CITS5551: Software Engineering Design Project Essay

Unintended Consequences of Software Applications and the Liability of Software Developers and Corporations

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In March 2018, three news organisations simultaneously published the evidence that Facebook gave unregulated and unauthorised access to personally identifiable information of more than 87 million users to the data firm Cambridge Analytica.[1,2] This discovery, among other faults, breaches and oversights in the software development domain, has driven a growing interest in the implications over software applications societal impact and risks to individual's privacy, rights and overall well-being.[3] Global technological advances, and the increased social networking capabilities provided by Web 2.0 technologies, has made way for more frequent examples of the law of unintended consequences: outcomes that are not the ones foreseen and intended by purposeful action of people and entities.[4] Software developers, product managers, upper-management and companies as a whole have a growing responsibility to consider how their software applications will be used, even outside the scope of what they were initially intended for. However, ethical guidelines, laws and other regulations remain ambiguous, and often unregulated or enforced in varying degrees globally. Financial, legal and cultural consequences of these breaches of public interest are varied and often non-existent. Therefore, it is crucial for technologists, researchers, and innovators to explore whether developers simply self-regulate, or if there needs to be meaningful contributions to the development of ethics, public policies and laws surrounding these issues.

Amazon is one of the largest technology companies with efficient and innovative products including AWS and Prime. The platform has enabled success for millions of small businesses trading through their platform. However, this has come with a plethora of criticisms,[5] and unintended consequences, including the slowing down of the physical retail market.[6] Uber and other transportation network companies were successful in their initial release because they were a more reliable and cheaper version of a taxi, leveraging the dominance of smartphones. But they have caused a noticeable

1 Harry Davies, "Ted Cruz using firm that harvested data on millions of unwitting Facebook users", *The Guardian*, December 11, 2015, accessed September 8, 2019, https://www.theguardian.com/us-news/2015/dec/11/senator-ted-cruz-president-campaign-facebook-user-data.
2 Hanna Kozlowska, "The Cambridge Analytica scandal affected 87 million people, Facebook says", *Quartz*, April 4, 2018, accessed September 8, 2019, https://qz.com/1245049/the-cambridge-analytica-scandal-affected-87-million-people-facebook-says/.
3 Michal Kosinski, et al. "Manifestations of user personality in website choice and behaviour on online social networks" *Machine Learning* 95, no.3 (2014): 357-380, https://link.springer.com/article/10.1007/s10994-013-5415.
4 Rob Norton, "Unintended Consequences", *The Library of Economics and Liberty*, accessed September 2, 2019, http://www.econlib.org/library/Enc/UnintendedConsequences.html.
5 Wikipedia contributors, "Criticism of Amazon" *Wikipedia, The Free Encyclopedia,* September 9, 2019, accessed September 10, 2019, https://en.wikipedia.org/w/index.php?title=Criticism_of_Amazon&oldid=914889052.
6 Travis Johnson, "Amazon Killed Brick and Mortar, So Why Is It Investing in Stores?", *Adweek*, July 15, 2019, accessed September 10, 2019, https://www.adweek.com/digital/amazon-killed-brick-and-mortar-so-why-is-it-investing-in-stores/.

increase in traffic congestion in many cities,[7] and induced a reduction in public transportation use, creating higher fares and lower investment in infrastructure.[8] Airbnb was initially put forward as a complement to the strong accommodation and tourism industries. However, investors and developers have bought millions of properties, with the sole purpose of turning them into temporary rental apartments. This has caused neighbourhoods to rapidly change, and residents forced out due to an unprecedented increase in rent prices in many cities.[9] All of these companies may have had an idealistic view of what their software applications were to be and do, but the unintended, and perhaps unexpected consequences of each have affected the overall functioning of society as well as some fundamental rights of the public.

Facebook is a prime example of unintended consequences in software. Facebook was originally intended as social networking service for Harvard students.[10] However, two years later it was opened to any member of the public aged 13 or over with a valid email address. Currently, Facebook has almost 2.4 billion users worldwide, adding on average 500,000 new users daily. What was initially developed as a small communications platform has now grown into one of the largest technology companies in the world.[11]

From 2013 to 2015, Cambridge Analytica, a data analytics firm, collected profile information from more than 87 million Facebook users without their active consent.[12] Cambridge Analytica was able to retrieve this information due to a loophole in Facebook's API that allowed third-party developers to access data from users of their apps, but also their friends network.[13] Facebook dictated in their documentation that this access should not be used non-consensually, and that the data could not be marketed or sold. However, Cambridge Analytica chose to ignore these stipulations, and built a targeted marketing database based on each user's individual likes and interests from the data. Using a personality profiling methodology, the company began offering its profiling system to multiple

7 Andrew Hawkins, "Uber and Lyft finally admit they're making traffic congestion worse in cities" *The Verge,* August 6, 2019, accessed September 10, 2019, https://www.theverge.com/2019/8/6/20756945/uber-lyft-tnc-vmt-traffic-congestion-study-fehr-peers.
8 Graham Rapier, "Uber and Lyft are having a terrible effect on public transportation, new research shows", *Business Insider Australia*, January 25, 2019, accessed September 10, 2019, https://www.businessinsider.com.au/uber-lyft-having-devastating-effect-on-public-transportation-study-2019-1?r=US&IR=T.
9 Sarah Holder, "The Airbnb Effect: It's Not Just Rising House Prices", *Citylab*, February 1, 2019, accessed September 9, 2019, https://www.citylab.com/equity/2019/02/study-airbnb-cities-rising-home-prices-tax/581590/
10 Wikipedia contributors, "Facebook", *Wikipedia, The Free Encyclopedia*, September 11, 2019, accessed September 12, 2019, https://en.wikipedia.org/w/index.php?title=Facebook&oldid=91522088.
11 Ibid.
12 Mike Schroepfer, "An Update on Our Plans to Restrict Data Access on Facebook", *Facebook Newsroom,* April 4, 2018, accessed September 11, 2019, https://newsroom.fb.com/news/2018/04/restricting-data-access/.
13 Ibid.

political campaigns. This caused public outcry, as users became increasingly concerned about the protection and privacy of their data. Facebook made a point to note that this scandal was not technically a data breach, this information was not hacked or leaked, and that users gave their consent.[14] But this does not consider the point in terms of user privacy and security; it should not matter whether their users' personal information was forcefully obtained or not.

Cambridge Analytica should not have taken advantage of the loophole in Facebooks API, but a large portion of liability arguably lies with Facebook due to their negligence of protecting their user's privacy. Developers at Facebook had exposed personal data not freely given by the user in sign-up and profile creation to third-party developers.[15] Journalist Aja Romano describes "…the factors that allowed Cambridge Analytica to hijack Facebook user data boiled down to one thing: no one involved in the development and deployment of this technology stopped to consider what the results might look like at scale".[16] The developers who built the API, the potential product managers who came up with the feature, and upper-level management at Facebook did not consider all of the ethical implications of the software that they were building.

Zeynep Tufekci, journalist and professor at the University of North Carolina, wrote on Twitter; "If your business is building a massive surveillance machinery, the data will eventually be used & misused…there is no informed consent because it's not possible to reasonably inform or consent."[17] One can condemn the misuse of this data and can argue that this is a violation of individual users right to privacy. But it illustrates a larger problem; that an unintended consequence of Facebooks free business model is that it has built massive data collection machines, with almost no control and regulations over how they are used. Additionally, most current data breach notification laws have created a separation between active breaches, where databases are compromised, and passive breaches,

[14] Paul Grewal, "Suspending Cambridge Analytica and SCL Group from Facebook", *Facebook Newsroom,* March 16, 2018, accessed September 11, 2019, https://newsroom.fb.com/news/2018/03/suspending-cambridge-analytica/.
[15] Jonathan Albright, "The Graph API: Key Points in the Facebook and Cambridge Analytica Debacle", *Medium,* March 21, 2019, accessed September 11, 2019, https://medium.com/tow-center/the-graph-api-key-points-in-the-facebook-and-cambridge-analytica-debacle-b69fe692d747.
[16] Aja Romano, "The Facebook data breach wasn't a hack. It was a wake-up call", *Vox,* March 20, 2018, accessed September 11, 2019, https://www.vox.com/2018/3/20/17138756/facebook-data-breach-cambridge-analytica-explained.
[17] Zeynep Tufekci (@zeynep), "If your business is building a massive surveillance machinery, the data will eventually be used & misused. Hacked, breached, leaked, pilfered, conned, "targeted", "engaged", "profiled", sold.. There is no informed consent because it's not possible to reasonably inform or consent." Twitter, March 18, 2018, 02:30am, https://twitter.com/zeynep/status/975076957485457408.

where users are being tricked into passing that data into unauthorised hands. But the result is the same; users' private data is compromised.[18] This illustrates a large gap in current legislation.

The examples described are just a few instances of software being used for unintended, and often nefarious purposes. But arguably there is no way to definitively know every possible outcome of the development and use of every software application and code. It is up to those who design and build the software applications to attempt to do the right thing. But in the case of employees of Cambridge Analytica and Facebook, did they act negligently or unethically? Perhaps, but additional questions need to be asked and addressed. Does each developer know, or have the ability to predict how their software will be used? Where does this liability lie within an organisation? It is a large amount of responsibility and pressure to place solely on individual developers building the software at Facebook or writing the programs that analysed the data at Cambridge Analytica. Particularly when it is difficult to navigate what's right and wrong, if you're not in a decision-making position, if you're pressured to meet deadlines, or when your job security and livelihood is threatened.

In 2018, the annual Stack Overflow developer survey posed questions addressing ethics in software development.[19] One question asked; "*Do developers have an obligation to consider the ethical implications of their code?*", where almost 80 percent responded 'Yes'. The last question asked; "*Who is ultimately responsible for code that accomplishes something unethical?*". About 58 percent responded upper-level management, 23 percent said the person who came up with the idea, while only 20 percent felt they themselves as a developer were personally responsible. This anecdotal evidence illustrates that while developers recognise that they should be thinking about public interest and ethics in the software they're creating, ultimately, they believe the weight of responsibility falls on upper-level management.[20]

It is easy for individual developers to pass the burden to upper-level management. Nonetheless, developers themselves still need to be aware of the ethical risks their code may give way for, and actively report these to upper-level management. Management may not be educated in spotting defects, or simply they may just not be aware or have looked over any vulnerabilities in the software. A standardised code of ethics could provide context and framework for professionals to fall back on if

[18] Ido Kilovaty, "The Cambridge Analytica Debacle is not a Facebook "Data Breach." Maybe It Should Be", *TechCrunch,* March 18, 2018, accessed September 11, 2019, https://techcrunch.com/2018/03/17/the-cambridge-analytica-debacle-is-not-a-facebook-data-breach-maybe-it-should-be/

[19] "Developer Survey Results 2018", *Stack Overflow*, accessed September 10, 2019, https://insights.stackoverflow.com/survey/2018/#ethics.

[20] Jennifer Riggins, "Are Programmers Ethically (and Legally) Responsible for Their Code?", *The New Stack,* 16 August 2018, accessed September 10, 2019 https://thenewstack.io/are-programmers-ethically-and-legally-responsible-for-their-code/.

they are feeling uncertain about any part of their job responsibilities, or to give guidance on how an individual should act in ethically ambiguous circumstances, and even to act as a resource they can use for any future discussions.

Companies such as Microsoft, IBM, and Google, have already published their own ethical principles. Other companies, including Facebook and Amazon, have opted to keep an arm's length approach to ethics by joining associations, such as Partnership on AI (PAI) and the Information and Technology Industry Council (ITI) which have published statements containing ethical principles. But these principles are voluntary, have no reporting requirements, objective standards or oversight.[21]

Much like the Australian Computer Society (ACS)' Code of Ethics/Professional Conduct,[22] which identifies six core, ethical values and their associated requirements for professional conduct. ACS states that their Code of Professional Conduct has some relevance to professional standards legislation, where a failure to abide could be used as grounds for a claim of professional negligence, and revocation of membership.[23] The first value, and the one which takes precedence over the others in a situation of conflict of values,[24] is described as "The Primacy of the Public Interest". This instructs members that they "*...will place the interests of the public above those of personal, business or sectional interests".* This value is arguably idealistic; software developers do not receive income from public interest, rather they are usually paid by the aforementioned "*business and sectional interests*". The interests that these businesses serve are most often the ones of its shareholders. Businesses will often act in ways that are detrimental to public interest in favour of the interests of their shareholders.[25]

These employee pressures are not unique to software developers. Doctors, engineers and lawyers are employed by businesses in a similar way to developers, but there is a key difference in that those professions have professional bodies or closely related registration bodies that control access to those skills, backed by the law.[26] The majority of Australian and global developers work in roles for which there is no institutional gatekeeper or regulator of any kind, legal or otherwise. Moreover, upper-level management often take their employee obligations of their management role more seriously than the

[21]James Arvanitakis, "What are tech companies doing about ethical use of data? Not much", *The Conversation*, November 28, 2018, accessed September 11, 2019, https://theconversation.com/what-are-tech-companies-doing-about-ethical-use-of-data-not-much-104845.
[22] "ACS Code of Ethics", *Australian Computer Society*, accessed September 10, 2019, https://www.acs.org.au/content/dam/acs/acs-documents/Code-of-Ethics.pdf.
[23] "ACS Code of Professional Conduct", *Australian Computer Society*, accessed September 10, 2019, http://teaching.csse.uwa.edu.au/units/CITS3200/ethics/ACS-Code-of-Professional-Conduct_v2.1.pdf.
[24]Ibid.
[25] See for example, Robert Hinkley, "Profits vs. Public Interest", *Global Policy Forum*, June 11, 2002, accessed September 11, 2019, https://www.globalpolicy.org/component/content/article/221/46863.html.
[26] For example, the Legal Practice Board of Western Australia.

professional obligations set out by the ACS or other codes and standards of practice. The ACS code is not something that developers have any real obligation to comply with, and at best, it is an educative tool.[27]

Professionalising software development in a similar fashion to a lawyer or doctor could answer the problem of how to enforce individuals to abide by a code of ethics or professional standard. Where if they breached this code, there may be fines and penalties, such as a ban from working in software development in a similar way to being disbarred or having a medical license revoked. However, the only way in which this would work is if having a professional certification was a requirement by law.[28] This concept has been proposed and researched before by the Association for Computing Machinery (ACM) in 2000, but they concluded that "The ACM should take a stand against government efforts to require the licensing of software engineers as impractical, potentially ineffective with respect to safety-critical projects, and potentially detrimental with respect to economic and other societal and technological factors". [29] More research and discussion would be needed from the industry and lawmakers to find a reasonable and achievable certification, with fair penalties to be implemented.

Currently, in theory, software developers could be liable for defects in their software that could lead to misuse under negligence, or deceit in tort law in Australia. However, a plaintiff would need to establish that there were a number of mitigating factors that may be cumbersome and difficult to prove. There are currently no reported cases in Australia that establish a duty of care owed by software developers to end users of the software.[30]

The onus is arguably on governments to regulate the behaviours and actions of large technology companies and their employees. In relation to data privacy, the Australian government has currently kept its focus on developing the Australian *Government Data Sharing and Release Legislation*; a

[27] Robert Merkel, "Codes of Ethics – worthy sentiments, but no teeth when it comes to the public interest", *The Conversation*, October 9, 2015, accessed September 10, 2019, https://theconversation.com/a-code-of-ethics-in-it-just-lip-service-or-something-with-bite-32807.

[28] Hen Ngee Mok, "A Review of the Professionalization of the Software Industry: Has it made Software Engineering a Real Profession?" *International Journal of Information Technology* 16, no.1 (2010): 61-75, https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=2368&context=sis_research.

[29] John Knight et al, "ACM task force on licensing of Software engineers working on safety critical software", *Association for Computing Machinery,* July 2000, accessed September 10, 2019, http://kaner.com/pdfs/acmsafe.pdf.

[30] Malcom Burrows, "Are software developers liable for defects in their software?", *Dundas Lawyers,* December 20, 2016, accessed September 11, 2019, https://www.dundaslawyers.com.au/are-software-developers-liable-for-defects-in-their-software/.

principle that's covered in legislation elsewhere.[31] The law needs to instead focus on data privacy as a fundamental right, not just a consumer right. As such, we need greater focus on fairness, transparency and shared benefit in our data privacy legislation with improvement to the current *Australian Privacy Act 1988*.[32] Although the legislations have some similarities, Australia could look to the EU *General Data Protection Regulation* (GDPR),[33]on the topics of consent, notification of data breaches, and their large fiscal infringements for breach of these regulations. The GDPR additionally gives a right for an individual to require an organisation to give them back a copy of their personal data or to send this data to another organisation, something which should be employed in our own legislation.

Although there has been recent focus on data privacy and security issues, leading to GDPR and the beginnings of some change, there needs to be further investigation into unintended consequences and their broader societal repercussions beyond data privacy. Software has become too deeply entrenched in our everyday lives for it to remain unregulated. Codes of ethics help with general guidance, but they need to somehow be enforced to make any real impact. Companies like Amazon, Uber, Airbnb and Facebook have proven that they do not place enough importance on considering the unintended consequences or real-world implications of their products and services. Often, they focus on revenue rather than the rights, safety and security of their users and the general public. Unfortunately, the technology industry has long resisted such regulation, and created the appearance that its own self-regulation would solve problems. This has not been effective, since technology companies do not have the incentive to follow their own regulations or guidelines. These self-regulations, if they do develop, only arise after a public uproar seen with something like the Cambridge Analytica scandal. This creates a reality where users are vulnerable, and companies do not seem to take any preventative measures. It is crucial for technologists, researchers, and lawmakers to make meaningful contributions to the development of ethics, public policies and laws surrounding software development. This in some cases, needs to be at an individual developer level, and a corporate level with fiscal and legal consequences.

[31] *Australian Privacy Act* 1988 (Commonwealth). Consolidated March 12, 2014, https://www.legislation.gov.au/Details/C2014C000761
[32] Ibid.
[33] *General Data Protection Regulation* (EU) 2016/679, Consolidated May 25, 2018, https://gdpr-info.eu/.

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