Design

CS 347 - Spr 2022
Maneesh Agrawala
Announcements

Articulating Research Contributions due this Friday at 9am

Goal: work your muscles for what a research contribution in HCI looks like

Pick papers that we’ve read, and riff to generate three ideas for follow-up research that could be done in the scope of this class.

These are not necessarily ideas that you need to follow up on with your project. We are evaluating your ability to generate research ideas.

---

Grading rubric
Collectively, the abstracts will be graded out of 10 points.

<table>
<thead>
<tr>
<th>Category</th>
<th>Insufficiency</th>
<th>Adequacy</th>
<th>Proficiency</th>
<th>Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research contribution</td>
<td>1: Ideas are present, but they do not clearly motivate why they represent significant new knowledge to HCI or why they have wide applicability.</td>
<td>3: The ideas demonstrate incremental new knowledge in HCI and have only minor generalizability.</td>
<td>5: The ideas introduce moderate new knowledge to HCI and are typically generalizable.</td>
<td>7: The ideas introduce creative new knowledge to HCI and are strongly generalizable.</td>
</tr>
<tr>
<td>7 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feasibility</td>
<td>1: The ideas have not been scoped to be completable in ten weeks.</td>
<td></td>
<td>3: The ideas have been scoped to be completable in ten weeks.</td>
<td></td>
</tr>
<tr>
<td>3 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Most common critiques

Not being clear on what problem you’re solving, or why it matters

Not being clear about the method you’re using, or algorithm/system you’re proposing

Not describing how the results might be evaluated
Announcements

Thinking ahead to Project Ideas Brainstorm due Fri Apr 15 at 9am

This is a team assignment

Need help finding a team! (see Slack #team-formation channel)
Course Overview

**INTRO**
- **week 1**: Intro to Interaction; Intro to Content Creation
- **week 2**: Intro to Design Process; Interaction pt 1

**DEPTH**
- **week 3**: Methods; Interaction pt 2
- **week 4**: Content Creation
- **week 5**: Design Process

**BREADTH**
- **week 6**: Foundations; Cognition
- **week 7**: Social Computing; Accessibility
- **week 8**: Collaboration; AR/VR
- **week 9**: AI + HCl; NLP + HCl
- **week 10**: Final Presentations
Design

Implement

Evaluate
Design is not a static process.

It can be studied, supported, and improved.
How might we facilitate and empower this process?
Brainstorming process
Early-stage design tools

Design

Evaluate
Study strategies
Cognitive modeling

Implement
Programming tools
WYSIWYG design tools
Rapid prototyping tools
“Enlightened trial and error outperforms the planning of flawless intellect.”

— David Kelley, also Donald Schön
Reflective practitioner

How does design work? Why does it work?

Donald Schön [1984] studied a variety of professionals, including designers, and articulated a theory of the how and the why that has remained influential.
Reflective practitioner

Design is not a “plan, then do” praxis

Instead, the designer is engaged in an ongoing conversation with the design

Critically, it’s only by observing the result of the doing can the designer engage in reflection, allowing them to improve
Reflective practitioner

Implication:

To improve the process, encourage more rapid reflection, or improve the quality of the reflection.

To improve the tools, create alternatives that make reflection easier to do or more informative.
Major themes of design research

Process
Tools
Design process

To improve the process, encourage more rapid reflection, or improve the quality of the reflection
Improve the process, improve the output.

The design process we teach in human-computer interaction need not be set in stone!

Many techniques we use today were once prototyped in research labs.
Wizard-of-Oz Prototypes

[Kelley, TOIS '84]

An iterative design methodology for user-friendly natural language office information applications

“Central to the methodology is an experimental simulation which I call the OZ paradigm, in which experimental participants are given the impression that they are interacting with a program that understands English as well as another human would.”
Prior practice: create your prototype, then show it to people to get feedback. But is this really optimal?

Study design:

Method: show participants low fidelity prototypes for a redesigned smart thermostat and ask for feedback

Control: show participants just one design (“the best”)

Treatment: show participants three designs

Measure: quantitative ratings of the design, as well as valence of the verbal feedback
How many designs? [Tohidi et al. 2006]

“We found that when presented with a single design, users give significantly higher ratings and were more reluctant to criticize than when presented with the same design in a group of three.”

Why do you think this is? [1 min]

Weakening demand characteristics
Breaking out of design fixation
Participatory design

[Schuler and Namioka '93]

Problem — the design process creates a power imbalance: the designer is in charge, and the user stakeholders are passive.

Participatory design is an alternative process, originally developed in Scandinavia (where everything is beautifully designed), that involves the stakeholders deeply in all stages of the design process:

- Initial exploration, problem definition, developing ideas, evaluation

How will this help? What issues might crop up? How might you manage them? [1 min]
Elicitation studies

[Wobbrock and Morris 2009]

When entering a new design space (e.g., large multitouch tables, VR, AR, mid-air interaction for drones), how do we know which gestures would most easily come to mind?

**Concept:** tell people the command, and ask them to gesture in a way that they think should invoke that command. Then, look for agreement amongst these spontaneous gestures.
Elicitation studies

[Wobbrock and Morris 2009]

*Select Single*₁: tap

*Select Single*₂: lasso

*Select Group*₁: hold and tap

*Select Group*₂: Use Select Single, or Select *Single*₂ on all items in the group.

*Move*₁: drag

*Move*₂: jump

Object jumps to index finger location.

Are these the “best” gestures?

What are the trade-offs with this elicitation method?
To improve the tools, create alternatives that make reflection easier to do or more informative
Sketch as input

[Landay, CHI ’96]

Tighten the reflective loop by letting me create the low-fidelity prototype more quickly
Sketch as input

[Landay, CHI '96]

Led to: Balsamiq
Explore alternatives

Tighten the loop by allowing users to explore design spaces and alternatives on a live version [Hartmann et al., UIST 2008]
Explore alternatives

Later: Inventing on Principle
[Victor 2012]
The Toastboard
Ubiquitous Instrumentation and Automated Checking of Breadboarded Circuits

Daniel Drew*, Julie Newcomb†, William McGrath‡, Filip Maksimovic*, David Mellis*, Bjoern Hartmann*
*UC Berkeley EECS, †University of Washington PLSE, ‡Stanford University HCI Group
ddrew73, fil, mellis, bjoern@berkeley.edu, newcombj@cs.washington.edu, wmcgrath@stanford.edu
Body Driven Graphics [Saquib et al. 2019]
Body Driven Graphics [Saquib et al. 2019]

reference skeleton
What’s difficult about design research?

Design tools:

Slight accelerations are easy; larger-scale improvements are not

Design process:

Multidimensional and difficult to measure
What’s exciting about design research?

The design process is now an accepted practice in industry, but still malleable.

Your contributions are generative: they lead to new designs and approaches that others will use and apply tomorrow.