Assistant Prof @ The University of Texas at Arlington

PhD from UC Berkeley (1995)

Research keywords: Design, new media, tangible user interfaces, HCI
Administrivia

Congrats on turning in your draft proposal! Peer reviews tomorrow/Tues

Today’s the last class!

Final draft & presentation (Google slides) due 6/8

Final presentations: Weds, June 8 9:30-11am, Gates 174 (Brown Institute)

6 min talk, 2 min Q&A

Additional lecture: read the “How to give a good talk” slides, and incorporate some of the tips in your final presentation!

Final small group meeting optional next next week (June 3/6) — we’ll message you to check
Final presentation order

9:30 - 9:38    Joseph Guman
9:39 - 9:47    Ian Ng
9:48 - 9:56    William Shabecoff
9:57 - 10:05   Mason Llewellyn
10:06 - 10:14  Brandon Vu (Remote)
10:15 - 10:23  Zouberou Sayibou (Remote)
10:24 - 10:32  Michael Doboli
10:33 - 10:41  Allison Tee
10:42 - 10:50  Joey O'Brien
10:51 - 10:59  Emily Jin
Today’s goals

Is science really “objective”?

The social model of science

Is computer science a science?

What are ways that scientific knowledge can harm?

Does computer science research have a bias towards novelty?

How can computer science research shift power structures?
The social model of science
Who are the people behind the research?

STS (Science, technology, and society) studies is a disciplinary field that looks at the social models of science.

Ideas aren’t created in a vacuum, and when considering how knowledge is created, we should also be looking into the people behind the work and their values.

Science is not always unambiguously good. Doing science will not always make the world a better place.
Anecdote: statistical testing

Statistical testing methods (e.g., t-tests, ANOVA) are often used to quantitatively prove differences between groups — e.g., my interface is better than the baseline, since users accomplish tasks fast in ours (p < 0.05).
Who helped create statistical testing?

Ronald Fisher is often considered the founder of modern statistics, contributing ideas such as variance, expanding Student’s t test, ANOVA, and establishing 0.05 as the threshold for rejecting the null hypothesis.

Fisher was also a founder of eugencis, or what he called the “science of improving the human stock”.

These tests of significance would be later used to justify eugenicist viewpoints that Fisher held, such as the voluntary sterilization of “feeble minded” individuals, and used his scientific methods to push for a bill in the British Parliament (which was ultimately rejected).

https://www.nature.com/articles/s41437-020-00394-6
The strength of science

Science has held a privileged position in society.

• It is viewed as objective by the public
• It has more funding than other fields

We’ve seen this rhetoric used a lot, especially during the Trump era.

Why do you think science is viewed as more legitimate than other methods of inquiry?

2 min individual thinking / 2 min pair up
Is computer science a science?
The Sciences of the Artificial (1969)

Written by AI pioneer Herbert Simon. He states makes a distinction between two kinds of worlds we study:

The **natural** world: naturally occurring phenomenon, like how plants grow, or gravity

The **artificial** world: human created things, like how to grow the biggest apples, or make a material that reduces the impact of collisions, i.e. the field of **engineering**

In most universities, the computer science department is within the school of engineering.
“Artificial” things were often characterized by their functions and goals.

What is the input? What is the output? What is this new thing trying to accomplish?

Much of this activity is design. Design involves specifying goals and making decisions to accomplish these goals and “changing existing situations into preferred ones.”

And...design wasn’t viewed very highly by the academic community.

“In the past much, if not most, of what we knew about design and about the artificial sciences was intellectually soft, intuitive, informal, and cook-booky.” (page 112)
The “scientification” of engineering

Simon argues that, as a result, engineering has become more of a “science” to try to become viewed as more legitimate.

While computer science research at the core is about building new computational systems, we often evaluate our research with empirical methodology from the sciences.

What percentage gain did I get in accuracy on this benchmark? How much faster is my system?

Furthermore, sometimes we inform our design with empirical methods, like collecting data or conducting experiments to guide us in our decision making. (Vectoring and velocity!)
Is computer science a science?

It depends on how you define science.

It certainly isn’t a natural science, as computational systems are human made.

But it does use shared empirical methodology to legitimize itself. Numbers are more “objective”, and having concrete baselines lets researchers explicitly compare their results.

Instead of uncovering and describing new phenomenon in the natural world, we are just creating this phenomenon ourselves. Computer science research does produce novel results.
The bias towards novelty
Recall: Lecture 1 slides

Research introduces a fundamental new idea into the world.

Examples:

- Simple instruction sets for complex computer architecture
- Computing that is interactive, not batch
- Algorithms and data needed to make deep learning effective

These ideas did not exist in any mature or well-articulated way before their creators developed them.

If the idea is already in the world, for example published by someone else, it is not considered novel, and thus not research.
If we value novelty, we are biased towards building things

Because computer science is engineering, technical contributions to the field are valued.

Recall our examples of software defined networking, Karger’s algorithm (randomized min graph cut), UbiFit garden (activity tracking with a cellphone instead of specialized hardware)...these are all great technical improvements over the past.

But since CS research values novelty, we can always create novelty ourselves by building something new. The default is to build something. We should also consider why we build things. What new future does it create? And when is it more appropriate to not build something?
4 min: What use cases can you envision for this technology? What are the potential benefits and harms? To whom?

https://speech2face.github.io/
How does AI research shift power?

“Through the lens of **power**, it’s possible to see why accurate, generalizable and efficient AI systems are not good for everyone. In the hands of exploitative companies or oppressive law enforcement, a more accurate facial recognition system is harmful. Organizations have responded with pledges to design ‘fair’ and ‘transparent’ systems, but **fair and transparent according to whom?** These systems sometimes mitigate harm, but are controlled by **powerful institutions** with their own agendas.”

– Pratyusha Kalluri (emphasis mine)

https://www.nature.com/articles/d41586-020-02003-2
Example: Automated clothing rigs

What is made possible by this research?
It’s easier to make new poses or proportions of 2D illustrated characters, since there is no need to redraw all the clothes to adapt to the new body shape.

Who are the people impacted by your research?
Artists who draw the assets, end users who composite these illustrations, the HCI/graphics research community, companies who want avatar creation tools

Out of these people, which groups benefit the most?
End-users, since they have more customizability and flexibility, e.g., in creating their own avatars, and don’t need to rely on artists to make every asset.

How does power shift from one group to another?
End users have more power, but original authors may feel like their artwork is misused or lose out on $.

Who are the people left out?
People who are blind or visually impaired, people without access to computers.
Your turn: Who are your stakeholders?

Template slide: Your name / Your project name

What is made possible by your research?

Potential groups (for the next box)
- Academic researchers
- Industry practitioners
- People who contribute to your dataset
- Users of your system
- People whose jobs are affected by your system

Who are the people impacted by your research?

Out of these people, which groups benefit the most? Does anyone lose out? How does power shift from one group to another?

http://tiny.cc/cs197-power

8 minutes
Wrapping it all up: research is social

Last lecture, we looked at the paper review process. We talked about how, to get a published paper (e.g., to “create knowledge”), you only need to convince a small set of people in the community.

While it’s important to conduct a literature review to situate the novelty of your work, it is also to prove to these reviewers that you are well read and they should take your work seriously.

Doing research is a conversation with other researchers. By putting your work out there, you are signaling that it’s important, and other people should care about it.

That’s the introduction of your paper: you’re making an argument on why they should care.
Takeaway 1: Research and science are not “neutral” and cannot be divorced from the social contexts in which they were done.
Takeaway 2: It is our imperative as CS researchers to understand the stakeholders of our research and examine how the systems we build shift power.
Your To-dos

Revise your draft proposal after you get feedback

Final presentation: 6 min presentation + 2 min Q&A, Weds June 8th
9:30-11am Gates 174

Exit ticket: http://tiny.cc/cs197-week9

Thanks for a great quarter!
Computer Science Research

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