

ECE444: Software Engineering

Software Engineering Ethics

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Learning Goals

- Awareness of ethical issues in software engineering
- Reflection on decision making
- Knowledge of professional codes
- Starting points to dig deeper
- Encouraging students to become comfortable exercising ethical discernment in a professional context with their peers.

Medical, Legal, Business, Engineering Ethics

Medical, Legal, Business, Engineering Ethics

- Many fields have well-developed professional ethics
- Basic ethical duty to “hold paramount the safety, health and welfare of the public”

Engineering ethics.

Ethics applies and is formalized in many professional fields: medical, legal, business, and engineering.

The first codes of engineering ethics were formally adopted by American engineering societies in 1912-1914. In 1946 the National Society of Professional Engineers (NSPE) adopted their first formal Canons of Ethics.

Kansas City Hyatt-Regency Collapse



Professional Ethics

Professional ethics encompass the personal, and corporate standards of behavior expected by professionals.

First three “professions”

- Divinity,
- Law
- Medicine

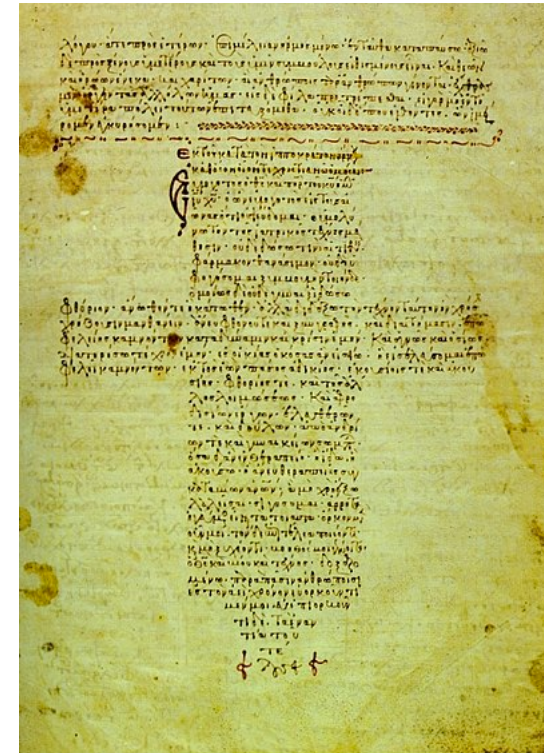


Medicine - Intrinsic

Hippocratic Oath

~450BC

“Do no Harm”



Law -Extrinsic

Bar regulates behavior

Oath to follow rules

Malpractice



Bioengineering Ethics:

- Respect for Autonomy
- Beneficence
- Nonmaleficence
- Justice



Through the Code of Ethics, professional engineers have a clearly defined duty to society, which is to regard the duty to public welfare as paramount, above their duties to clients or employers. Their duty to employers involves acting as faithful agents or trustees, regarding client information as confidential and avoiding or disclosing conflicts of interest. Their duty to clients means that professional engineers must immediately disclose any direct or indirect interest that might prejudice (or appear to prejudice) their professional judgment.

The code states that "it is the duty of a practitioner to the public, to the practitioner's employer, to the practitioner's clients, to other licensed engineers of the practitioner's profession, and to the practitioner to act at all times with,

1. fairness and loyalty to the practitioner's associates, employers, clients, subordinates and employees;
2. fidelity to public needs;
3. devotion to high ideals of personal honour and professional integrity;
4. knowledge of developments in the area of professional engineering relevant to any services that are undertaken; and
5. competence in the performance of any professional engineering services that are undertaken."

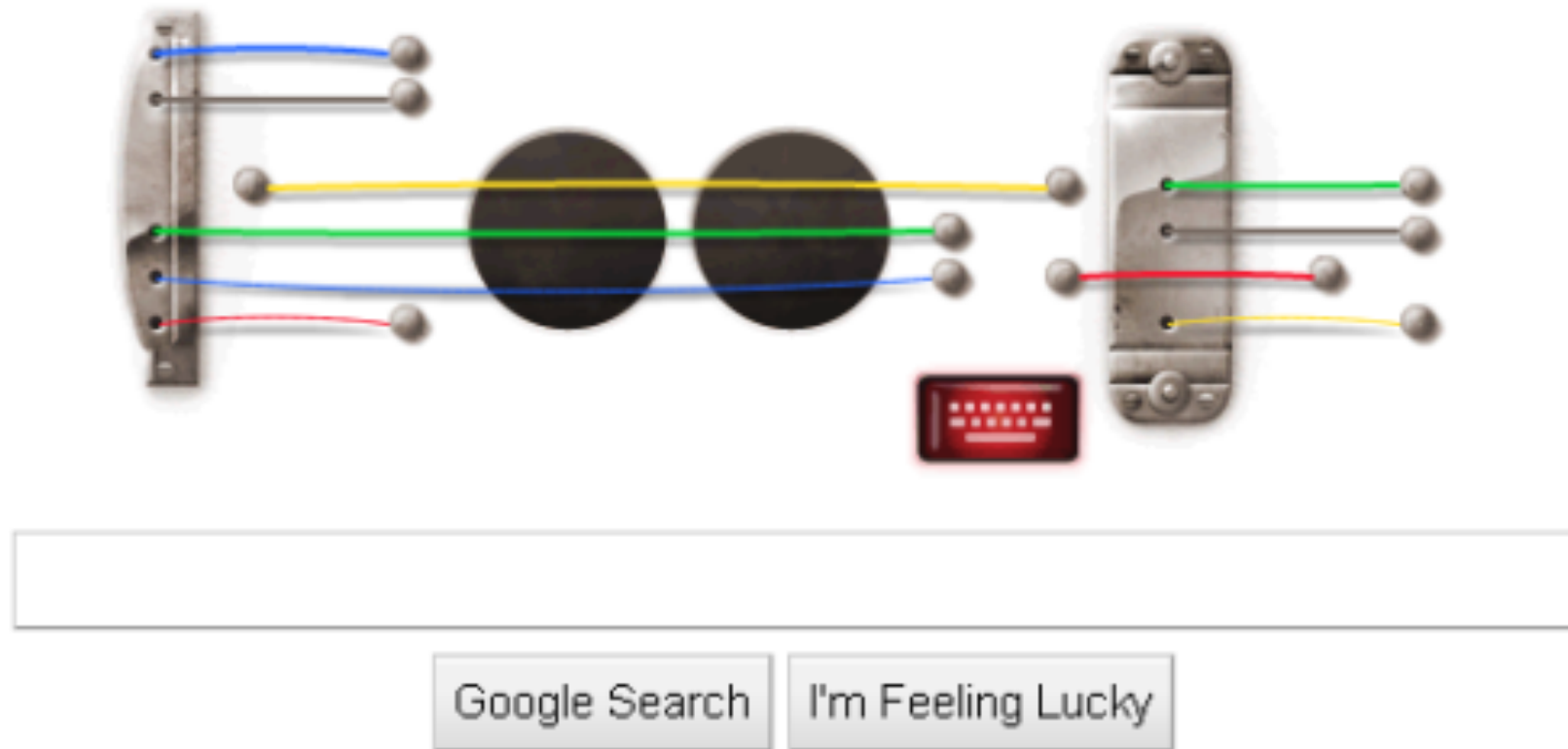
The complete Code of Ethics is included in section 77 of the ***Professional Engineers Act, R.S.O. 1990, c. P.28.***

Profession	Duties Include/May Include	Licensing Required?
Barbers / Hairdressers	Cutting and styling of hair Applying of dyes to hair Use of proper hygiene	Generally required
Manicurists	Cutting and trimming of nails. Grooming of nails Maintaining proper sanitization of equipment	Generally required
Civil Engineers	Design and construction of bridges, roadways, industrial buildings and complexes, military complexes and transit systems, dams, etc...	Mandatory
Prostitutes	"Personal Services" Regular medical testing. "Safe" practices.	Mandatory where lawful e.g. The Netherlands, United States (Nevada, outside the Las Vegas City Limits)
Software Engineers	Design and construction of software components of: <ul style="list-style-type: none"> ○ Medical diagnostic equipment, ○ Medical dosing systems ○ Air Traffic Control Systems, ○ Strategic nuclear weapon control systems, ○ Command and Control Systems, ○ Anti-aircraft/missile systems ○ Aircraft fly-by-wire systems ○ Automotive computer control systems ○ Banking and financial systems 	No requirement

http://pages.erau.edu/~kornecka/papers/21SSC_ethics.pdf

Why Software Engineering Courses Should Include Ethics Coverage?

- Software helps shape, not just reflect, our societal values
- Examples:
 - How many cars or rockets are made today that do *not* depend upon critical software for their safe operation?
 - How many bridges are built today without the use of sophisticated computer programs to calculate expected load, geophysical strain, material strength and design resilience?



“Update Jun 17: Wow—in just 48 hours in the U.S., you recorded 5.1 years worth of music—40 million songs—using our doodle guitar. And those songs were played back 870,000 times!”

<https://blog.rescuetime.com/google-doodle-strikes-again/>

Les Paul Doodle

- Likely designed in days, side project
- Used by users for 5.3 million hours (8 lifetimes)
- Questions: Time sink, lost productivity? Negative or positive net contributions to the world? Who should consider cost/benefits? Based on what principles?

EA calls its loot boxes 'surprise mechanics,' says they're used ethically

80

'People like surprises,' executive tells UK Parliament

By [Ana Diaz](#) | [@AnaLikesPikachu](#) | Jun 21, 2019, 9:10am EDT




SHARE




(Un)Ethical situations


Open Source Maintainers




dominictarr commented 7 days ago Owner ...




dominictarr commented 7 days ago Owner ...



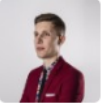
limonte commented 7 days ago • edited ...



dominictarr commented 6 days ago Owner ...





XhmikosR commented 6 days ago ...





jaydenseric commented 6 days ago ...


There is a huge difference between not maintaining a repo/package, vs giving it away to a hacker (which actually takes more effort than doing nothing), then denying all responsibility to fix it when it affects millions of innocent people.


 884


 162


 7


 16


 18














Domino's Would Rather Go to the Supreme Court Than Make Its Website Accessible to the Blind

Rather than developing technology to support users with disabilities, the pizza chain is taking its fight to the top

by Brenna Houck | @EaterDetroit | Jul 25, 2019, 6:00pm EDT

f t SHARE



Blind Man Wins Supreme Court Case Over Domino's Pizza in Huge Gain for Accessibility Rights Online

BY YELENA MANDENBERG ON OCTOBER 7, 2019



Andreas Stefik, Ph.D.

Associate Professor
Computer Science



Engaging Students with Disabilities

One of my passions is for increasing the number of students with disabilities that participate in the field of computer science. Broadly, while students with disabilities make up ballpark 15% of the population, Such student can face severe challenges to entering the field. For example, students learning in high school often use environments with no keyboard support and no screen reader support, which increases the challenges for those with mobility impairments or blindness significantly. We are working to alleviate as many of the challenges as we can in a wide variety of

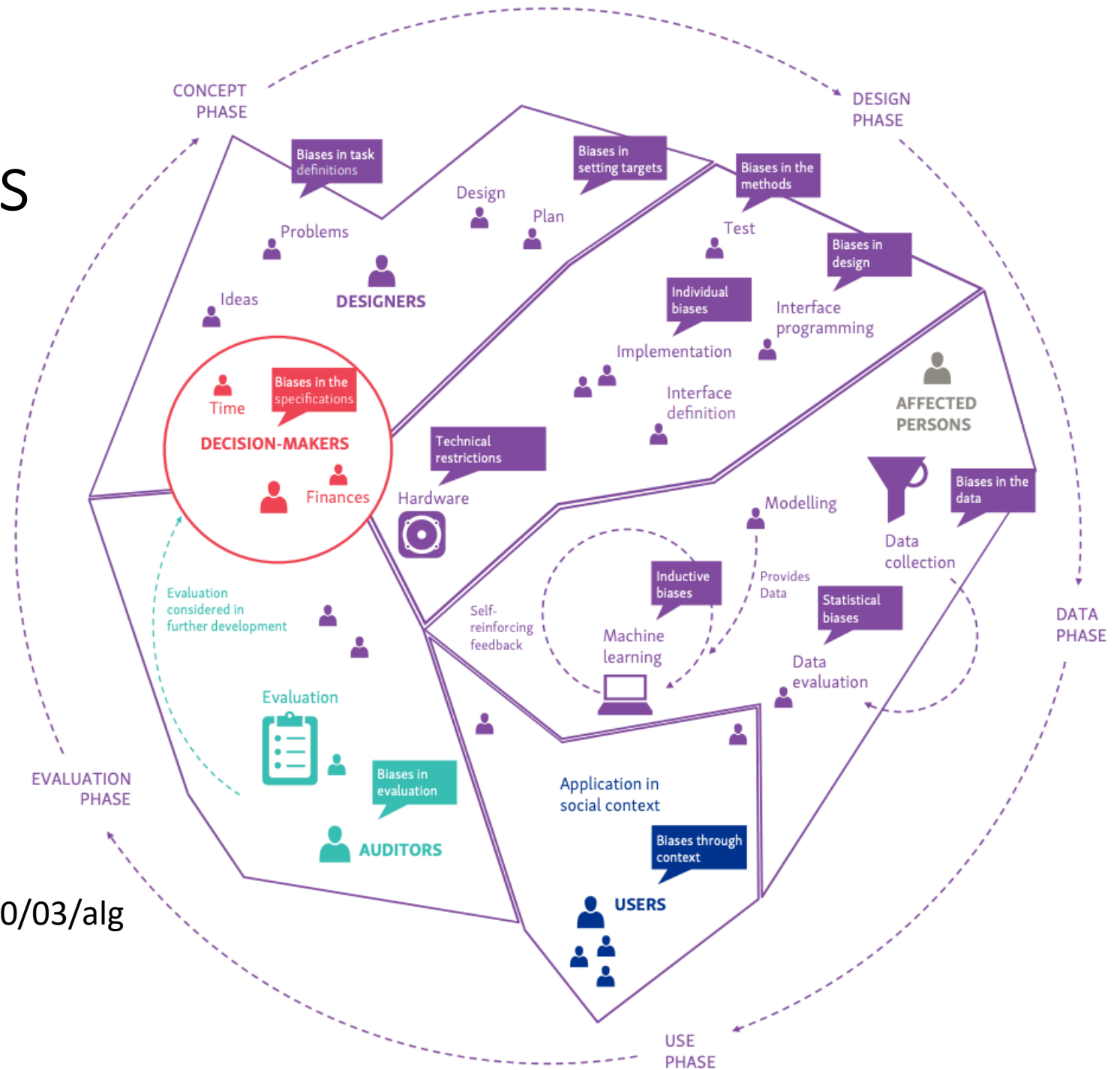
★ Keynote: It Is Time We Made Software Development Accessible to People with Disabilities

Software Engineering in Society

diagrams

4. [EPIQ Training for teachers that want to learn more about Quorum](#)

Algorithmic Bias



https://initiated21.de/app/uploads/2020/03/algorithm_mon_denkimpuls_bias_eng_200319.pdf

Airlines

Some airlines may be using algorithms to split up families during flights

Your random airplane seat assignment might not be random at all.

By Aditi Shrikant | aditi@vox.com | Nov 27, 2018, 6:10pm EST

[f](#) [🐦](#) [🔗](#) SHARE



Passengers boarding a Boeing aircraft of the low cost airline carrier Ryanair in Thessaloniki Macedonia Airport, Greece. | Nicolas Economou/NurPhoto/Getty Images



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Lime halts scooter service in Switzerland after possible software glitch throws users off mid-ride




Ingrid Lunden @ingridlunden / 9:51 am EST • January 12, 2019

Comment



The Morality Of A/B Testing

Josh Constine @joshconstine / 8:50 PM PDT • June 29, 2014



Facebook COO Sheryl Sandberg apologizes for psychological News Feed experiment



by NICK SUMMERS — Jul 2, 2014 in FACEBOOK



Therac-25

Bug in software lead to at least 6 deaths

Traced to:

Lack of reporting bugs

Lack of proper due diligence

Engineers were overconfident





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PROFESSIONAL AND ETHICAL DILEMMAS IN SOFTWARE ENGINEERING

Brian Berenbach, Siemens Corporate Research

Manfred Broy, Technical University of Munich

patch the software, but you can't patch a person if you, you know, damage someone's reputation." Sam Hodgson for The New York Times

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Unprofessional

“if a project is running late, the project manager might be tempted to cut short the requirements definition phase, hoping to make up for some lost time. In order to get the product out the door, developers base their testing not on the requirements, but on developer descriptions of how their code will work. The team then delivers the result to the customer with possibly catastrophic consequences, such as an unusable product, contract cancellation, or lawsuits.”

Ethical Dilemma in Software Engineering

- **Mission impossible:** when an individual is asked to create or accept a schedule that is obviously impossible to meet
- **Mea culpa:** when staff members must deliver a product that still lacks key functionality or has known software defects.
- Rush job
- Not my problem
- Red lines
- Fictionware versus vaporware
- Nondiligence
- Canceled vacation
- Sweep it under the rug

Should software developers have a code of ethics?

With the power to drive technology, comes great responsibility. What should developers do when faced with ethical dilemmas?



Data - Article

Professional Ethics in Software Development

by The RIQ News Desk Feb 08, 2017

Professional codes

- Codes for ethical practice
- Identify problems, guide solutions
- Judgement still necessary

IEEE CS/ACM Software Engineering Code of Ethics (short version)

Software engineers shall commit themselves to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety and welfare of the public, software engineers shall adhere to the following Eight Principles:

- **Public:** Software engineers shall act consistently with the public interest.
- **Client and Employer:** Software engineers shall act in a manner that is in the best interests of their client and employer, consistent with the public interest.
- **Product:** Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.
- **Judgement:** Software engineers shall maintain integrity and independence in their professional judgment.
- **Management:** Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.
- **Profession:** Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.
- **Colleagues:** Software engineers shall be fair to and supportive of their colleagues.
- **Self:** Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

Code of Ethics

research shows that the code of ethics does not appear to affect the decisions made by software developers.

Does ACM's Code of Ethics Change Ethical Decision Making in Software Development?

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ABSTRACT

Ethical decisions in software development can substantially impact end-users, organizations, and our environment, as is evidenced by recent ethics scandals in the news. Organizations, like the ACM, publish codes of ethics to guide software-related ethical decisions. In fact, the ACM has recently demonstrated renewed interest in its code of ethics and made updates for the first time since 1992. To better understand how the ACM code of ethics changes software-

The first example is the Uber versus Waymo dispute [26], in which a software engineer at Waymo took self-driving car code to his home. Shortly thereafter, the engineer left Waymo to work for a competing company with a self-driving car business, Uber. When Waymo realized that their own code had been taken by their former employee, Waymo sued Uber. Even though the code was not apparently used for Uber's competitive advantage, the two companies settled the lawsuit for \$245 million dollars.

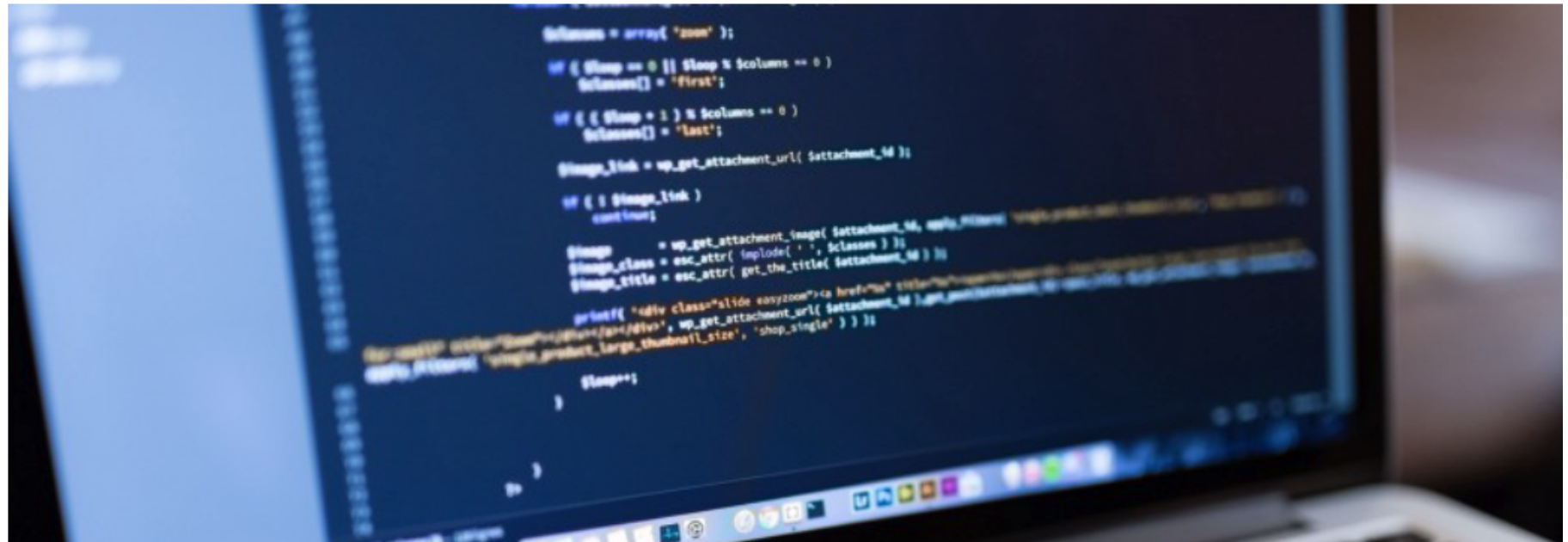
Break-out room and Discussion

W NOVEMBER 13, 2016 / #PROGRAMMING

The code I'm still ashamed of

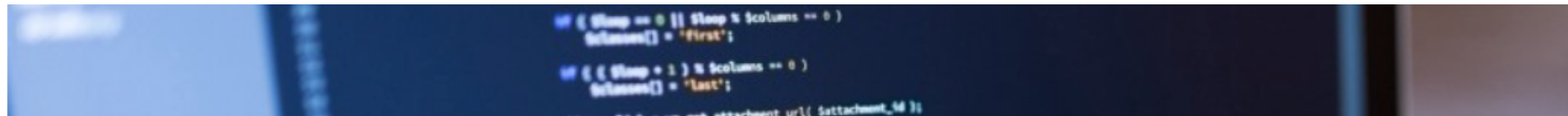


Bill Sourour



One of the projects I was assigned to involved a drug that was targeted at women. The graphics and general style of the website made it clear that the client wanted to specifically target teenage girls.

One of the features of this website was a quiz that asked girls a series of questions and recommended a type of drug based on their answers.



I wish I could tell you that when I first saw those requirements they bothered me. I wish I could tell you that it felt wrong to code something that was basically designed to trick young girls. But the truth is, I didn't think much of it at the time. I had a job to do, and I did it.



Since that day, I always try to think twice about the effects of my code before I write it. I hope that you will too.

Challenge:

How do we apply ethics to a field (Software Engineering) that is changes so often?

Remember the Dominos case? The ADA law was written before the first website (1990)

To handle this uncertainty about the future, let's focus on three questions we can ask to remind ourselves to focus on promoting human flourishing.

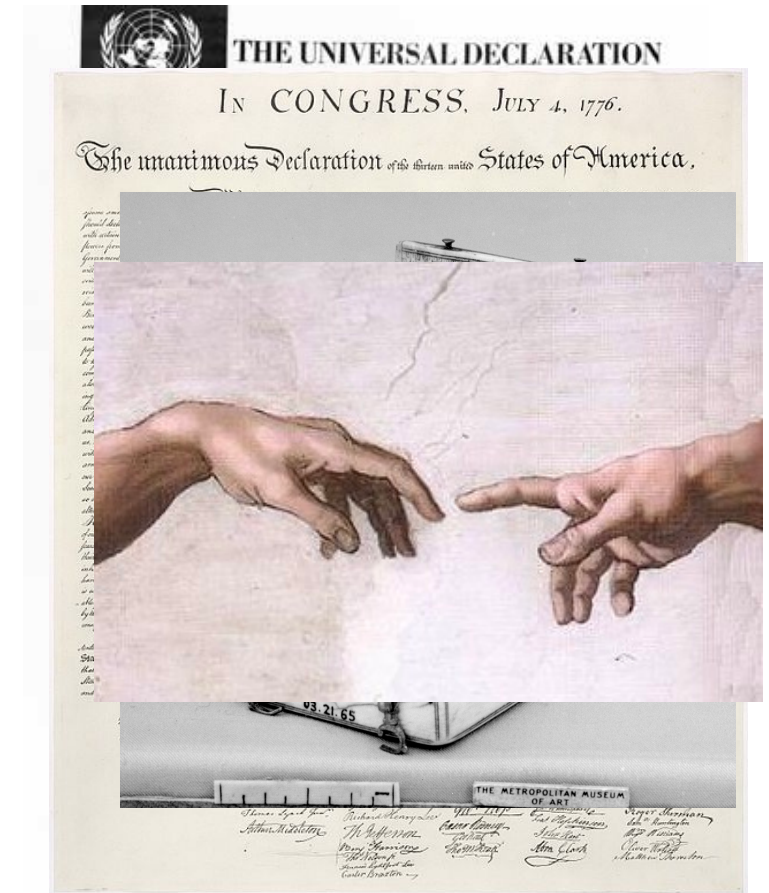
What is Human Flourishing?

According to Harvard's Human flourishing program: Human flourishing is composed

of five central domains: **happiness and life satisfaction, mental and physical health, meaning and purpose, character and virtue, and close social relationships.**

Why Human Flourishing?

- Universal Declaration of Human Rights: “All human beings are born free and equal in dignity and rights.”
- Declaration of Independence: “We hold these truths to be self-evident...”
- Internal Compass
- Faith



Three questions to promote human flourishing

1. Does my software respect the **humanity** of the **users**?
2. Does my software **amplify positive** behavior, or **negative** behavior for users and society at large?
3. Will my software's **quality** impact the **humanity** of others?

1. Does my software
respect the **humanity** of
the **users**?

Humane Design Guide

<http://humanetech.com>

“We envision a world **where technology is realigned with humanity’s best interests**. Our work expands beyond tech addiction to the broader societal threats that the attention economy poses to our well-being, relationships, democracy, and shared information environment. We must address these threats to conquer our biggest global challenges like pandemics, inequality, and climate change.”

https://assets.website-files.com/5f0e1294f002b15080e1f2ff/5f0e1294f002b1f8b2e1f482_Design-Guide-Alpha.pdf

Humane Design Guide (Alpha Version)

Use this worksheet to identify opportunities for Humane Technology.







Product or feature:

Value proposition:

Measure of success:

What are Human Sensitivities?

Human Sensitives are instincts that are often vulnerable to new technologies.

Human Sensitivity	We are inhibited when	What inhibits	We are supported when	Opportunity to improve
Emotional What we feel in our body and in our physical health.	We are stressed, low on sleep, afraid or emotionally exhausted.	<ul style="list-style-type: none">Artificial scarcityUrgency signallingConstant monitoringOptimizing for screentime	Design engenders calm, balance, safety, pauses and supports circadian rhythms.	
Attention How and where we focus our attention.	Attention is physiologically drawn, overwhelmed or fragmented.	<ul style="list-style-type: none">Constant context switchingMany undifferentiated choicesFearful informationNo stopping cues (e.g. infinite scroll)Unnecessary movement	Enabled to bring more focus and mindfulness.	
Sensemaking How we integrate what we sense with what we know.	Information is fear-based, out of context, confusing, or manipulative.	<ul style="list-style-type: none">Facts out of contextOver-personalized filtersEquating virality with credibilityDeceptive authority (ads vs. content)	Enabled to consider, learn, express and feel grounded.	
Decisionmaking How we align our actions with our intentions.	Intentions and agency are not solicited nor supported.	<ul style="list-style-type: none">Avatars to convey authorityStalking ads and messagesPush content modelsServing preference over intent	Enabled to gain agency, purpose, and mobilization of intent.	
Social Reasoning How we understand and navigate our personal relationships.	Status, relationships or self-image are manipulated.	<ul style="list-style-type: none">Quantified social statusViral sharingImplied obligationEnabling impersonation	Enabled to connect more safely and authentically with others.	
Group Dynamics How we navigate larger groups, status, and shared understanding.	Excluded, divided or mobilized through fear.	<ul style="list-style-type: none">Suppressing views and nuanceEnabling ad hominem or hate speechEnabling viral outrageLack of agreed-upon norms	Enabled to develop a sense of belonging and cooperation.	

[Center for Humane Technology] www.humanetech.com


Now rank the sensitivities 1-6 based on what you now see as the largest opportunities for Humane Design. Then use the second sheet to develop an action statement. ↑

Humane Design Guide

<http://humanetech.com>

Provides a template for considering a piece of software, and asking questions to help us arrive at a “humane design”

Consider 6 human sensitivities: Emotional, Attention, Sense making, Decision making, Social Reasoning, and Group Dynamics

Human Sensitivity	We are inhibited when	What inhibits	We are supported when	Opportunity to improve
Attention How and where we focus our attention.	Attention is physiologically drawn, overwhelmed or fragmented.	<ul style="list-style-type: none">• Constant context switching• Many undifferentiated choices• Fearful information• No stopping cues (e.g. infinite scroll)• Unnecessary movement	Enabled to bring more focus and mindfulness.	

Identify Opportunities to improve

Humane Design Guide

<http://humanetech.com>

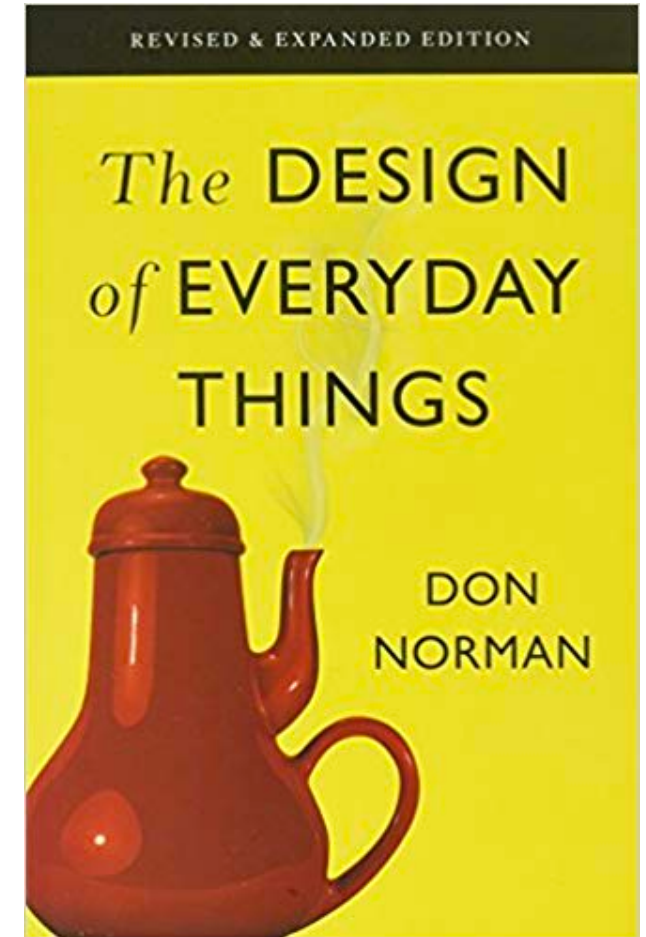
After analysis step, develop plan of action:

1. In what ways does your product/feature currently engage Human Sensitivities?
2. How might your product/feature support or elevate human sensitivities?
3. Action Statement

User Centered Design

User-centered design tries to optimize the product around how **users can, want, or need to use the product**, rather than forcing the users to change their behavior to **accommodate the product**.

-Wikipedia



2. Does my software **amplify**
positive or **negative** behavior for
users and society at large?

What if...

<https://pair-code.github.io/what-if-tool/>

Visually probe the behavior of **trained machine learning models**, with minimal coding.

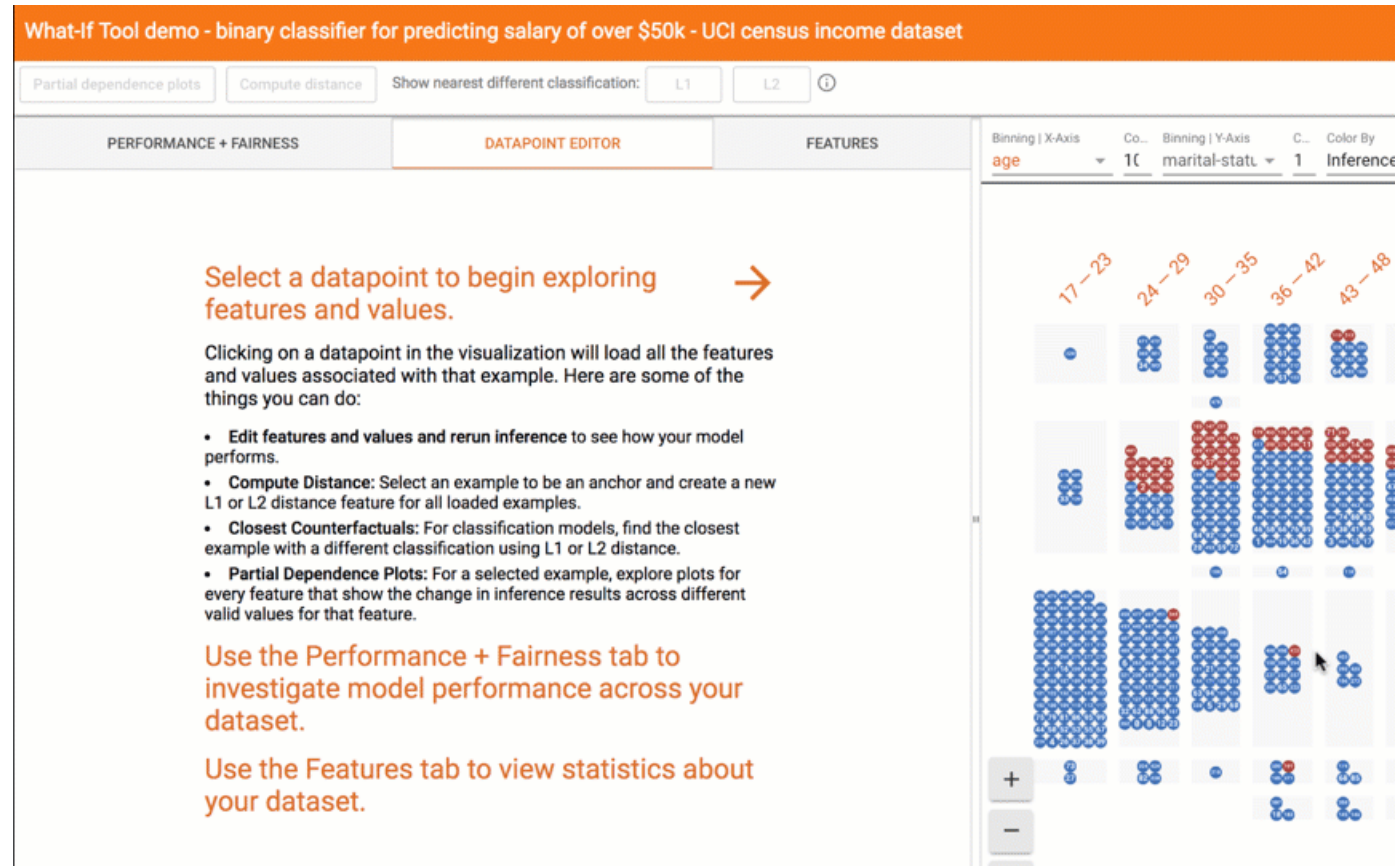
What If...

you could inspect a machine learning model,
with minimal coding required?



What if...

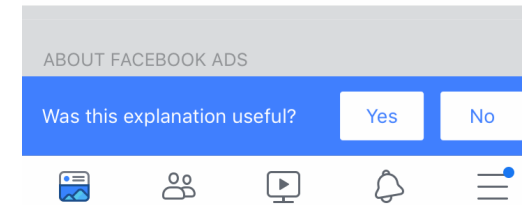
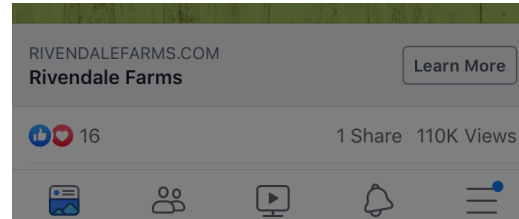
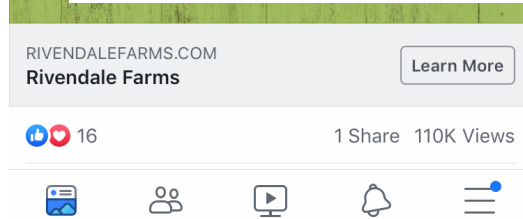
<https://pair-code.github.io/what-if-tool/>



Explain “why” to customers



There may be other reasons you're seeing this ad, including that Rivendale Farms wants to reach **people ages 22 to 64 who live or were recently near Pittsburgh, Pennsylvania**. This is information based on your Facebook profile and where you've connected to the internet.



3. Will my software's
quality impact the
humanity of others?

Quality has long been considered

Quality attributes [\[edit \]](#)

Notable quality attributes include:

- [accessibility](#)
- [accountability](#)
- [accuracy](#)
- [adaptability](#)
- [administrability](#)
- [affordability](#)
- [agility](#) [Toll] (see Common Subsets below)
- [auditability](#)
- [autonomy](#) [Erl]
- [availability](#)
- [compatibility](#)
- [composability](#) [Erl]
- [configurability](#)
- [correctness](#)
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- [resilience](#)
- [responsiveness](#)
- [reusability](#) [Erl]
- [robustness](#)
- [safety](#)
- [scalability](#)
- [seamlessness](#)
- [self-sustainability](#)
- [serviceability](#) (a.k.a. supportability)
- [securability](#)
- [simplicity](#)
- [stability](#)
- [standards compliance](#)
- [survivability](#)
- [sustainability](#)
- [tailorability](#)
- [testability](#)
- [timeliness](#)
- [traceability](#)
- [transparency](#)
- [ubiquity](#)
- [understandability](#)
- [upgradability](#)
- [vulnerability](#)
- [usability](#)

DISCUSSION: What should we do going forward?

Summary

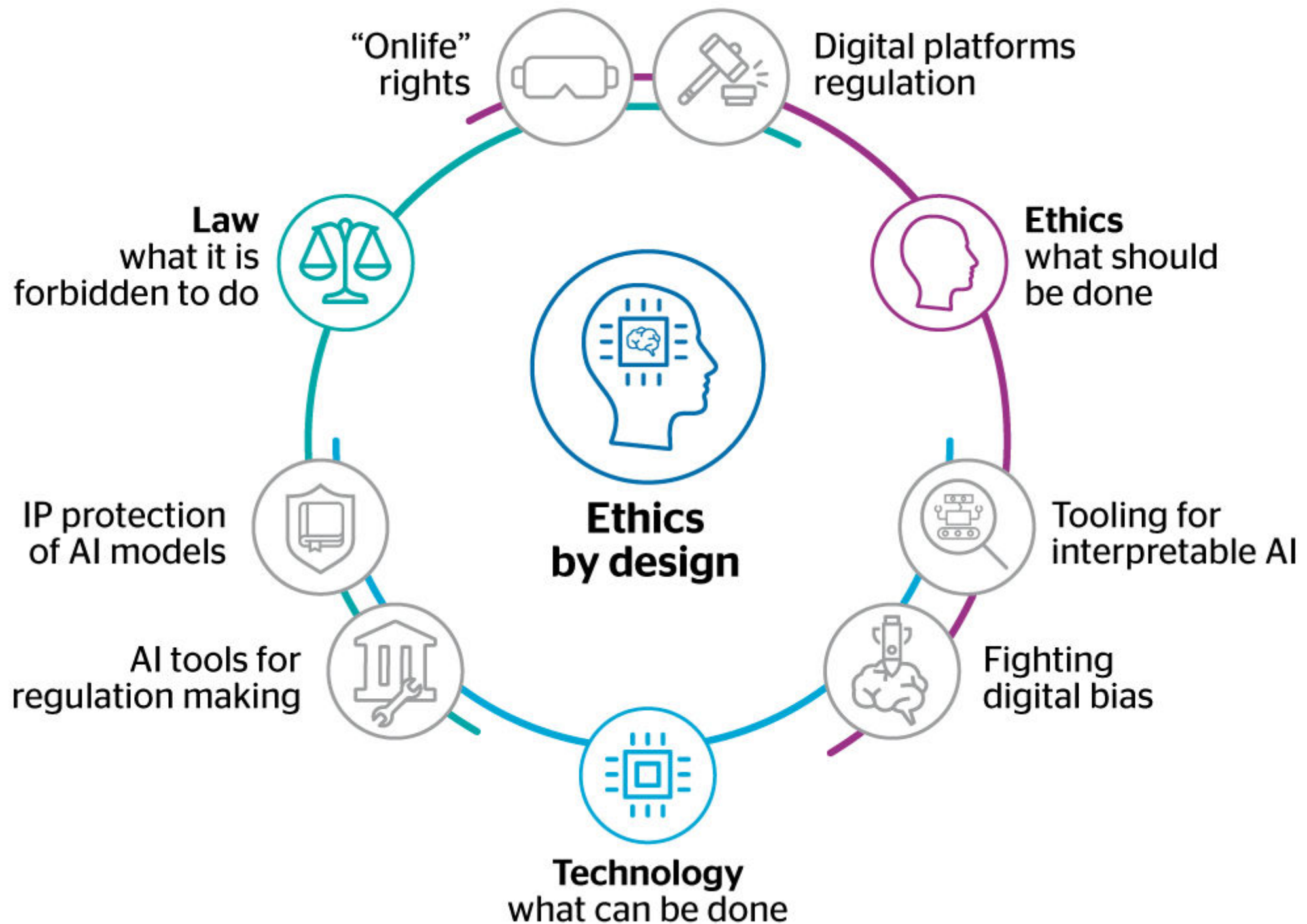
- Software engineers face ethical questions regularly
- Most software can potentially cause harm
- Fast decision making under constraints
- Professional codes can guide

Further Reading

- ACM/IEEE-CS: Software Engineering Code of Ethics
<https://www.computer.org/web/education/code-of-ethics>
- Vallor and Narayanan. An Introduction to Software Engineering Ethics
<https://www.scu.edu/media/ethics-center/technology-ethics/Students.pdf>
- CMU 08-200 Ethics and Policy Issues in Computing
- O'Neil. Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books, 2017.

More cases

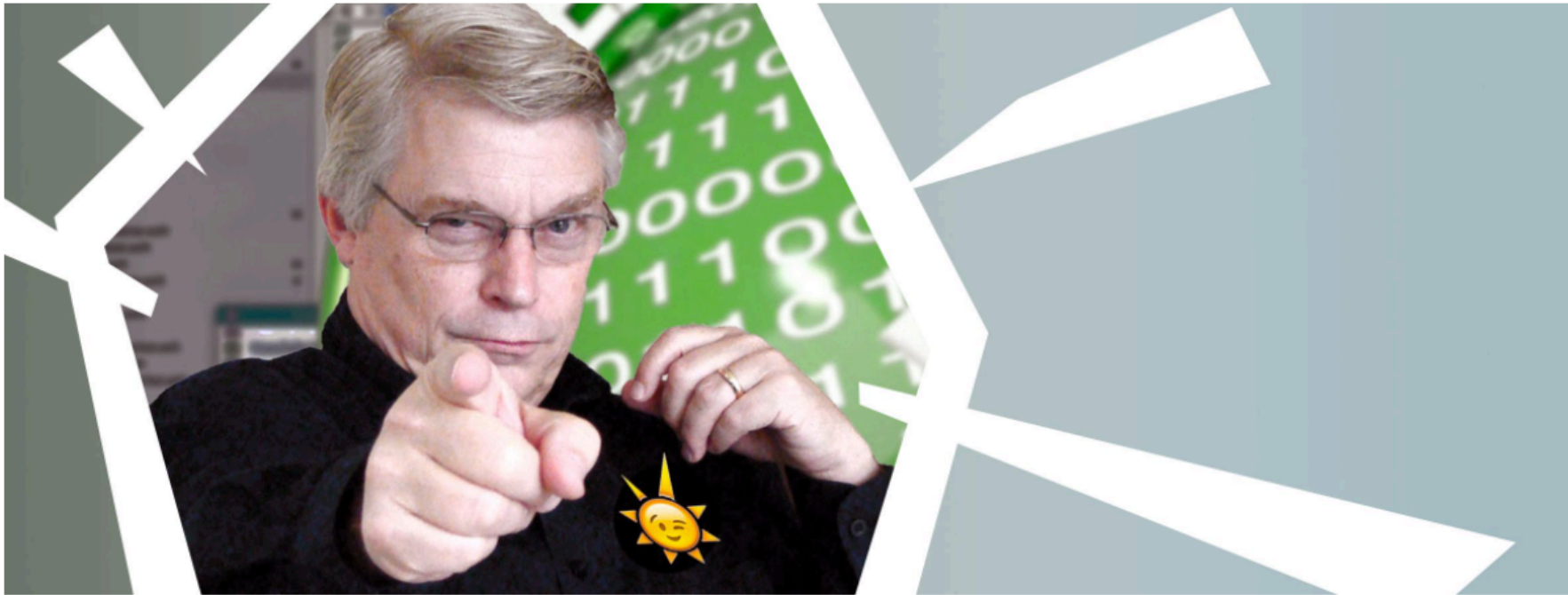
- Offshore development
- Experimentation and IRB
- Privacy, Data economy
- Copyright
- Streetview
- Self-driving cars
- Artificial intelligence – super intelligence
- 3d printing



The Ethics of Software Development with Uncle Bob Martin

October 19th 2020

2 ❤️💡📊💰



- <https://hackernoon.com/the-ethics-of-software-development-with-uncle-bob-martin-6f153t2r>