

CS61B, 2021

Lecture 33: Software Engineering III

- Candy Crush and Friends
- The Ledger of Harms
- Your Life

Overview

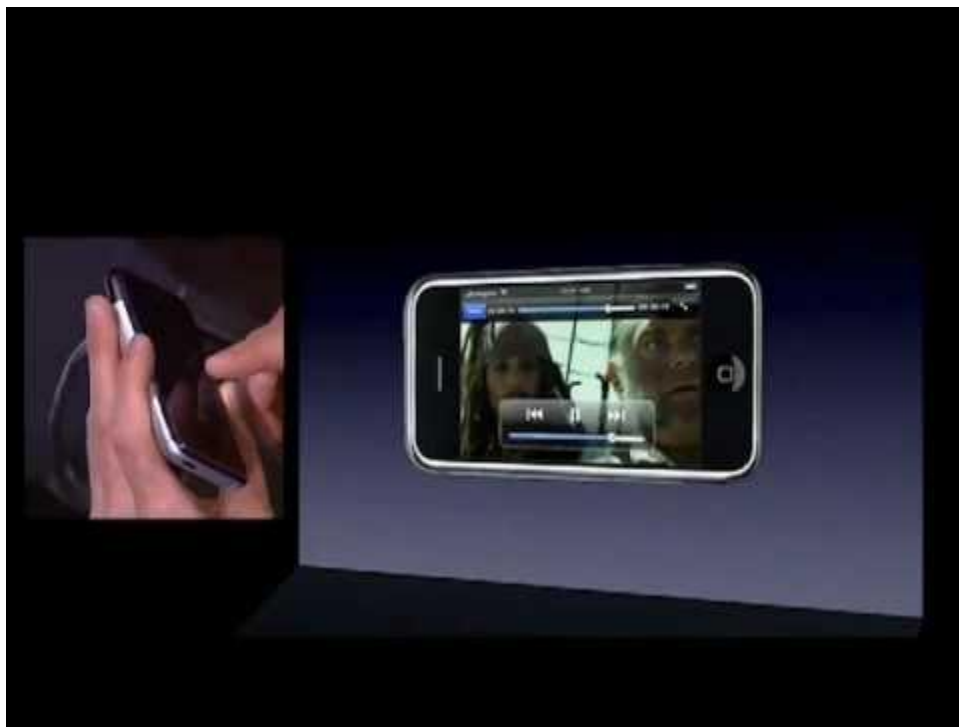
Software has completely reshaped society in my lifetime.



1994
Today Show

Today, we'll discuss your role in the future we're creating.

2007



Candy Crush

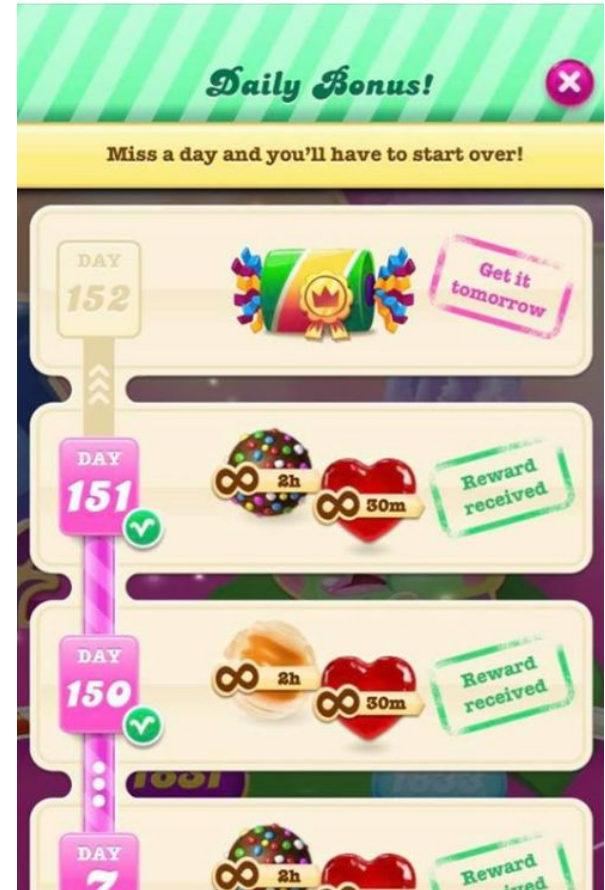
The mobile game Candy Crush tracks the number of days you have played in a row.

- Every consecutive day gets you a reward.
 - Progress indicator.
 - Up to 2 hours worth of a special item for that day that makes the game more fun.

If you miss a day, the counter resets.

Why does this feature exist in Candy Crush?

- Encourages you to engage every day.

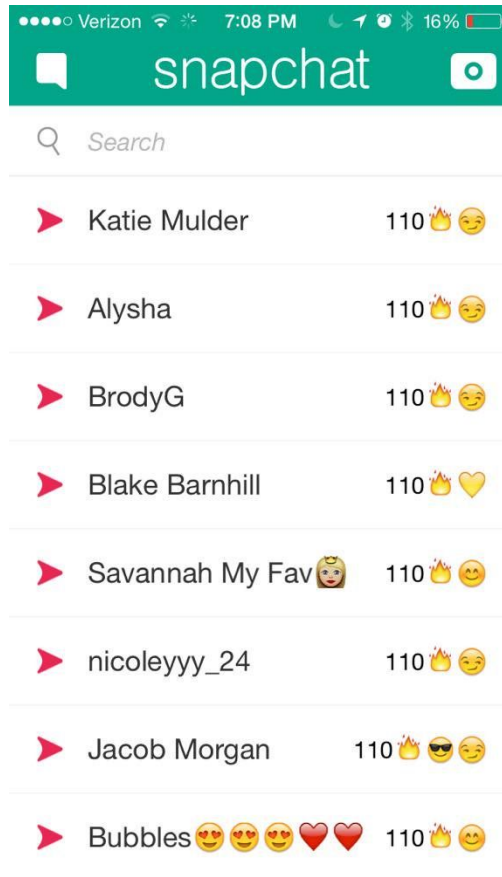


Snapchat

Similarly, for every day that you and a friend communicate on snapchat, your snap streak is extended by one day.

Why does this feature exist in Snapchat?

- To encourage engagement.



Snapstreaks and Candy Crush Streak

What positive impacts do these features have on the world?

- For Snapchat - encourages connection between people.
- Easy dopamine fix.
- For learning apps like duolingo, it encourages you to do the productive activity.
- It's a goal to shoot for, gamifies our existence, spreads the word about the app so you can outdo your friends (foursquare and mayoring)
- It allows you to be engaged with a community.

What negative impacts do these features have on the world?

- Yet another thing that eats your attention.
- More addiction to our damn phones.
- Induces anxiety (which is one reason you keep coming back).
- Reduces our connection to some boring old number

Snapstreaks and Candy Crush Streak

What negative impacts do these features have on the world?



Snapstreaks and Candy Crush Bonuses

Are these features net positives for the world?

- One vote: Remove! Harm seems worse.
-

More Generally

Are Candy Crush/and Snapchat net positives for the world?

Khan Academy

I'm assuming you're familiar with Khan Academy: <https://www.khanacademy.org/>.

- ... but just in case you're not, let's check it out.



For every student,
every classroom.
Real results.

We're a nonprofit with the mission to provide a free, world-class education for anyone, anywhere.

Learners

Teachers

Districts

Parents

Khan Academy

What positive impacts does Khan Academy have on the world?

- Sal's voice.
- Facilitates learning.
- Unbiased classroom -- doesn't matter who you are or where you are, you can access it.
- **Free** education.
- Easy way for teachers to give homework (efficiency of scale).
- Makes AP exams more fair.
- Standardizes curriculum.

What negative impacts does Khan Academy have on the world?

-

What negative impacts does Khan Academy have on the world?

- Requires people to have internet access to be free and fair (people without access fall behind).
- Discourages teachers from doing a good job (potentially).
- Many unsupported languages.
- Reduces learning to more and more interacting with a computer.
 - Makes it harder to learn other ways.
 - It's more screen time.
- If you have questions, it's hard to ask.
- Learning becomes shallow. Drill and kill questions.
 - Opposite of the Gitlet or BYOW experience.
- Takes jobs from teachers.

Khan Academy

Is Khan Academy a net positive?

- Seems clearly positive.

Workplace Preference

What are some reasons people might prefer working at King (developer of Candy Crush) over Khan Academy?

- Larger target audience (people playing games vs. people learning).
 - Candy Crush comes pre-installed in Windows. Khan Academy doesn't.
 - Candy Crush is a language-free game (for the most part).
- Money. Game developer likely pays more than education website.
- Maybe more fun to work on a game than a web-based learning platform.
- Different set of skills that you can grow (art, animation, etc).

Revenues

King and Snapchat generate enormous amounts of revenue.

- Note: Even with all this revenue, Snapchat is still not profitable (net loss of 200 million in 3rd quarter of 2020).

	Revenues	Profits	# Employees	Revenue / Employee
King (2019)	2 billion	Unreported*	~2,000	~\$1,000,000
Snapchat (2019)	1.7 billion	-0.8 billion	~2,734	~\$600,000
Khan Academy	0.037 billion (includes gifts)	N/A	205 (including 11 dogs, 7 cats)	N/A

* King is owned by Blizzard-Activision and yearly report doesn't give profit for King as a unit.

Sources: [Link](#), [Link](#), [Link](#), [Link](#), [Link](#)

The Ledger of Harms

Concerns Expressed by Tech Leaders

- “I think we have created tools that are ripping apart the social fabric of how society works.” - [Chamath Palihapitiya](#) (early executive at Facebook)
- “God only knows what it[Facebook]’s doing to our children’s brains.” - [Sean Parker](#) (the Napster guy)
- “The technologies we were most excited about 10 years ago are now implicated in just about every catastrophe of the day.” - [Farhad Manjoo](#) (technology journalist)
- “*These are our lives*. These are our precious, finite, mortal little lives. The idea that we are spending them distracted, not accomplishing the thing that we’re trying to do, is just painful. It’s crazy.” - [Justin Rosenstein](#), creator of the Like button and founder of Asana
- ““Facebook appeals to your lizard brain — primarily fear and anger,” he said. “And with smartphones, they’ve got you for every waking moment.”” - [Roger McNamee](#) (early investor in many tech companies, interesting guy)

My Thoughts

Technology companies do inflict significant negative externalities upon society.

- Most of them are still a net positive, e.g. I personally use and enjoy Facebook.

My personal sense is that these are largely unintended consequences by well intentioned people.

- Yes, there are some bad actors, but I don't think they are common.
- Workers and executives at these companies do care.
 - ... but money does skew people's perspective in strange ways.

The Center for Humane Technology and the Ledger of Harms

The [Center for Humane Technology](#) was founded by current and former tech workers to raise awareness and try to combat harmful side effects of internet tech platforms.

In 2018, they created a [Ledger of Harms](#) “collect those negative impacts of social media and mobile tech that do not show up on the balance sheets of companies, but on the balance sheet of society.”

- It is “aimed at guiding rank-and-file engineers who are concerned about what they are being asked to build.” [[Link](#)]

Ledger of Harms

The Ledger:

- Making Sense of the World: Misinformation, conspiracies, fake news.
- Attention: Loss of ability to focus without distraction.
- Physical and Mental Health: Stress, loneliness, addiction, risky behavior.
- Relationships: Less empathy, more confusion and misinterpretation.
- Politics and Elections: Propaganda, distorted dialogue, disrupted democratic processes.
- Systemic Oppression: Amplification of discrimination.
- Children: Developmental delays, suicide, physical/mental/social changes.,
- Do Unto Others: Tech employees limit tech usage in their own homes.

For each category, they provide research and citations for potential harms.

Making Sense of the World

- “64% of all extremist group joins are due to our recommendation tools...our recommendation systems grow the problem”, noted an internal Facebook presentation in 2016. Yet repeated attempts to counteract this have been repeatedly ignored, diluted, or deliberately shut down by senior Facebook officers, according to a 2020 Wall Street Journal investigation.”
- “Fake news spreads six times faster than true news. According to researchers, this is because fake news grabs our attention more than authentic information: fake news items usually have a higher emotional content and contain unexpected information which inevitably means that they will be shared and reposted more often.”
- “45% of tweets about coronavirus are from bots spreading fake information, according to research from Carnegie Mellon University.”
- “2 minutes of exposure to a conspiracy theory video reduces people’s pro-social attitudes (such as their willingness to help others), as well as reducing their belief in established scientific facts.”

Attention

- “The presence of a smartphone, even when off, can reduce cognitive capacity by taxing the attentional resources that reside at the core of both working memory capacity and fluid intelligence.”
- “72% of teens and 48% of parents feel the need to immediately respond to texts, social-networking messages, and other notifications.”
- “1 hour per day is the amount of time most Americans spend dealing with distractions and then getting focused and back on track each day, which comes to a grand total of 5 full weeks in a year.”
- “Almost 90% of 290 undergraduates reported feeling "phantom vibrations," which were experienced an average of once every two weeks.”

Mental Health

- “30% of 18-44 year olds feel anxious if they haven’t checked Facebook in the last 2 hours.”
- “1 month away from Facebook leads to a significant improvement in emotional well-being. In an experimental study of over 1,600 American adults (who normally used Facebook for up to an hour each day), deactivating Facebook accounts led to a significant increase in emotional well-being (including a reduction in loneliness and an increase in happiness), as well as a significant reduction in political polarization.”
- “In just 3 years, there has been a quadrupling in the number of plastic surgeons with patients undergoing cosmetic surgery for the sake of looking good on social media (from 13% in 2016 to 55% in 2019).”

Relationships

- “Even the mere presence of smartphone can disrupt the connection between two people, having negative effects on closeness, connection, and conversation quality.”
- “People overestimate their ability to correctly interpret sarcasm, humor, or sincerity over text communication, and this means people tend to believe they can communicate over e-mail more effectively than they actually can.”
- “50% of Americans report that their partner is often or sometimes distracted by their devices when they are trying to talk to them.
- “89% of cellphone users admit to using their phones during their last social gathering.”

Politics and Democracy

- “More fake political headlines were shared on Facebook than real ones during the last 3 months of the 2016 US elections.”
- “Exposure to a fake political news story can rewire your memories: in a study, where over 3,000 voters were shown fake stories, many voters later not only “remembered” the fake stories as if they were real events but also "remembered" additional, rich details of how and when the events took place.”
- “Fake news stories posted before the 2016 US elections were still in the top 10 news stories circulating across Twitter almost 2 years later, indicating the staying power of such stories and their long-term impact on ongoing political dialogue.”

Systemic Oppression

- “Russia's IRA spread false information designed to create outrage about Black Lives Matter and deepen social division in the US. Research indicates that one of the IRA's major strategies was to use social media platforms to target conservative groups who supported the police or veterans and specifically feed them misinformation about BLM.”
- “With over 800 million users, TikTok promotes itself as a place for self-expression and unrestricted creativity, yet its internal documents reveal a policy of downgrading content from users who do not fit normative ideals of gender, race, class, sexuality, or able-bodiedness, with moderators urged to censor users with "abnormal body shape", "too many wrinkles", or whose environment shows signs of poverty such as "cracks in the wall" or "old decorations".”

Children

- “58 minutes per day is the average amount of time 2-4 years old spend on mobile devices.”
- “In a longitudinal study tracking over 200 children from the age of 2 years to 5 years old, children with higher levels of screen time showed greater delays in development across a range of important measures, including language, problem-solving, and social interaction. Analyses indicated that the level of screen time was significantly linked to the specific level of developmental delay 12 -14 months later. “

Your Life

The Power of Software

Unlike other engineering disciplines, software is effectively unconstrained by the laws of physics.

- Programming is an act of almost pure creativity!

The greatest limitation we face in building systems is being able to understand what we're building!

The Limiting Reagent

You are a rare commodity.

Revenue per employee rankings:

1	Apple	\$1.867 million
2	Facebook	\$1.394 million
3	Alphabet Class A Shares	\$1.3 million
4	Microsoft	\$902 500
5	Amazon	\$436 000

Sources: [Link](#), [Link](#)

Net income per employee rankings:

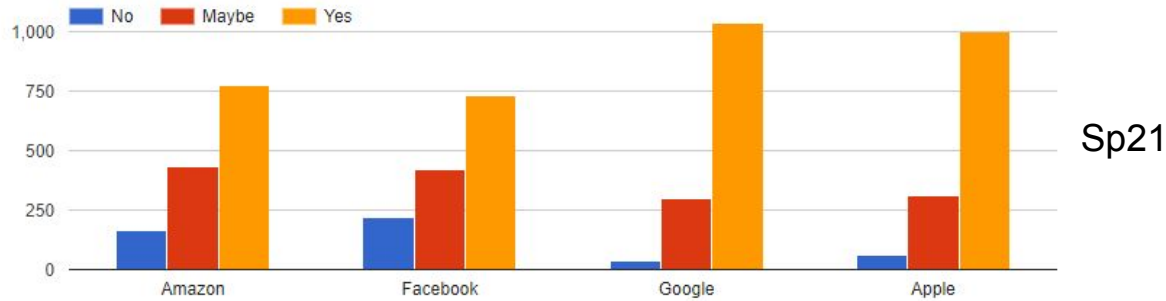
1	Facebook	\$446 100
2	Apple	\$390 600
3	Microsoft	\$291 400
4	Alphabet Class A Shares	\$270 300
5	Amazon	\$21 780

The skills you are building will be in high demand from companies, non-profits, government agencies, educational institutions, and more.

- The choice of how to spend your career is yours.

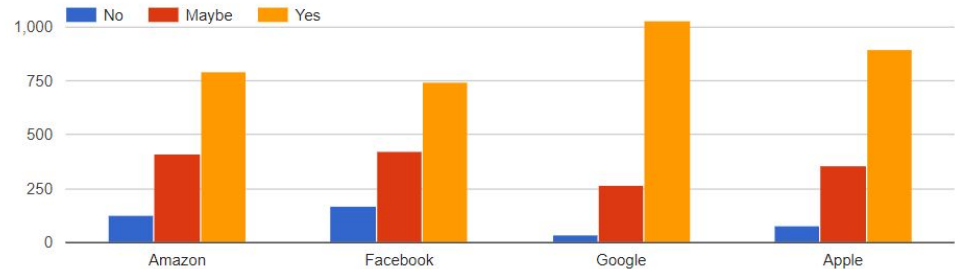
Some 61B Data (Sp 2019 vs Sp 2021)

If you were presented with the opportunity to take a job from a big-four company (Amazon, Facebook, Google, Apple) immediately after college would you?



If you were presented with the opportunity to take a job from a big-four company (Amazon, Facebook, Google, Apple) immediately after college would you?

Sp19



Steering the Course

Quite a lot of you will likely end up working at some sort of technology company at some point in your life.

There's nothing (IMO) wrong with working at profit driven tech companies.

- Please do realize that even as a rank and file employee, you have the power to effect change, particularly if you are paid in stock (because then you are a partial owner).

Let's see some examples.

Example 1: Google and the Censored Chinese Search Engine

From 2006 to 2010, Google operated a censored version of Google in China.

- Withdrew in 2010 in response to cyber attacks by the Chinese government on users of Google's services: "These attacks and the surveillance they have uncovered--combined with the attempts over the past year to further limit free speech on the web--have led us to conclude that we should review the feasibility of our business operations in China. We have decided we are no longer willing to continue censoring our results on Google.cn."

In Oct 2018, leaked documents published in [The Intercept](#) revealed a secret project by Google to re-enter the Chinese market.

- This new search engine would be censored, and also allow government officials to hypothetically track Chinese residents making undesired queries.

Example 1: Google and the Censored Chinese Search Engine

Some employee responses:

- After the leaks, access within the company to documents related to the project were curtailed: “Everyone’s access to documents got turned off, and is being turned on [on a] document-by-document basis,” said one source. “There’s been total radio silence from leadership, which is making a lot of people upset and scared. ... Our internal meme site and Google Plus are full of talk, and people are a.n.g.r.y.” [\[Link\]](#)
- Over 1400 employees signed a letter demanding more transparency, and at least five employees resigned in protest [\[Link\]](#).

Example 1: Google and the Censored Chinese Search Engine

Jack Poulson (a senior scientist who resigned): ([Link](#))

- “There are serious worldwide repercussions to this... what are Google’s ethical red lines? We already wrote some down, but now we seem to be crossing those.”
- Poulson said that he “very much agree[s] with the case Sergey made in 2010. That’s the company I joined, the one that was making that statement.” If the anti-censorship stance is shifting, he said, then he could no longer “be complicit as a shareholder and citizen of the company.”

Ultimately, in response to employee outcry, the project was cancelled [[Link](#)].

Example 2: Amazon and Climate Change [[Link](#)]

18 months + a few weeks ago, 6,772+ employees at Amazon publicly signed [a letter](#) demanding better responses to climate change by Amazon.

- Specifically, they want the company to adopt a shareholder resolution ([link](#)) to study how the company will adapt to and reduce its contribution to climate change.
- “Amazon is not a mere victim of climate change—its operations contribute significantly to the problem... Coal still powers Amazon data centers. Diesel, gasoline, and jet fuel still power package delivery.”
- “Amazon has the resources and scale to spark the world’s imagination and redefine what is possible and necessary to address the climate crisis.”

“Like other shareholders, they can file a resolution urging a particular corporate change that investors vote on at a company’s annual meeting.”

Time

You get some number of decades on the planet.

Each week is 168 hours.

Anecdotally, most of you will have much more free time after college than you do now.

- ~40 hours of work.
- ~56 hours of sleep.
- ~72 hours for everything else.

Spend your time wisely, in both your career and personal life.