

# Human-Computer Interaction

## IS4300

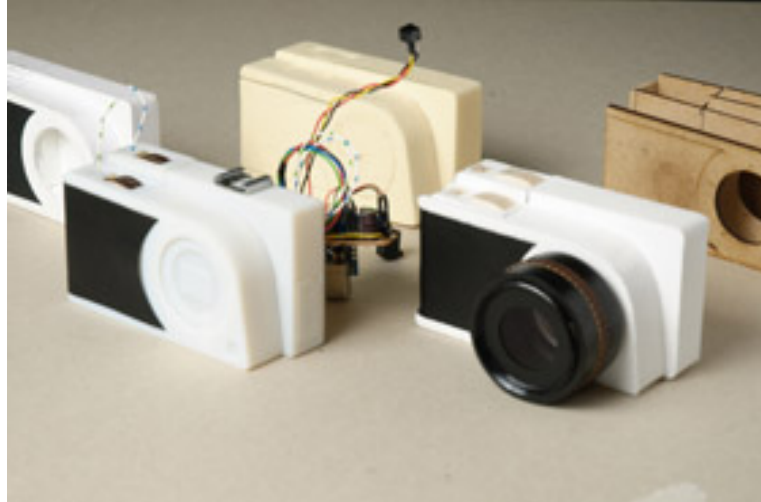


## Homework I6

### *due*

- Your objective in this assignment is to get some experience with Frames, Dialogs and layout managers in Swing. Your mission is to create your own (ideally project-related) application with the following minimum requirements:
  - A JFrame and a (non-modal) JDialog.
  - A JTabbedPane and JScrollPane.
  - Nested JPanels including the following layout managers: GridLayout, FlowLayout, BorderLayout
  - Some interaction widgets (JButton, etc.) on every JPanel and tab.
  - Reasonable behavior when the JFrame is resized.
- NOTE: You may not use GridBagLayout, Free Design, Box, Overlay, Null or Absolute Layout anywhere in the project.

## “Envisioning” & Prototypes



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## Prototyping

- A concrete but partial representation or implementation of a system design.
- A UI prototype should be “interactive” in some way
- A way of involving people and clients in evaluating your design ideas

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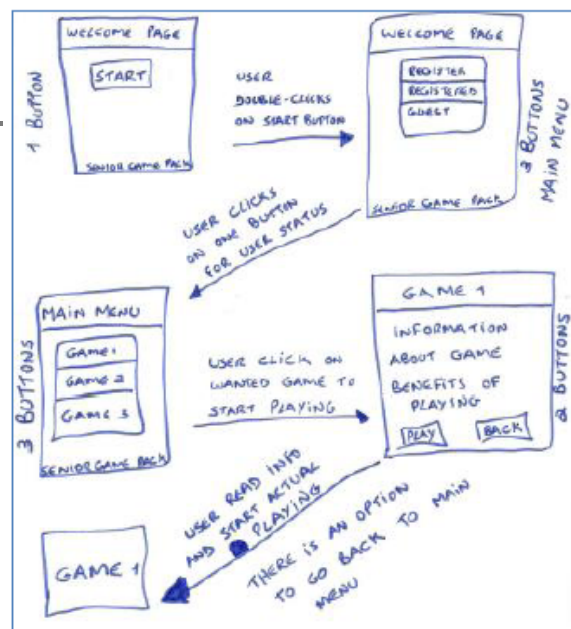
## Example

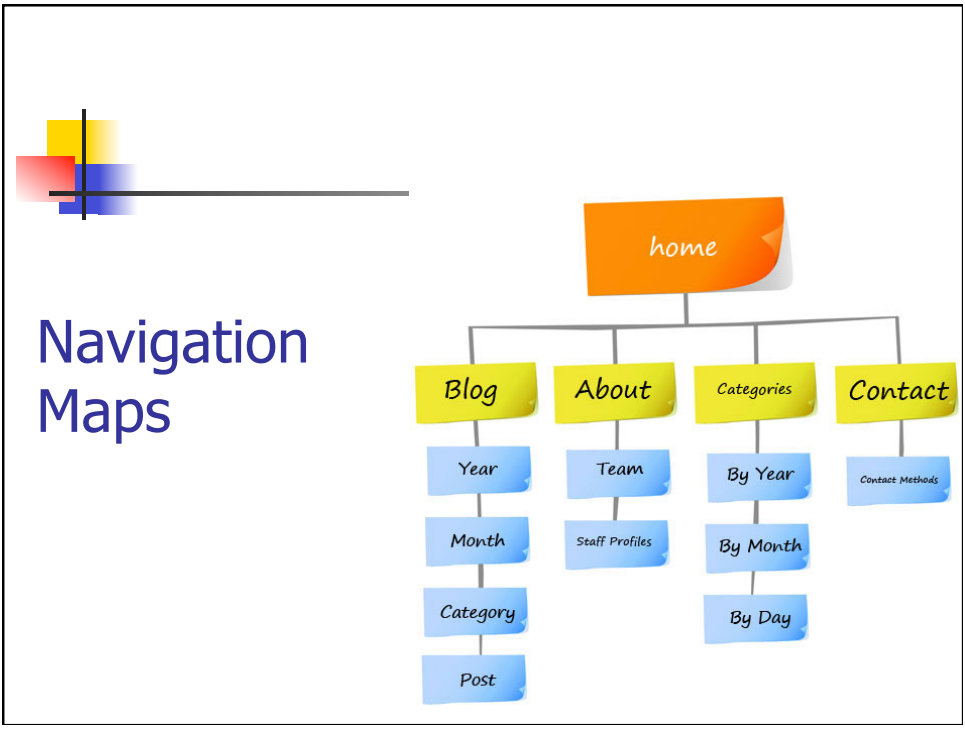
### Kinds of prototypes? Kinds of feedback?

1. A car designer has been commissioned to produce a new luxury sports car.
2. Doodles a few designs on paper and shows them to other designers on the team.
3. Designer is satisfied with one of the designs and draws up detailed blueprints that are given to the firm's model maker.
4. Scale models are produced and sent to Marketing and Sales for customer reaction.
5. The models are subjected to wind tunnel experiments to investigate the aerodynamics of the design and the results are used in a computer program that will calculate the car's speed and fuel efficiency.

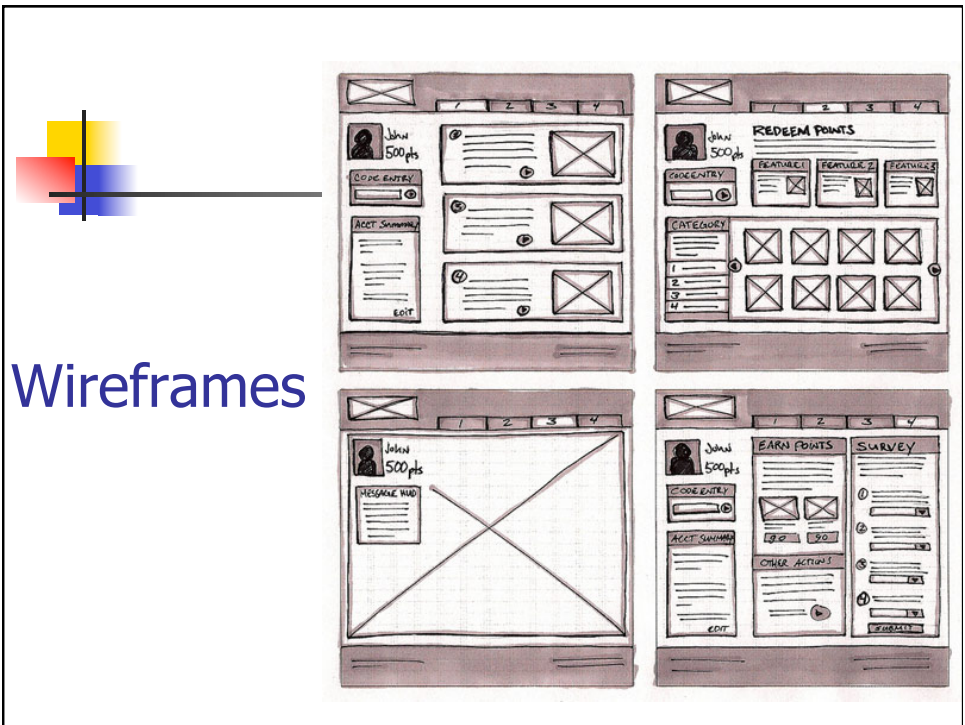
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## Interface Storyboards





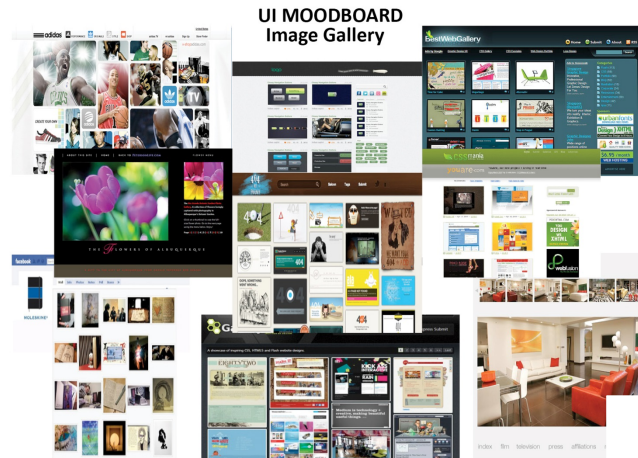
# Navigation Maps



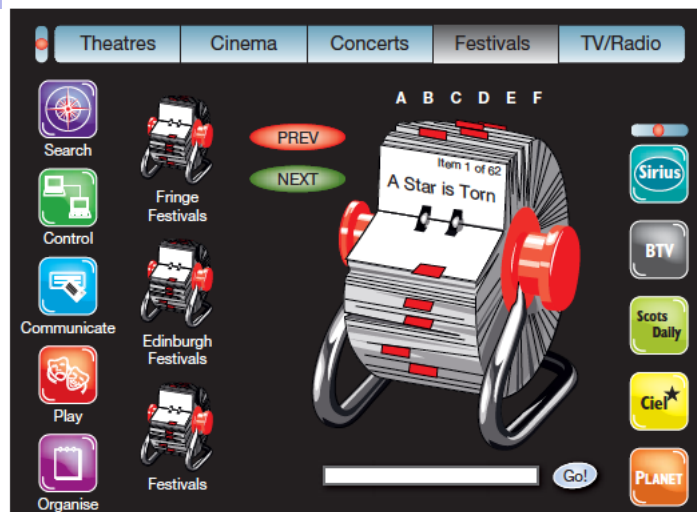
# Wireframes

# Mood Boards

*provide design inspiration*



# Hi-Fi Prototypes



## Video Prototyping



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## Prototyping tools

- Paper
- PowerPoint and drawing packages
- Flash, Director, Visual Basic, hypermedia tools, Web tools such as Dreamweaver
- IDEs for more complex functionality (e.g., Netbeans!)
- Many custom UI prototyping tools
  - "pop" (prototyping on paper) for iPhone/Android
  - Crank Software Storyboard suite
  - Adobe fireworks
  - Antetype.com
  - Etc etc etc (Google "user interface prototyping tool")

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# Research Articles

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CHI 2010: End-User Programming I

April 10–15, 2010, Atlanta, GA, USA

## FrameWire: A Tool for Automatically Extracting Interaction Logic from Paper Prototyping Tests

Yang Li<sup>1\*</sup> Xiang Cao<sup>2</sup> Katherine Everitt<sup>1</sup> Morgan Dixon<sup>1</sup> James A. Landay<sup>1</sup>

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### ABSTRACT

Paper prototyping offers unique affordances for interface design. However, due to its spontaneous nature and the limitations of paper, it is difficult to distill and communicate a paper prototype design and its user test findings to a wide audience. To address these issues, we created FrameWire, a computer vision-based system that automatically extracts interaction flows from the video recording of paper prototype user tests. Based on the extracted logic, FrameWire offers two distinct benefits for designers: a structural view of the video recording that allows a designer or a stakeholder to easily distill and understand the design concept and user interaction behaviors, and automatic generation of interactive HTML

playing the role of the “computer”, presents an interface screen (e.g., drawn on a piece of paper) to a user according to the user’s actions. The user interacts with the interface

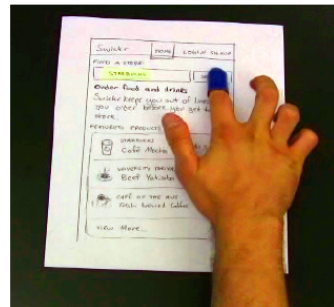


Figure 2. A user clicks on an interface component by tapping

# FrameWire: A Tool for Automatically Extracting Interaction Logic from Paper Prototyping Tests

Yang Li Xiang Cao Katherine Everitt  
Morgan Dixon James Landay

## DisplayObjects: Prototyping Functional Physical Interfaces on 3D Styrofoam, Paper or Cardboard Models

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Human Media Lab  
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Kingston, ON K7L 3N6

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### ABSTRACT

This paper introduces DisplayObjects, a rapid prototyping workbench that allows functional interfaces to be projected onto real 3D physical prototypes. DisplayObjects uses a Vicon motion capture system to track the location of physical models. 3D software renditions of the 3D physical model are then texture-mapped with interactive behavior and projected back onto the physical model to allow time interactions with the object. We discuss the implementation of the system, as well as a selection of one and two-handed interaction techniques for DisplayObjects. We conclude with a design case that comments on some of the early design experiences with the system.



Figure 3. Brick model with 5 retroreflective markers



# DisplayObjects

## Human Media Lab

Pers Ubiquit Comput (2008) 12:269–277  
DOI 10.1007/s00779-007-0147-2

ORIGINAL ARTICLE


### Adapting paper prototyping for designing user interfaces for multiple display environments

Brian P. Bailey · Jacob T. Biehl · Damon J. Cook · Heather E. Metcalf

Received: 13 February 2006 / Accepted: 2  
© Springer-Verlag London Limited 2007

**Abstract** A multiple display en  
networks personal and shared devic  
workspace, and designers are just b  
with the challenges of developing






## Conducting Usability Studies

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## Formative Usability Studies

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- Primary purpose: identify design problems
- Secondary: rough assessment of usability metrics
- Approach
  - Have representative users work through representative tasks
  - Observe
  - Ask Questions / "Think Aloud" during test
  - Questionnaires / Interview post test

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## Example



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## Wrangling Test Users

- How to recruit?
- How much to compensate?
  - Issues?
- What data do you collect?
  - Why?



## Always collect basic demographics

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- Age
- Gender
- Race (?)
- Educational level
- Computer literacy
- Experience using similar applications
- If student: year, major
- Etc



## Most common measures

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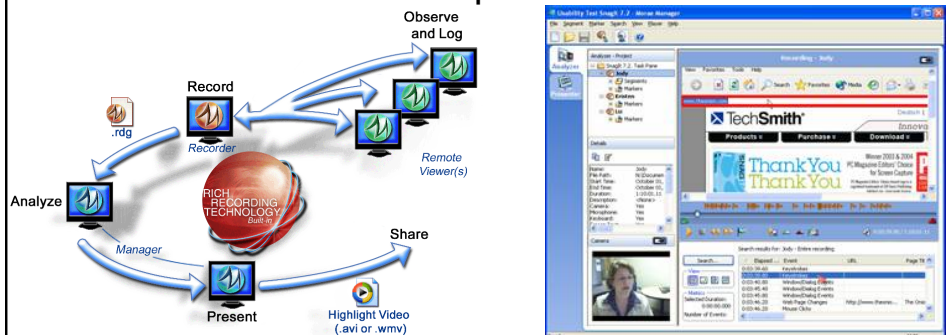
- Qualitative
  - Post-test semi-structured interview
  - Think aloud comments
- Quantitative
  - Time to complete, number of errors
  - Questionnaires
    - Satisfaction
    - Other scale measures

## Where Will You Do the Evaluation?

- Field Studies – user's own environment
  - Better "ecological validity"
  - Only practical choice for longitudinal efficacy studies.
- Controlled Studies / Lab Studies – other than user's environment
  - Important if special equipment or tight control required.
  - Less distracting.
- Arranging Usability Evaluation Sessions
  - Call / email day before to confirm
  - Still may get up to 50% no-show rate

## Other ways of measuring usability...

- Auto logging data
- Quantitative behavioral measures
  - Number of frowns per task



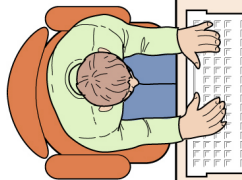
# Other ways of measuring usability...



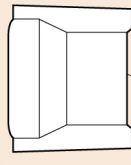
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# Low cost video mixing

Participant



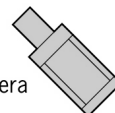
External monitor, keyboard & mouse



Laptop



Video camera



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## Video recording

- Think carefully about why you want to video record.
- Not a substitute for real-time observation.
- Reviewing & coding video takes 2x – 10x real time..
- However, can be used in retrospective review.
- Be sure you get consent.

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## Audio Recording

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- Important for capturing exact quotes (fodder for qualitative analysis).
  - Post test interview
  - Think aloud
- Be sure you get consent.

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## Think-Aloud and Offering Help

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- Using Cognitive Walkthrough Questions
  - “Is there anything there that tells you what to do next?”
  - “Is there a choice on the screen that lines up with what you want to do? If so, which one?”
  - “Now that you’ve tried it, has it done what you wanted it to do?”





## Think Aloud interferes with Usability Metrics

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- Quantitative usability metrics
  - E.g., time to complete
- Think aloud
  - To get qualitative info on bugs
- Can be overcome with retrospective review methods


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## Conducting Post-Session Discussions

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- Recommend semi-structured interview
  - Write down most important questions in advance
- Retrospective protocol
- Post-session interview / debrief



## Questionnaires

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### ■ Advantages

- Can't forget to ask a question
- All participants see the same questions
- Ability to collect quantitative data

### ■ Disadvantages

- Difficult to design
- Must predict topics the users will need
- Closed questions don't give reasons why the users answered the way that they have.



## "Mixed-Method" Studies

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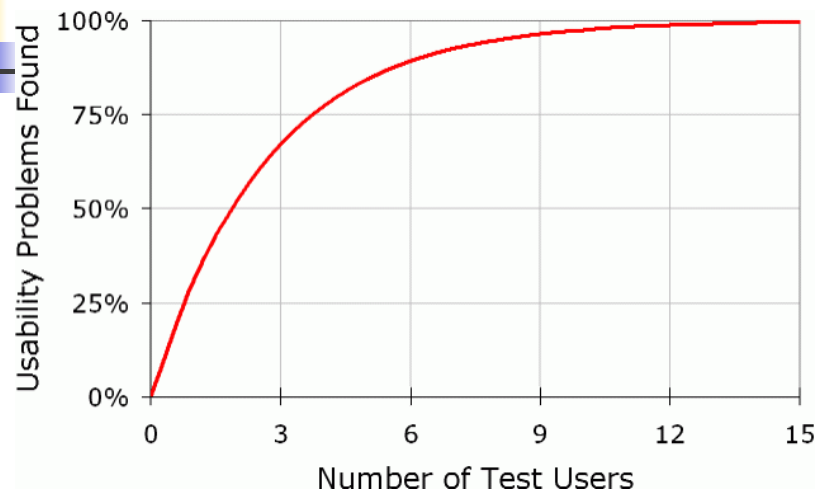
- Use scales and questionnaires for things you anticipate wanting to know.
- Follow with semi-structured interview to learn about things you didn't think of.
  - Probe with follow up questions

## How many participants are needed for usability testing?

- Topic of lively debate in HCI.
- Good historical summary:  
<http://www.measuringusability.com/blog/five-history.php>
- Consensus (?): 3-5 users to get 80% of bugs
  - When used in conjunction with good design practices and heuristic evaluation.

## How many participants are needed?

Assumes each find 31% of problems



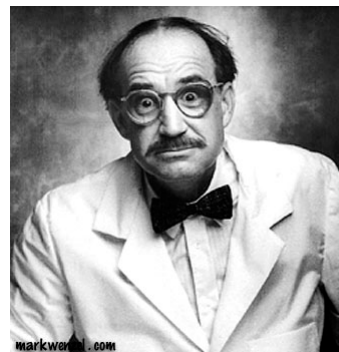
Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp.206-213). Amsterdam: ACM

## How many participants are needed for usability testing?

- Better to do more tests with fewer users given a budgeted total number of test users
  - E.g., 3 iterations with 5, rather than 1 iteration with 15

## Plan Everything: Study Protocol

- Describe in step-by-step detail everything that you do when a test user walks in the door.
- Especially important for controlled, quantitative studies
- Helps reduce demand effects
- Helps reduce stupid mistakes



### ***PDA ECA Modality Study Protocol***

***[Subject is assigned sequential ID at time appointment is made. Subject is randomized during lab setup just prior to experiment. Configure and check PDAs, make sure they are charged. Write subject ID and study configuration number on all forms]***

***[Seat subject at desk in observation room. Experimenter stands.]***

Thanks for helping out with this experiment. Let me tell you what you're going to be doing in the study. We're building an animated virtual exercise coach to help people get more exercise. This coach works on a PDA so that it is portable. ***[Show PDA]*** Today you will be talking to four different animated coaches, primarily so we can test how well people are able to interact with them. You will not be asked to do any exercise. You will interact with each coach for about five minutes. After each interaction we will ask you to fill out a questionnaire telling us what you thought about it. The entire study should take about 30 minutes and it pays \$10.

Are you able to help us out with this?

Now I need you to sign some consent forms. ***[hand subject forms]*** You can go ahead and read the consent forms now. ***[Give subject time to read and sign consent forms.] [Collect consent forms.]***



## Preparation

- Documents
  - Study Protocol / User briefing
  - Task descriptions
  - Demographic Questionnaires
  - Screeners
  - Measure Questionnaires
  - Debriefing
  - Payment receipt
- Equipment
  - Computer & Software
  - Video, Audio recorders, batteries, tapes
  - Gaze tracker, logging software, etc.



## The Pilot Test / aka “Walk Through”

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- Participants for Your Pilot Test
- Design and Assemble the Test Environment
- Run the Pilot Test



## Paper Prototyping: Conducting the test

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- Need at least two people
  - Computer – usually sits across from user
  - Facilitator
    - Talks to user, explains purpose of study and interface, hands him/her tasks, constantly encourages user to talk about what he/she is thinking about, asks user for clarification, etc.
- Others: observers
  - When any issue/problem arises writes them down (ideally on separate index cards)



## Sample Briefing

### *from Snyder "Paper Prototyping"*

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- Greeting & Introduction
  - "We're working on a product for... The purpose of today's session is for you to help us figure out how to make this interface more user-friendly before we finish developing it. But believe it or not, we aren't going to use a computer. As you'll see, we've actually created paper versions of the screens, and this guy named Stan will be playing the computer."
  - "We'll give you some tasks that we think are representative of what people might do in real life. [example] Your job is to tell us what makes sense, what's confusing, whether it works the way you'd expect it to, etc."
  - "The other members of the team will just be watching and quietly taking notes."



## Sample Briefing

### *from Snyder "Paper Prototyping"*

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- Greeting & Introduction, cont'd
  - "Keep in mind that we're testing the interface--we're not testing you--so if you run into any problems it's not your fault and it means that there's something we need to change. I'll be sitting next to you, and I can help you if you want."
  - "The prototype still has some rough edges--we're still thinking through how it should work and some parts of it are incomplete. Before we cast it in concrete, we want to get some feedback about how well this design works."
  - "Stan here will be playing the computer. Stan may seem like a pretty smart computer, but he has no speech recognition and no artificial intelligence. Since machines can't talk, he's not allowed to explain anything. If you want to do something, you'll need to interact with the prototype just as you would on a computer. Use your finger to click on buttons. These pieces of tape indicate places where you can type something in, and here's your keyboard (give pen). It's OK to write on this."



## Sample Briefing

### *from Snyder "Paper Prototyping"*

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- Greeting & Introduction, cont'd
  - "Please tell us what makes sense to you, what's confusing, and any questions that come to mind. Your questions are especially valuable, but I may not answer them right away because our goal is to change the interface so it answers them."
  - "Remember that we're testing the interface—we're not testing you. Are you ready to start?"
  - "OK, here's the first thing we'd like you to do. Take a minute to read this and let me know if it makes sense. If so, then whenever you're ready please show us what you would do first."
- **See "briefing.doc" under last week's readings.**



## Facilitator – during test

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- Encourage questions but don't answer them
- Use user's vocabulary
- Use open-ended questions
  - "What will that do?"
  - "What are you trying to do right now?"
  - "What are you thinking?"
  - "Tell me more about that."
- Watch for "hmm", "ah", "oh", "oops", furrowed brow, etc. - ask what's going on.
- Make changes during test or between tests if necessary
- Take a break if something goes wrong





## Post-test Design Team Debrief

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- Spend a few minutes immediately after the test meeting with the testing team, discussing results, clarifying problems, and writing down prioritized problems.
- Classify usability problems as: ***critical, serious, or minor***
- Correct significant problems that can be fixed before the next test.



## Your Projects

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- Write user briefing (suggest full protocol)
  - Verbal informed consent
  - Backgrounder on project, process
- Computer practices
- Write user tasks
  - Each on 1 index card
  - Goal to be accomplished (not how to do it)
- Walkthrough the entire process

## In Class Exercise for Project Teams

- In addition to “think aloud” during 3 standard tasks:
  - What usability metrics will you gather?
    - You should measure at least 1-2 quantitative
  - What sociodemographic measures will you record?
  - What post-test questions will you ask?
    - You should ask at least 2-3 open-ended Qs

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## Crash course in human subjects research



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## Ethical Principles in Human Subjects Research - History

- Nazi Experiments
  - 1939-1945 - Thousands of 'subjects'
- Tuskegee Syphilis Study
  - Study of 600 black males by US Public Health Svc, 1930's – 1972
  - No consent ('special treatment')
  - No treatment – just observation
- US Govt Radiation Experiments
  - 1944-1974 – exposed thousands to radiation
- NY Jewish Chronic Disease Hospital Study
  - 1963 – injected live cancer cells into subjects
  - Improper (oral only) consent, deception
- NY Willowbrook School Study
  - 1963-66 – infected children with hepatitis ("would get it anyway")

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## Regulatory Milestones

- 1947 - Nuremberg Code
- 1949 - International Code of Medical Ethics of the World Medical Assembly
- 1964 - Helsinki Declaration
- 1966 - U.S. Surgeon General policy statement, establishes IRBs
- 1979 - Belmont Report
- 1991 – US "Common Rule"

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## Ethical Principles in Human Subjects Research (Belmont Report)

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- Respect for persons (autonomy)
- Beneficience
- Justice



## Respect for Persons aka Autonomy

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- Individuals should be treated as autonomous agents
- Persons with diminished autonomy may need special protections
- Primary implication: informed consent



## Beneficence

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- Maximize benefits
- Minimize possible harm
  
- Primary implication: ensure minimal risk



## Justice

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- Treat subjects fairly
- Risks vs. benefits must be equitably distributed across population
  
- Primary implication: don't experiment on one group for results to be primarily applied to another.



## Northeastern University IRB

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- Office of Research Regulatory Compliance

<http://www.northeastern.edu/research/hsrp/>

- Application process takes 1-2 months



## IRB application not needed if...

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- is a normal part of the students coursework;
- is supervised by a faculty member;
- has as its primary purpose the development of the student's research skills;
- does not present more than minimal risk to participants or to the student investigator;
- does not include any persons as research subjects under the age of 18;
- does not include any persons as research subjects who are classified as part of a vulnerable populations according to Federal regulations (see below);
- is not "genuine research" that is expected to result in publication or some other form of public dissemination;



## Minimal risk

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- means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests of healthy individuals.



## But, cannot gather "sensitive" information...

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- 1) Relating to sexual attitudes, preferences or practices;
- 2) Relating to use of alcohol, drugs or other addictive products;
- 3) Pertaining to Illegal conduct;
- 4) That if released could reasonable damage an individual's financial standing, employability, or reputation within the community;
- 5) That would normally be recorded in a patient's medical record and the disclosure of which could reasonably lead to social stigmatization or discrimination;
- 6) Pertaining to an individual's psychological well-being or mental health;
- 7) Genetic Information.



## And cannot use special subject populations...

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- 1) Minors (under eighteen years of age).
- 2) Fetuses or products of labor and delivery;
- 3) Pregnant women (in studies that may influence maternal health);
- 4) Prisoners;
- e) Individuals with a diminished capacity to give informed consent.



## You should obtain verbal consent – Example:

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“Hi, we’re designing a *XYZ*. *Explanation of XYZ*. We are conducting a study to find out what people think about this. We will not record or publish any information with your name. This is for a course we’re taking in Human-Computer Interaction from Prof. Bickmore in the College of Computer and Information Science. Your participation is voluntary and you can stop anytime and ask that your data not be used. It should take about 30 minutes and we will compensate you with a can of Red Bull. Can you help us out with this?”





## Exercise

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- What are the human subjects ethics issues for your project?
- How can you remediate these?

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## To Do

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- Read
  - Reporting usability test results. Skim Usability report template ([usability.gov](http://usability.gov)).
- Start conducting usability tests
  - P5 – finish in one week (11/4)

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