition and focus instead on how the condition affects on your coursework.

WEEKLY SCHEDULE

Week	Date	Topic(s)	Readings	In-Class	Deliverable
1	14 Jan	Course introduction Why sketching and prototyping?	—	Syllabus review Class discussion Thinking with a pencil	
2	21 Jan	Design thinking	*Paper Prototyping* chapter 3 *Sketching User Experiences* sections 1, 2, and 6.5	Class discussion Trying out the 10-plus-10 process	
3	28 Jan	The single image	*Paper Prototyping* chapter 4 *Sketching User Experiences* sections 3.1–3.7	Crit 1: Sketch 1 Class discussion Slideware tool overview	Sketch 1
4	4 Feb	Hybrid and physical sketching	*Sketching User Experiences* sections 3.8–3.11	Crit 2: Sketch 2 Class discussion Getting your hands dirty	Sketch 2
5	11 Feb	Storyboarding and animation	*Sketching User Experiences* chapters 4–5	Crit 3: Sketch 3 Class discussion	Sketch 3
6	18 Feb	*Class cancelled (instructor ill)*	—	—	—
7	25 Feb	**Class reboot** Interactive prototypes	—	Crit 4: Sketch 4 Class discussion Arduino workshop 1 **Midterm assignment introduced**	**Sketch 4** **Midterm teams formed** *(due Friday 11:59pm)*

| 8 | 4 Mar | Interactive prototypes | *(recommended)* Kelley, T. (2001). Prototyping is the shorthand of innovation. *Design Management Journal 12*(3), 35–42.

 (required) Lim, Y., Stolterman, E., & Tenenberg, J. (2008). The anatomy of prototypes: Prototypes as filters, prototypes as manifestations of design ideas. *ACM Transactions on Computer–Human Interaction 15*(2), Article 7. doi:10.1145/1375761.1375762 | **Crit 5: Initial midterm sketches**

 Class discussion

 Arduino hackfest

 Midterm project work | **Initial midterm sketches/early digital prototypes** |
| 9 | 11 Mar | Midterm project presentations | (required) Erickson, T. (1995). Notes on design practice: Stories and prototypes as catalysts for communication. In J. Carroll (Ed.), *Scenario-based design: Envisioning work and technology in system development*. New York: Wiley & Sons. http://www.pliant.org/personal/Tom_Erickson/Stories.html

 (recommended) Rudd, J., Stern, K., & Isensee, S. (1996). Low vs. high fidelity prototyping debate. *interactions 3*(1), 76–85. doi:10.1145/223500.223514

 (recommended) Schrage, M. (1996). Cultures of Prototyping. In Winograd, T. (Ed.), *Bringing design to software*. Reading, MA: Addison-Wesley. | Class discussion

 Midterm project presentations | Submission of midterm assignment materials (sketches, prototypes, and written report; **due Friday 11:59pm)** |

10	18 Mar	*Spring Break (no class)*			
11	25 Mar	*Guest lecture (prototyping as part of professional practice)*	—	—	—
12	1 Apr	Putting prototypes to work	*Sketching User Experiences* sections 6.1–6.3 *Paper Prototyping* chapter 5	**Crit 6: Sketch 5** Introduce final project	**Sketch 5** **Final project teams formed** *(due Friday 11:59pm)*
13	8 Apr	Experiment design	*Paper Prototyping* chapters 6–7	Crit 7: Final project ideation sketches Class discussion Final project work	Final project concept ideation sketches
14	15 Apr	Running your study	*Paper Prototyping* chapters 8–9	Crit 8: Final project sketches (first iteration) Class discussion Final project work	Final project sketches (first iteration)
15	22 Apr	Making sense of what you see	*Paper Prototyping* chapters 10–11	Crit 9: Final project sketches (second iteration) Class discussion Final project work	Final project sketches (second iteration) Final project evaluation plan *(due Friday 11:59pm)*
16	29 Apr	Pros, cons, and politics Wrapping up	*Paper Prototyping* chapters 12–13	Crit 10: Final project prototypes (first iteration) Class discussion and debrief	Final project prototypes (first iteration)
Finals	**8 May 10:30a–12:30p**	Final project presentations	—	—	Final project report

CODE OF CONDUCT

All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code > Responsibilities > Academic Misconduct* at http://www.indiana.edu/~code/. All students must also successfully complete the Indiana University Department of Education "How to Recognize Plagiarism" Tutorial and Test. https://www.indiana.edu/~istd You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else's words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com. http://www.ulib.iupui.edu/libinfo/turnitin

Academic Misconduct:

1. **Cheating:** Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.

   a. A student must not use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.

   b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.

   c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.

   d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.

   e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

   f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.

   g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.

   h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.

2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.

3. **Plagiarism:** Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.

   a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.

   b. A student must give credit to the originality of others and acknowledge indebtedness whenever:

      1. directly quoting another person's actual words, whether oral or written;

      2. using another person's ideas, opinions, or theories;

      3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;

      4. borrowing facts, statistics, or illustrative material; or

      5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment

4. **Interference:** A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

5. **Violation of Course Rules:** A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.

6. **Facilitating Academic Dishonesty:** A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

OTHER POLICIES

1. **IUPUI course policies:** A number of campus policies governing IUPUI courses may be found at the following link: http://registrar.iupui.edu/course_policies.html

2. **Classroom civility**: To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones engagement in private conversations and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, surfing the Internet, and posting to Facebook or Twitter during class

are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued" (IUPUI Strategic Initiative 9). IUPUI prohibits "discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or [veteran] status" (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

3. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.

4. **Bringing children to class:** To ensure an effective learning environment, children are not permitted to attend class with their parents, guardians, or childcare providers.

5. **Disabilities Policy:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of accommodations needed for the course. Students requiring accommodations because of a disability must register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: aes@iupui.edu, Tel. 317 274-3241). Visit http://aes.iupui.edu for more information.

6. **Emergency Preparedness:** Safety on campus is everyone's responsibility. Know what to do in an emergency so that you can protect yourself and others. For specific information, visit the emergency management website. http://protect.iu.edu/emergency

MISSION STATEMENT

The Mission of IUPUI is to provide for its constituents excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.

STATEMENT OF VALUES

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.