

# CS 4530

## Fundamentals of Software Engineering

### Module 16A: Engineering Ethical Software

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# Learning Goals

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- By the end of this lesson, you should be able to...
  - Illustrate how software can cause inadvertent harm or amplify inequities
  - Explain the role of human values in designing software systems
  - Explain some techniques that software engineers can use in producing software systems that are more congruent with human values.

# Ethically and morally implicated technology is **everywhere!**

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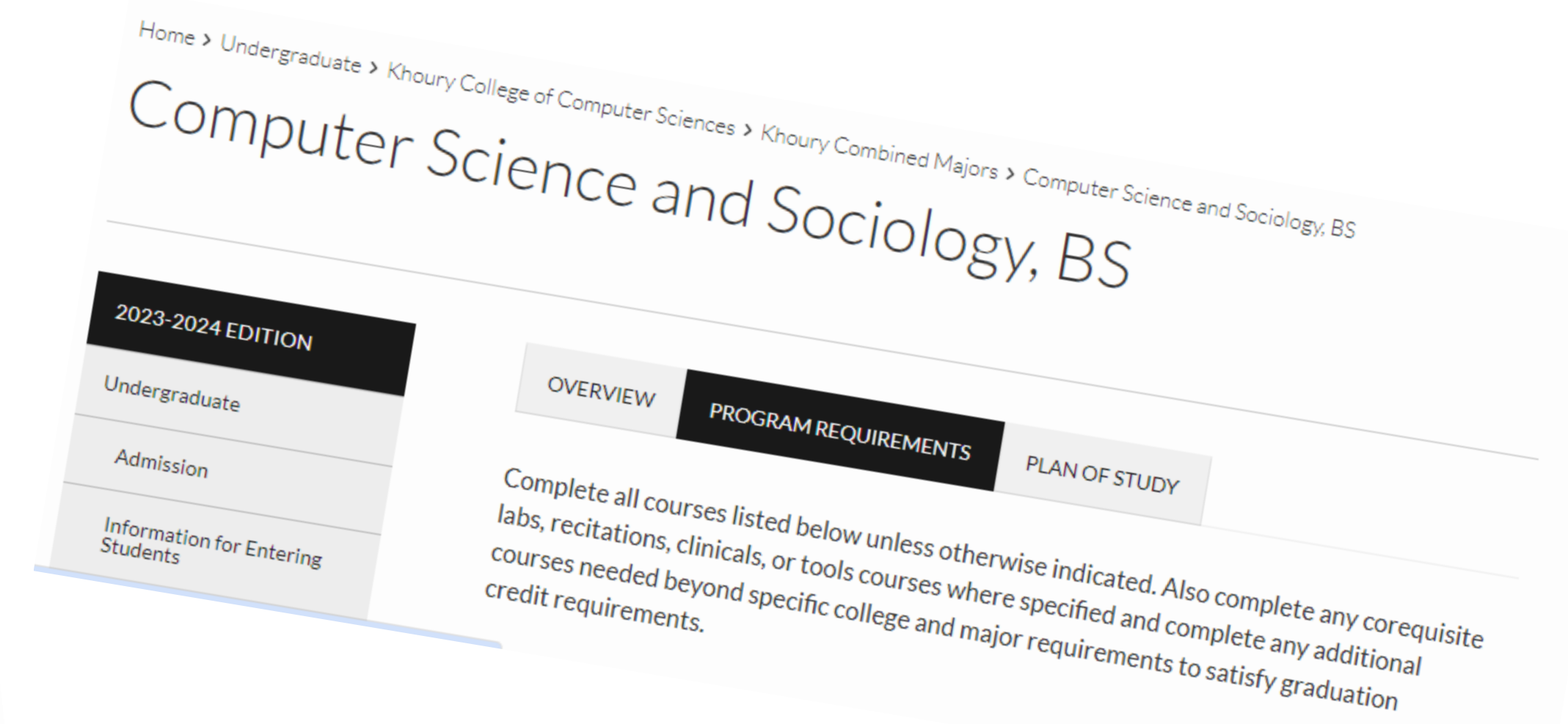
- Algorithms that gate access to loans, insurance, employment, government services...
- Algorithms that perpetuate or exacerbate existing discrimination
- Bad medical software can kill people (Therac-25)
- UIs that discriminate against differently-abled people
- Third-party data collection for hyper-targeted advertising
- LLM's that harvest copyright or personal data
- And on... and on... and on...

# And this is only the tip of the iceberg

- Other Challenges:
  - interfaces and systems designed to be addictive;
  - corporate ownership of personal data;
  - weak cyber security and personally identifiable information (PII) protection;
  - and many more ...

**SOCL 4528. Computers and Society. (4 Hours)**  
Focuses on the social and political context of technological change and development. Through readings, course assignments, and class discussions, offers students an opportunity to learn to analyze the ways that the internet, artificial intelligence, and other technological advances have required a reworking of every human institution—both to facilitate the development of these technologies and in response to their adoption.

Attribute(s): NUpath Difference/Diversity, NUpath Societies/Institutions



# Equity and Software

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*As new as software engineering is, we're newer still at understanding its impact on underrepresented people and diverse societies.*

*We must recognize imbalance of power between those who make development decisions that impact the world.*

*and those who simply must accept and live with those decisions that sometimes disadvantage already marginalized communities globally.*



# Recognize inequities in your software

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*One mark of an exceptional engineer is the ability to understand how products can advantage and disadvantage different groups of human beings*

*Engineers are expected to have technical aptitude, but they should also have the discernment to know when to build something and when not to*

**Demma Rodriguez**  
**Head of Equity Engineering, Google 2018-2020**  
**Meta 2020-2022**  
**AirBnB 2022-present**



# More than *don't be evil*

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- Engineering equitable software requires conscious effort
  - How do we determine what “the right thing” is?
  - How do we weigh competing interests and values
  - How do we convince our investors/managers to take this action?

# Identify Unintended Consequences

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- Technology *will* be adopted in unanticipated ways. Being intellectually rigorous means considering and mitigating risks in designs ahead of time.
- What if:
  - Our recommendation system promotes misinformation or hate speech?
  - Our database is breached and publicly released?
  - Our facial recognition AI is used to identify and harass peaceful protestors?
  - Our child safety app is used to stalk women?
  - Our chatbot is sexist or racist?



# Identify the human and social contexts in which our software will run

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- Social Context
- Business Context
- Legal and Regulatory Context
- Others?

# What is the social context?

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- what categories of people will benefit from our software?
- what categories of people will be harmed by the use of our software?

# What is the business context?

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- Who is going to pay for this software?
  - users?
  - advertisers?
  - sponsors or sponsoring agencies?
- What are their incentives?
  - how do their incentives affect (or distort) our priorities in designing or developing this software?
    - if our sponsors are selling advertising, then we may be pressed to prioritize "engagement"
    - if our sponsors want to help disadvantaged people to connect with services, we may be pressed to prioritize accessibility.

# Who is selling what to who?

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- "If you're not paying for the product, then you are the product"

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generally credited to Richard Serra and Carlota Fay Schoolman (1974, about TV advertising)

# What is the legal and regulatory context?

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- Americans with Disabilities Act (ADA)
- Litigation-averse sponsors may insist on elaborate Terms & Conditions
- Software for use in the EU may need to comply with the GDPR.
- What about financial software?
- What about personal data?
- What about leaving cookies, etc., on our machines?



# Is the activity of the software transparent?

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- What data does it collect about the individual user?
- Does it store things on our computers?
- Does it touch our files?
  - Does it violate the "CIA" of computer security?

# Special considerations for AI

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- Incentives for AI system may be particularly mysterious
- What objective function is your LLM optimizing?
- AI "agents" that operate in the real world present particularly complicated risks

# A short course in AI safety

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[aisafety.dance](https://aisafety.dance)

# A short plug for Nicky Case



[blog](#) · [faq/contact](#) · [toss monies at me](#)

Hi, I'm Nicky! I make shtuff for curious & playful folks.

Wanna know when I make new shtuff? Well, the algorithms would rather show you mental-health-eroding clickbait, so let's get around 'em with...



[my infrequent newsletter!](#) or better yet, [let's do RSS!](#)

max 1 update per month · [see full archive](#)



## SHTUFF YOU CAN PLAY



**adventures with anxiety** – an interactive story about anxiety, where *you* are the anxiety



**explorable explanations** – a hub for learning through play



**the evolution of trust** – an interactive guide to the game theory of why & how we trust each other



**we become what we behold** – a game about news cycles, vicious cycles, infinite cycles



**nutshell** – a tool to make expandable explanations



**emoji simulator** – a tool to make cellular automata, with emoji

[\(see all projects\)](#)

[ncase.me](https://ncase.me)

# What can we do?

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- There is **not** a single standard that everyone follows for developing ethical or equitable software.
- There have been a number of attempts:
  - Value Sensitive Design
  - Microsoft's Responsible AI Standard
  - Gender Inclusive Design
  - and many more

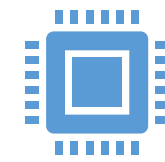


# Value Sensitive Design: an approach to consider human values in the design process.

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Technology is  
the result of  
human  
imagination



All  
technology  
involves  
design



All design  
involves  
choices  
among  
possible  
options



All choices  
reflects  
values



Therefore, all  
technologies  
reflect and affect  
human values



Ignoring  
values in the  
design  
process is  
irresponsible

- Identify Direct and Indirect Stakeholders
- Identify Human Values
- Study Impact of Values on Stakeholders
- Resolve Value Tensions and Identify unintended consequences

# Microsoft's **Trust Code** includes a standards that is based on 6 values

- Microsoft's company-wide "Trust Code," covers specific policies like the: **Responsible AI Standard**, and codes of conduct for open-source communities
- The Responsible AI Standard focuses on *fairness, privacy, reliability, inclusiveness, transparency, and accountability* for AI systems.



# Gender Inclusive Design

- Gender Stereotypes are fairly common in real world and many apps
- GenderMag is a structured approach for evaluating – and fixing – technology products and services
  - A set of cognitive styles for using technology that statistically cluster by gender. These are the **5 facets**.
  - A set of fictional people (called **personas**)
  - **Evaluation walkthrough**: a prescribed series of steps to uncover gender-inclusion issues



Gender\*

☐ Male ☐ Female

# GenderMag

## Facets

- Information processing style
- Learning style for new technology
- Computer self-efficacy
- Attitude to risk
- Motivations

## Personas

- Abi, Tim and Pat

## Walkthrough

- Answer a series of questions for each persona
- Generate Report on how usage differs

Subgoal report form

Use case (What is to be achieved overall):

(e.g., Abi wants to find a science fiction book.)

Subgoal

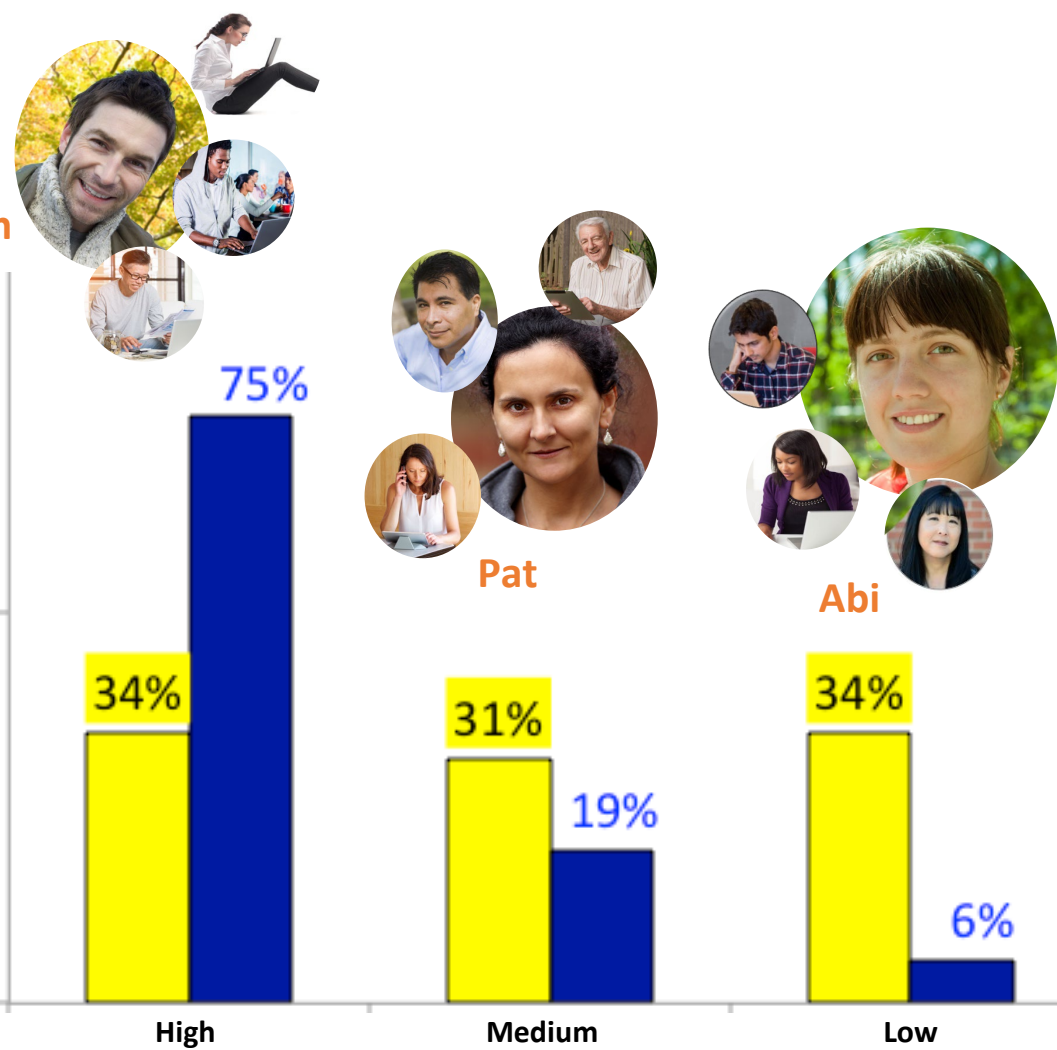
(e.g., See bookstore map.)

Will have thought of this as a step toward achieving the overall use case?

(fill in persona name)

<input type="checkbox"/> Yes	Facets Considered? <input type="checkbox"/> Motivations <input type="checkbox"/> Information Processing Style <input type="checkbox"/> Computer Self-Efficacy <input type="checkbox"/> Attitude Towards Risk <input type="checkbox"/> Learning: by Process vs. by Tinkering <input type="checkbox"/> None of the above	Why?
<input type="checkbox"/> Maybe	<input type="checkbox"/> Motivations <input type="checkbox"/> Information Processing Style <input type="checkbox"/> Computer Self-Efficacy <input type="checkbox"/> Attitude Towards Risk <input type="checkbox"/> Learning: by Process vs. by Tinkering <input type="checkbox"/> None of the above	
<input type="checkbox"/> No	<input type="checkbox"/> Motivations <input type="checkbox"/> Information Processing Style <input type="checkbox"/> Computer Self-Efficacy <input type="checkbox"/> Attitude Towards Risk <input type="checkbox"/> Learning: by Process vs. by Tinkering <input type="checkbox"/> None of the above	

Go to Action report form next.





# Don't ignore the challenges

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- **Have a core set of Principles of Ethical SE/AI**
  - **Harvard:** Fairness, Transparency, Accountability, Privacy, Security
  - **AWS:** Fairness, Explainability, Privacy and security, Safety, Controllability, Veracity and robustness
  - **Google AI:** Design for safety, Be transparent, Secure AI systems
- **Follow guidelines like - *Balance technical and moral responsibility***
  - Be Proactive
  - Be honest
  - Be accountable
  - Be a responsible citizen



# There are SE-level mitigations for some of these risks

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- Form a diverse team
  - People from diverse backgrounds bring different experiences and different perspectives
- Consider human values throughout the project
- Rely on standards when possible
  - ADA
  - ARIA
  - etc.
- Monitor actual usage & misuse, user feedback
  - who? what? when? how?

# Systemic mitigations

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- Work for systemic change?
  - political, social, etc.
- Work to convince developers to consider human values?

# Where does this leave us?

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- **So that we can sleep at night**
  - Consider the different ways that our software may **impact** others
  - Consider the ways in which our software **interacts** with the political, social, and economic systems in which we and our users live
  - Develop and Follow your own individual “code of ethics”
  - Follow **best practices**, and actively push to improve them
  - Encourage **diversity** in our development teams
  - Engage in **honest conversations** with our co-workers and supervisors to explore possible ethical issues and their implications.