**Alexa Knows More than You Tell Her: How Corporations Control Consumer Data**

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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The term “the internet of things”, commonly referred to as IoT, refers to computers, connected to the internet, that are embedded in household items, cars, and other objects that were in use before the internet. IoT devices range from thermostats and fitness trackers to cars. IoT devices are spreading rapidly and produce a huge amount of information. If the current trend holds, there will be about 50 billion devices connected to the internet worldwide by the year 2020 (Federal Trade Commission, 2015). All of the devices produced by a relatively small IoT company produce an average of 150 million points of data (Federal Trade Commission, 2015). IoT companies will collect huge amounts of possibly extremely personal consumer data, such as sensitive health information, driving habits, and whether or not you are at home (Federal Trade Commission, 2015).

The collection and retention of data collected by IoT systems present privacy risks that did not previously exist.Privacy, in this case, means the right of individuals to have a measure of control over the flow of personal information about themselves. Examples of information that falls under this definition of personal privacy include information about one’s medical records, voting history, academic records, and daily habits. Privacy applies differently to information depending on the sensitivity of that information, the context in which it is shared, and people’s expectations; for example, people expect that their medical records would be kept more private than their recent shopping history.

IoT privacy risks firstly include the fact that companies can use data collected by IoT devices, that is not apparently sensitive, to infer private information and thus give those corporations significant control over their users’ privacy. Companies have put a lot of effort into predicting what consumers will likely buy based on the information that they have and IoT devices can provide an unprecedented amount of information that they can analyze. Once corporations collect information from IoT devices about their users, they will effectively have exclusive legal control it. There is a whole industry around buying and selling consumer data already and there is little to no regulations governing buying and selling consumer information. Another privacy risk is the fact that many companies that store data on their users have historically misused, by violating consumer privacy, and insufficiently protected that data; IoT device manufacturers will likely behave the same way. All this begs the question: How should the data produced by IoT systems affect personal privacy? The widespread use of IoT devices will make corporations effectively own a large amount of their users’ personal information, which the companies could easily misuse or put their users’ personal privacy at risk without significant legal ramifications.

To explore this question, I will use contextual integrity to analyze the situation. Contextual integrity is a theory which states that every social context has norms about how information should be shared and what information is appropriate to share and that there is no context where anything goes (Nissenbaum, 2004). Whenever one of these norms is violated or information is revealed in the wrong context, a person’s privacy has been violated (Nissenbaum, 2004). For example, if you share personal information about yourself, like severe health problems, to a friend, you would not expect them to share that with others. If they did share such personal details, without appropriate reasons, it would violate the social norm of keeping private information about one’s friends secret. Another example is when you go to a medical professional. They are expected to not disclose your medical history; this norm is enforced by law.

I will use contextual integrity to highlight that IoT systems mostly lack social norms governing the flow of consumer data. When the social norms for information flow described by contextual integrity are violated, I will also show that related industries lack sufficient legal protection for their consumers. Also, I will cover how related industries can violate privacy in new ways using data mining.

The data collected by IoT devices, though maybe not apparently sensitive, can be used to infer private information and thus give corporations significant control over their users’ privacy. Data mining is the process of taking large amounts of data and analyzing it to find patterns or relationships that exist between members of certain data points (Keating, 2008). Possible applications of this technique include figuring out if a company is insolvent, if a prospective employee will likely be successful, and what customers will likely purchase which products (Keating, 2008). This technique allows companies to o­­­­­btain sensitive information about their customers that the customers did not directly provide, thus allowing them to obtain private information outside of an appropriate context. Companies are already using data mining to figure out information about their consumers given different circumstances.

Retail stores have used data mining to infer private information. The retailer Target has a sophisticated model for predicting how much money a person will likely spend on different items (Corrigan, Craciun, & Powell, 2014). It has proven to be pretty accurate for at least a few types of applications. One way that they used data mining is predicting when a woman is pregnant. Target researchers found that pre-natal mothers usually bought certain items regularly, such as cocoa-butter lotion, a large purse, and magnesium supplements, and came up with a scoring system to predict the likelihood of a woman being pregnant (Corrigan et al., 2014). It is so accurate that Target knew that one teen girl was pregnant before her father did (Lubin, 2012). This is disturbing and is an example of how data mining can violate consumer privacy as defined by contextual integrity. Typically, women keep the fact that they are pregnant to be only known by close family and friends and do not want other entities like retail stores to know. The information that women provide by what they purchase in the original context might be innocuous, but in the surrounding context of other people’s purchasing decisions, that information reveals additional data that stores interpret in inappropriate ways in this new context.

IoT devices present a huge source of new information that can be analyzed using data mining and thus gives companies more control of their customer's privacy. The data from an IoT lighting system could be used to tell when people get home from work, when they go to bed, and when they get up in the morning. Smart fridges that detect what food items people regularly eat could potentially tell how much they likely weigh, whether or not they are lactose intolerant, whether or not they have diabetes, or if they have heart problems by they eat. All of this evidence might suggest that I am arguing that companies should not use data mining. However, I believe companies should be able to use data mining to improve their services, but they should be limited in what information they mine and use and how closely they link it to individual consumers. Without restrictions on data mining, companies would store and have access to this information and would be able to violate consumer privacy of the information given to them by consumers.

Once corporations collect information from IoT devices about their users, they will have complete control that information. The control that companies have over the data collected about their customers includes the right to sell it, mining it for more information, and releasing it to governments and other third parties. This allows companies to release information in inappropriate contexts and thus violate consumer privacy as defined by contextual integrity. As it stands now, companies can do whatever they want with the data they collect about customers.

Search engines are an example of companies that collect information about their users and have control over that information. Not too long ago, Aol released search results to the public that were organized by user ID; people were identifiable from the results (Barbaro & Zeller, 2006). This violated the privacy of Aol’s users, because users expect their search history to be kept only by the search engine. Aol did not face legal consequences for this release and any attempt to pursue such action would probably fail. Once search engines collect information about users they can do practically anything they want without significant legal ramifications (Grimmelmann, 2007). It may not even be a significant legal risk for a search engine to use their customer data in a way that is against their own privacy policy (Grimmelmann, 2007). This lack of regulation allows search engines to violate the contexts that they themselves have defined in their privacy policy without any legal ramifications.

Other companies like data brokers collect, buy, and sell personal information legally. Data brokers are companies that collect information on consumers, mine it for additional information, and sell it. Data broker companies are not widely known; Acxiom and Datalogix are two of them. Their customers range from antivirus companies to political campaigns (Rostow, 2017). A 2014 Federal Trade Commission report found that the data brokers that were studied gathered information from publicly available sources, such as government records and social media, as well as commercial sources; none of them collected information directly from people (Federal Trade Commission, 2014). The information that data brokers collect while validly used in their original contexts, like publicly available records and information collected about customers by companies for their internal use, should not be shared in this new context. Data brokers sell information for different purposes including marketing, risk mitigation, and people search, a way of finding a person’s contact information, without interacting with the people they collect information about (Federal Trade Commission, 2014). Thus, most people don’t see that information about themselves is being bought and sold, which raises questions about whether or not companies should buy and sell this information in this new context.

Buying and selling information about consumers is perfectly legal. With a few exceptions, there are no laws regulating the data broker industry in the United States on the federal level (Rostow, 2017). Even on the state level, there has been little done to regulate the data broker industry (Rostow, 2017). This highlights the fact that if these companies violate consumer privacy, they will likely not face any legal repercussions. Given the quantity and quality of the information produced by IoT systems, it is likely that data brokers will want to obtain IoT data either by buying it or acquiring IoT device manufacturers. Also, IoT service providers will be tempted to sell that information because of the amount they can pad their profit margins. This would give data brokers a new source of data that was previously unavailable and new opportunities to violate consumer privacy as defined by contextual integrity.

Since existing companies have control over consumer data, IoT service providers will likely have the same control over data produced by their customers. IoT service providers may appropriate the social norms of sharing consumer data from similar industries. All the evidence I provide might make it seem like I am arguing that companies shouldn’t have control over consumer data. Although companies should have control over their customer data, they should not sell, release it to third parties, or reveal it in inappropriate social contexts without their customers’ knowledge or consent.

Companies that store their users’ information have historically misused and insufficiently protected that data. While even the most robustly developed software ends up having security vulnerabilities, companies have exposed consumer data to hackers by not building sufficient security measures into their products, thus allowing unauthorized third parties to access and release information in contexts that would harm, disturb, or embarrass consumers.

Companies have released personal data on consumers without their knowledge or consent to different parties that could use that information to directly harm those consumers. PRISM was a secret government program by which the FBI obtained information on people directly from IT companies without a warrant (Gellman & Poitras, 2013). Companies like Yahoo, Google, and AOL have participated in the FBI’s surveillance program (Gellman & Poitras, 2013). This was a case where consumer privacy as defined by contextual integrity was violated. Existing norms state that law enforcement should have access to private information in criminal investigations even without the person they are investigating’s knowledge or consent, but there should be some restrictions on that power. For example, it is the current norm that police should have a warrant before obtaining information from someone’s private email account. Even though there was a law which made PRISM legal, PRISM violated the expectations of consumers and thus caused a public outcry. Another example of inappropriate use of consumer data is the time that InfoUSA sold information on elderly people that ended up being used by criminals to steal their life savings (Duhigg, 2007). Companies continue to offer services that are used to facilitate identity theft, while collecting millions of dollars, despite evidence that their services are used to perpetrate fraud (Duhigg, 2007). The InfoUSA incident shows how companies are willing to sell information on consumers for profit even though third parties will likely use that information to directly harm them.

Companies in the past have insufficiently secured consumer data, thus inadvertently providing third parties access to sensitive information. From May through July, a credit reporting agency called Equifax reported a massive security breach in which hackers stole the names, social security numbers, birth dates, and addresses of U.S. customers (Equifax, 2017). Equifax initially estimated that 143 million Americans were affected by this breach (Equifax, 2017). The scale of this breach is concerning, to say the least. According to their website, when the security vulnerability was disclosed by Apache Struts, the security team was aware of it and were taking measures to secure their vulnerable systems (Equifax, 2017). This seems implausible. Apache announced this vulnerability on March 7, 2017, and released a patch for it the same day (Khudairi, 2017). Equifax had two months to secure their applications, but they only patched their applications after they discovered the method of attack (Equifax, 2017). If Equifax prioritized protecting consumer data, they would have patched their web applications significantly sooner. This incident shows a limitation of contextual integrity. Contextual integrity does not cover the responsibilities of persons to ensure that the information that they have is not taken by other parties as Equifax has here. While that responsibility could be added to social norms concerning information flow, contextual integrity would do well to describe how securely the parties involved should keep data secret. Consumers expect companies will keep their credit card information and social security number more secure than their purchase history.

In its short life, IoT companies have already left consumer data at risk by insecurely storing and communicating it. Security standards are either fragmented or not present at some IoT manufacturing companies and some IoT devices have no security measures built into them (Chen, 2017). Thus, many IoT devices present little to no obstacles to hacking. A few years ago, TRENDnet, Inc. marketed and sold IoT baby monitors as secure that were not so secure (Riga, 2017). When hackers access the baby cameras in 2012, they posted footage on the internet and authorities launched an investigation that found that when login credentials were transmitted, they were not encrypted and thus attackers were capable reading them (Riga, 2017). This situation is likely to continue. According to a report by the Federal Trade Commission, IoT faces unique security challenges including new companies lacking security experience, the inability to update device software, and companies’ lack of willingness to secure and fix low-cost, low-profit margin-devices (Federal Trade Commission, 2015). This situation will allow many more third parties, such as hackers, to access and disseminate information outside of their proper social norms than if companies put more effort into securing them.

Since existing companies have historically misused and insufficiently protected consumer data, IoT companies will likely do the same. All of this evidence might suggest that companies can’t be trusted with consumer data. While there are many companies that have taken adequate measures to protect consumer data and don’t misuse it, there have been several notable instances where the information released is damaging. So, there should be some legally binding expectations about how companies will use and protect consumer data.

The widespread use of IoT devices will make corporations effectively own a large amount of their users’ personal information, which the corporations could easily misuse or put at risk without significant legal ramifications. Corporations can mine data to gain access to more personal information about their users than what their users explicitly gave them. If the data that IoT companies collect is misused, the users who produced that information will have little to no legal recourse.

Currently, this new technology lacks social norms for the flow of personal information. It will likely borrow contexts from existing ones. For example, biometric information will likely borrow contexts from existing medical practices. In some cases, existing informational norms will be adequate, but there will be many in which it is not. Therefore, the industry and governments should form new informational sharing norms. Companies should be able to collect and mine data on their customers so that they can improve their services, but they should be limited in what they can do with it. For example, companies should not be able to sell or release consumer data on a whim. Corporations should also have the explicit legal responsibility to protect their consumer data from malicious hackers. These legal responsibilities should be different corresponding to how sensitive that information is. Future research on the topic could take the direction of looking at existing legal principles on privacy and framing the problem in actor network theory to get a better perspective on the parties involved.

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