Human Computer Interaction and Design (a primer)

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Accessible Slides at http://tinyurl.com/mHealthHCI
WE’RE IN A TIME OF INNOVATION AND OPPORTUNITY

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What is Design?

- Process of creating or shaping tools or artifacts *for direct human use*

  - Creative endeavor
  - Outputs are *things*
  - People-centered concerns
  - Processes, methods
Characteristics of Design

Design...

- is conscious
- keeps human concerns in the center
- is a conversation with materials
- is creative
- is communication
- has social implications
- is a social activity
What is Designed?

“Look around you. The only thing not designed is Nature.”

- David Kelley

Anything consciously intended for human use is designed

- Often poorly, though :(  

![Nature Image]

![Mower Image]
Bad Design is Everywhere
Bad design can have big consequences

Voting
Bad design can have big consequences

Human Lives: Therac-25 Radiation Therapy machine

low current
electron beam
was scanned
across the field

high current
electron beam
was tracked
at the target

high current
electron beam
with no target
> 'lightning'

Electron Mode

X-Ray Mode

THE PROBLEM

tray including the target, a flattening filter, the collimator jaws and an ion chamber was moved OUT for "electron" mode, and IN for "photon" mode.
But we can try to help

NYNEX was going to buy new workstation for their telephone operators

- Each second saved per call saves $3M/yr.
- User modeling discovered it would be 3% slower than original
- NYNEX did not buy workstation
- Prevented mistake, saved $2M/yr.
## Your Test Results

**Name:** Cora Peterson  
**Gender:** Female  
**Date of Birth:** August 12, 1969  
**Ordered By:** Dr. Pico Duval  
**Ordered Date:** November 13, 2010, 8:12 a.m.  
**Completed By:** November 13, 2010, 8:40 a.m.

### RESULTS:

#### Comprehensive Metabolic Panel
- **Glucose (fasting):** 125 mg/dL  
  - **Normal:** < 100  
  - **Prediabetic:** 100 to 125  
  - **Diabetic:** 126 or more  
  - **You:** 135

#### Lipid Profile
- **Total cholesterol:** 211 mg/dL  
  - **Desirable:** < 200  
  - **Borderline:** 200 to 240  
  - **High:** > 240  
  - **You:** 211

- **HDL ("good" cholesterol):** 46 mg/dL  
  - **Low:** < 40  
  - **Normal:** 40 to 60  
  - **You:** 46

- **LDL ("bad" cholesterol):** 165 mg/dL  
  - **Low:** < 100  
  - **Normal:** 100 to 129  
  - **Borderline:** 130 to 159  
  - **High:** 160 to 199  
  - **Very High:** > 199  
  - **You:** 165

#### Vitamin D
- **Total vitamin D:** 22 ng/mL  
  - **Deficiency:** < 20  
  - **Sufficiency:** 20 to 100  
  - **Insufficiency:** 101 to 125  
  - **You:** 82

#### Urinalysis
- **Normal:** for all 20 values, including color, appearance, and protein.

#### Endocrinology
- **Normal TSH** indicates normal thyroid function(s), and by inference, normal levels of thyroid-stimulating hormone function.

#### Chemistry
- **Normal** for age, sex, socioeconomic status, and test type. Abnormal levels could indicate abnormal health, or other problems.

### WHAT DO YOUR RESULTS MEAN?

- **Elevated Glucose:** The relatively high amount of sugar in your blood is typical of a patient with prediabetes, which can double your risk for heart disease, depending on other risk factors. See diabetes.org for more information.

- **Elevated Cholesterol:** Your relatively high cholesterol level(s) (very low density lipoprotein cholesterol) may also increase your risk of heart disease, depending on other risk factors. See heart.org for more information.

- **Low Levels of Vitamin D:** Your results suggest a deficiency of vitamin D, which promotes bone density and immune system function. Women who fit your profile can become deficient within three months of no action is taken. Vitamin D deficiency may increase your risk for osteoporosis, high blood pressure, and certain cancers.

### WHAT CAN YOU DO?

- **Consider Your Lifestyle:** If you are inactive, overweight, and/or a smoker, your risk for diabetes and heart disease rises. Exercising regularly (30 minutes/day) and reducing your weight by 5 to 10 percent lowers your risk of diabetes by 58 percent.

- **Address Other Risk Factors for Diabetes and Heart Disease:** Dietary changes, like reducing salt consumption and increasing fruit and vegetable intake, can decrease your cholesterol and triglyceride levels.

- **Ask Your Doctor About Reducing Your Heart Disease Risk:** Medications like statins can lower cholesterol and delay the onset of heart disease. Calculate your risk at heartrisk.nhlbi.nih.gov/heart-risk.

- **Consider Lifestyle Changes to Correct Vitamin D Insufficiency:** These include diet, vitamin D supplements, and more exposure to sunlight.
By the end of this talk...

You should be able to:

#1: Care for and feed the technical geeks in your lives

#2: Identify a number of low-cost, quick methods to ensure your technologies are usable and useful

#3: Create technology prototypes (yes, really)
Best practices on the care and feeding of geeks

INTERDISCIPLINARY COLLABORATIONS
Information and Computer Scientists and Designers are Different.

Things are *really* different here

- Publishing practices in technical disciplines are different.
- And so are our ways of working with graduate students.
- And so is our relationship with theory.
- You probably won’t find our work in pubmed.
We’re complementary.

• **Things computing researchers do well**
  – Finding competent (and sometimes cheap) technical labor
  – Identifying and overcoming technical, usability, and other constraints
  – Understanding social and cultural context surrounding technologies
  – Measuring successes and failures with respect to design process, adoption, and usage

• **Things we geeks don’t do well**
  – Measuring outcomes
  – You are great at research design. We often aren’t. Help us 😊
Some Homework

- Katie Siek and Kay Connelly (2010) Achieving Success in Research Collaborations in Health Informatics Interdisciplinary Collaborations *Health Informatics: A Patient-Centered Approach to Diabetes*
WHAT IS DESIGN AND HOW CAN YOU LEARN TO DO IT (WELL)?
Design is not just “lipstick on a pig”

- Not just changing how things look
- Or making things pretty
- Or designing graphics
Interaction design mantras

“The user is not like me.” – Don Norman

“The best way to have good ideas is to have lots of ideas.” – Linus Pauling

“Enlightened trial-and-error succeeds over the careful planning of the lone genius.” – IDEO
Why a design process?

- It helps us get started with a proven tack
- It prevents “designer's block”
- It keeps us directed toward a final product
- It helps us stay on schedule and within cost
- It helps us measure design progress
- It helps us communicate where we are to others
- It prevents us from omitting important steps
- It is more reliable than intuition
- It forces us to *iterate*!
- It helps us keep the *user first!*
What is designed?

- **Artifact view**: The object, device, or system that is designed
- **Holistic view**: The interaction, the flow, the user’s experience is designed
- Think in terms of users’ goals
  - Artifacts have no goals
  - People have goals!
  - Keep users in the center in the beginning, middle, and end
Design Process?

Sketch it

Prototype it

Try it out

Goal!

Done!

NO! WRONG!
Design Requires Iteration

- Ideate
- Investigate
- Produce
- Evaluate
- Prototype
Stage Goals

- Generate lots of ideas
- Grasp issues and potential solutions

Stage joined by：

- Investigate
  - Learn about stakeholders
  - Discover goals and needs
  - How is it done now?
  - What is wanted?
  - What else has been tried?

- Produce
  - Build final product
  - Ramp up marketing, support, and maintenance

- Evaluate
  - Discover problems
  - Assess progress
  - Determine next steps

- Ideate
  - Produce something tangible
  - Identify challenges
  - Uncover subtleties
Investigate
Why investigate?

You cannot design apart from the world in which your users and design will live
Investigation Questions

- Identify users
- Identify stakeholders
- What are the requirements?
- How do they do it now?
- How long does it take?
- What do they want?
- What do they need?
- What else have they tried?
- Is there already another solution?
Investigation Methods

- User surveys
- Focus groups
- Interviews
- Analysis of competition
- Contextual inquiry
- Design Ethnography
Ideation

- Ideation = “idea generation”
  - Volume matters most!
- To increase the chances for success by considering a huge volume of ideas in a *systematic way*
- One of the worst things you can do is go with the first idea that you get
  - You can always come back to it later
Ideation Methods

- Affinity diagramming
- Personas
- Scenarios
- Role-playing, play-acting, scripts, props
- Card sorting
- Structured Brainstorming
- Sketching

- You can practice this any time.
Prototype

Investigate

Produce

Evaluate

Ideate

Prototype
Why prototype?

- It is hard to evaluate something that does not exist
- It is hard for users to react to abstract concepts
- Prototyping brings subtleties and nuances into the light
- Begin to wrestle with the technical constraints
Want to know what your target audience wants?
The art of faking it, and doing it cheaply, too...

PROTOTYPING
(I’LL SPEND A LITTLE MORE TIME HERE THAN THE OTHER SECTIONS FOR THE SAKE OF TODAY.)
How do you get started?

All you need is a piece of paper
Integrating prototypes and products

• throw-away
  – prototype only serves to elicit user reaction
  – creating prototype must be rapid, otherwise too expensive

• incremental
  – product built as separate components (modules)
  – each component prototyped & tested, then added to the final system

• evolutionary
  – prototype altered to incorporate design changes
  – eventually becomes the final product
LOW-FIDELITY PROTOTYPES

Storyboards
Paper & physical prototypes
Storyboarding

• a series of key frames as sketches
• users can evaluate quickly the direction the interface is heading

paper prototypes: design on the cheap
getting started: your bag of tools

- Posterboard: background
- Blank paper (large pieces)
- Index cards (dialog boxes, pop-ups, drop-down menus)
- Markers and Pens (drawing interface)
- Highlighter (for simulating highlighted items)
- Scissors
- Transparent Tape (permanent pieces)
- Restickable glue (for temporary items)
- Removeable tape, or cut up post-its
- Transparencies and pens (“typing” for larger boxes)
- Wite-Out (For when you make mistakes)
backgrounds: a few ideas

Poster board

Manila folders

From “Paper Prototyping” by Carolyn Snyder & http://www.alistapart.com/articles/paperprototyping/
using screenshots?
Incorporating Physical Devices

From “Paper Prototyping” by Carolyn Snyder
Scrolling

From “Paper Prototyping” by Carolyn Snyder
Radio Buttons

From “Paper Prototyping” by Carolyn Snyder
Tabbed Dialog

From “Paper Prototyping” by Carolyn Snyder
Limitations of paper

• The finer points of mouse use
  – dragging and dropping, right mouse button
• Graphics
  – Video, zooming
• Unexpected issues
  – Scrolling problems
  – Page refresh time
Simulations
Powerpoint mockups
Wizard of Oz Techniques

MEDIUM FIDELITY
Wizard of Oz

A method of testing a system that does not exist
— the listening typewriter, IBM 1984

Interface building/wireframe software

• Design tools for showing look and feel
• Click ‘n drag
• Functionality added selectively

• Tools to try
  – Powerpoint or keynote!
  – Omnigraffle (mac only)
  – Cacoo (free!) https://cacoo.com
  – And there are many others....
Evaluation, why do we need it?
(not necessarily the same thing as your outcomes trials)

- Automated procedures can find bugs, but not usability problems
  - (active research area, but hard!)
- You can’t iterate without knowing what to fix, leave, or remove
- Answers both questions:
  - Did we build the right thing?
  - Did we build it right?
Evaluation Methods

- Heuristic Evaluation
- Guidelines Review
- Cognitive Walkthrough
- Usability Testing
- Laboratory Experiments
- Real World Deployments

Check out discount methods here: https://www.nngroup.com/articles/discount-usability-20-years/
Evaluation Drives Iteration

• If problems are in user performance
  – Probably need to return to prototyping phase
• If problems are in conceptual model and how users understand it
  – Probably need to return to ideation phase
• If problems are in usefulness or appropriateness
  – Probably need to return to investigation phase
“Production” refers to all steps required to go from a functional prototype to a final product

- Software architecture
- Programming, building
- Manufacturing
- Packaging
- Help systems
- Manuals
- Training
- Customer support
- Marketing
- Branding
- Distribution
Design Processes

There is no agreement on an exact design process

Do what works for you, but do it systematically, thoughtfully, and consistently.
Summary

- Design is a highly iterative process
- Design processes must keep the user’s interests central
- Design starts with understanding the user
- Designs are never truly perfect - They can always be improved.
- It is a skill to know when to stop iterating and call a design “finished”
Want to learn more?

Listen to Pedja for the next 45 minutes

[https://www.coursera.org/specializations_interaction-design](https://www.coursera.org/specializations_interaction-design)
- Human Centered Design Introduction
- Next session starts August 8

- Applications Closed for 2016, but will be available through March for 2017

Or get in touch... gillianrh@ics.uci.edu or @gillianrhayes

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