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Assistance from Alexa: The social and material benefits of the Internet of Things

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Imagine a woman named Alex, living in a smart city. She wakes up and opens her phone. An app tells her traffic is relatively light, and that she should drive to work today.[1] The same app automatically routes her to an empty parking spot it has found near her building.[1] The smart-meter connects to her phone and asks if she wants to pay for parking until the time she usually leaves work.[1] She agrees and walks inside. There is no need to hold up her badge because the facial recognition system at the door recognizes her, and the elevator automatically takes her to the floor of her office.[2] On her way home her thermostat connects with her car's location on her phone and sets the temperature to the one she prefers just before her arrival. She comes home and takes out the trash into a smart trash receptacle that is now full.[1] Instantly it sends the waste management service a notification to pick up trash tomorrow.[1] Smart cities like this one may seem like a thing of the future, but the Internet of Things is here and rapidly developing. The National Science Foundation has even committed more than $60 million to a smarter cities' initiative.[3]

The Internet of Things is also impacting lives on a smaller scale than cities. Many people Internet of Things products in their everyday lives. Google Home systems connect to smart lights, smart coffee makers, thermostats, and security systems, to make everything available by voice command.[4] Fitbits track steps, calories, sleep, and heartrate to help users stay motivated and find health patterns in their life.[5] The North American Internet of Things consumer

1. Maddox, Tina, "Smart Cities: A cheat sheet." *Tech Republic* July 16, 2018.
2. Barendrecht, Arie, "The Future Is Now: Five Smart Building Features Transforming Today's Workplace" August 31, 2017.
3. "NSF commits more than $60 million to Smart Cities Initiative" *NSF* September 26, 2016.
4. "Google Home" *Google Store*.

electronic market alone is expected to grow from $90B in 2017 to $180B in 2022[6]. This growth shows people are rapidly adopting these products into many aspects of their lives.

Despite this increase in popularity, there is limited research on why consumers are adopting these technologies so quickly. There are a few articles on why users adopt such technologies, and many articles on the limitations of the Internet of Things, specifically about biases in the products and privacy flaws. By combining and expanding on these separate aspects of research, I will explain the complex reasons that people adopt the Internet of Things into their lives. I will examine things from a user perspective and see why consumers decided to invest their money into these expensive products rather than others. I will argue that people incorporate the Internet of Things into their lives because they expect the products to make their lives easier, increase their sense of self-esteem and belonging, strengthen their social connections, and possibly bring them excitement. I will also describe how the Internet of Things gratifies these needs, both through the products and surrounding social trends. While there are many benefits to the Internet of Things, I will argue that sometimes products do not live up to expectations. They are less perfect at fulfilling needs due to bias and security flaws. This failure to live up to expectations creates user dissatisfaction and could lead to people using these products less or not at all. However, the popularity of Internet of Things products is dramatically increasing, and the continued use of these products shows that the benefits of these products outweigh the flaws for many users.

It is important that we expand our knowledge of the Internet of Things because this kind of technology is becoming increasingly popular with many groups of people. Businesses, consumers, and manufacturers, even in traditionally low-tech industries like farming, are taking advantage of the benefits.[7] The Internet of Things has the potential to become ingrained in our

5. "Our Technology" *Fitbit.*
6. Columbus, Louis, "10 Charts That Will Challenge Your Perspective of IoT's Growth," *Forbes.*
7. Krotov, Vlad, "The Internet of Things and new business opportunities," *Business Horizons,* 60 no. 6 (November-December 2017): pages 831-841.

society, because it will connect many devices together, sometimes at a city-wide level.[7] For example, Alex may be required to use the smart meter if she wants to park in public spaces. It is important to understand what the benefits of these devices are and also the possible drawbacks, so people can make self-aware decisions. This will allow us to take full advantage of the many benefits these products offer and protect ourselves from potential flaws.

What is the Internet of Things?

The Internet of Things is a category of technology that can be difficult to describe. It contains everything from Siri to t-shirts that keep track of heart rate and other vitals. Some products are commonplace and may even seem mundane. Other devices seem like they belong in a science fiction movie. The Internet of Things is distinct because it is a network of products.[8] Devices share collected data with their databases and also other devices.[8]

The Internet of Things stretches into almost every aspect of human life. It is an incredibly broad group of products, but some basic categories are wearables, building and home automation, smart cities, health care, smart manufacturing, and automotive.[8] Vlad Krotov uses a socio-technical lens to define the Internet of Things.[7] He explains they function "as a complex socio-technical network located in physical, technical, and socioeconomic environments." [7] These devices impact both businesses and consumers.[7] They have shaped the way entire industries do business and even altered how our legal systems function because they are so wide spread and novel.[7] According to Bruce Weinberg et al. it is characteristics rather than categories that determine if something is a part of the internet of things.[8] These characteristics are that items "transmit data via the internet," and that they, "enable more of the physical and natural world to be integrated into…the internet."[8] Popular examples include Fitbits, that help users track their health,[9] Nest home thermostats, Google Home assistants, the Amazon Alexa voice service, and

8. Weinberg, Bruce, George Milne, Yana Andonova and Fatima Hajjat. "Internet of Things: Conveniene vs. privacy and secrecy." *Business Horizons*58, (2015): 618. https://www-sciencedirect-com.libproxy.scu.edu/science/article/pii/S0007681315000865?via%3Dihub
9. "Why Fitbit" *Fitbit.* https://www.fitbit.com/whyfitbit

smart watches. These devices are all commonplace, and for younger people especially they do not seem incredibly novel. However, they link to a larger idea of the interconnected Internet of Things.

Uses and Gratifications Theory

Next, I will explain uses and gratifications theory, the theory I use to examine why people adopt the Internet of Things. Uses and gratifications is an influential theory in the field of communications.[10] It explains why consumers choose to use specific forms of media, like a certain television program.[11] It is unique because it assumes the audience plays a strong role in choosing the media they consume.[10] They are goal-oriented, and actively consume media that fits their needs. [12] In addition, the theory believes not all users are homogenius.[10] Individual traits such as social roles and life circumstances change how people select and react to their media.[10] For example, a study of college students revealed that students who were more apprehensive about traditional communication had an unfilled social need, and were more likely than others to use Snapchat to fill it.[12] In addition, the more needs that Snapchat fulfilled for the student, the more satisfied they were with the platform.[13] User needs, like those filled by Snapchat, may vary even on a day-to-day or person by person level.[10]

Uses and gratifications theory states that people who adopt media or technology are, “not passive, inert or submissively duped by messages originating from media sources.”[10] They have power and control over what they participate in.[14] For example, in the Snapchat example, college students were not uniformly satisfied with Snapchat, but instead their responses depended on

10. Danesi, Marcel ed. "U" in Encyclopedia of Media and Communication University of Toronto Press, 2013: 688-692.
11. Kim, Yonghwan, Youngju Kim, Yuan Wang, and Na Yeon Lee. "Uses and Gratifications, Journalists' Twitter Use, and Relational Satisfaction with the Public. Journal of Broadcasting & Electronic Media 60 no. 3, (September 2016): pages 503-526.
12. Mclean, Grace, and Kofi Osei-Frimpong, "Hey Alexa...examine the variables influencing the use of artificial intelligent in-home voice assistants," *Computers in Human Behavior* 99, (October 2019): 28-37.

how many personal needs the app filled.[15] This level of audience control is a large break from previous media theories.[10] Traditional theories believe that communication and power only flow from the producer to the consumers.[10]

While the needs of consumers vary significantly based on the person and the environment, they are generally broken up into five categories.[10] The first category, cognitive needs, is related to gaining knowledge and understanding of the world.[10] These needs can also be called utilitarian needs. An example is a woman using an in-home voice assistant to tell her the traffic and weather for the day.[12] Affective needs are related to creating, "aesthetic, pleasurable and emotional experiences."[10] Also referred to as enjoyment, users engage with media to feel joyful emotions in ways like using Snapchat to stay connected with friends.[13] The third type of needs is integrative needs, which help users with self-esteem and confidence.[10] Purchasing a trendy luxury good like a Google Home assistant can improve self-esteem and create a sense of belonging.[12] Social needs are related to strengthening contact with others.[10] Snapchat does this by creating disappearing photos that allow users to share their authentic self with others.[13] Lastly, escape related needs provide a distraction from the present.[10] These five types of needs are considered an overview of needs consumers would use media to fulfill, and I will examine how users might expect the Internet of Things to fill them.

Media sources fulfill user needs in multiple ways.[10] The first way is by providing content.[10] The second way is by when a user simply consumes media, by visiting a specific site, watching a certain program, or interacting with a device.[10] The third way is the social context in which a person consumes media.[10] An example of social context is how TV is usually watched at home alone or with a group of friends or family, whereas movies are watched in public theaters.[10] There are also four distinct categories of gratifications that media provides: diversion,

13. Punyanunt-Carter, Narissa and J.J. De La Cruz. "Investigating the relationships among college students' satisfaction, addiction, needs, communication apprehension motives, and uses & gratifications with Snapchat." Computers in Human Behavior 75 (October 2017): pages 873-874.

personal relationships, personal identity, and surveillance.[10] Diversion is the way media provides an escape from everyday life and allows people to escape emotions such as stress and sadness.[10] This type of gratification is very relevant today. One writer explained our fascination with escaping through the media by saying, "people lose their minds in the perfect worlds shown in the movies, and they forget how to leave their imagination on the screen and come back to the real world, when the season is over."[16] Personal relationships refer to the ways that media can help bring people closer together, and how it can serve as a sort of social interaction if someone is lonely.[10] Personal identity is the way media allows consumers to explore the world from different points of view and affirm or challenge their views, values, and opinions.[10] For example, social media provides a new level of agency for children and teens to create their own identity and interact with others, as they put many images on their profiles with no input or regulation from adults.[17] Surveillance gratification is the way that media allows citizens to be informed about political, economic and social events, and to learn more about the world around them.[10] These categories of gratifications are a start, but there are also many other gratifications users derive from media.[10] These gratifications differ than the needs listed above because they are what the media actually provides, rather than what consumers hope it will provide.[10]

Users may not always get what they expect to out of media, which is why uses and gratifications theory differentiates between gratifications sought and gratifications obtained.[10] Gratifications sought are what people expect to get out of their media, while gratifications

14. Mclean, Grace, and Kofi Osei-Frimpong, "Hey Alexa...examine the variables influencing the use of artificial intelligent in-home voice assistants," *Computers in Human Behavior* 99, (October 2019): 29-30, https://www-sciencedirect-com.libproxy.scu.edu/science/article/pii/S0747563219301840?via%3Dihub
15. Punyanunt-Carter, Narissa and J.J. De La Cruz. "Investigating the relationships among college students' satisfaction, addiction, needs, communication apprehension motives, and uses & gratifications with Snapchat." Computers in Human Behavior 75 (October 2017): pages 870-875.
16. Sode, Raajas, "Why Digital-Escapism might be worse than Social Media addiction." *Medium*. March 13.2018. https://medium.com/@RaajasSode/why-digital-escapism-might-be-worse-than-social-media-addiction-c9d2c6992384
17. Renner, Nausicaa, "How Social Media Shapes Identity" *The New Yorker*. August 8, 2019.

obtained are the benefits they actually receive.[10] The gap between gratifications sought and obtained is usually a good indicator of how satisfied a user will be with a media source.[10] If a product exceeds expectations consumers will likely continue to use it, and they will develop a habit of consumption.[10] However, if it falls short they will move on to something else.[10]

Uses and gratifications theory has been used to examine many types of media and technology.[12] It began as a way to understand traditional media such as radio and television.[12] It has more recently been used to gain insight about newer media such as online games, social media, and the internet.[12] For example, it has been shown that IM is used mainly for, "social entertainment purposes." [10] This new media is slightly different than traditional media because it tends to be more interactive, and the line between producer and consumer is much less clear.[10] Users even have the ability to distribute their own products.[10] There has also been some research applying uses and gratifications theory to the Internet of Things, and using this to explain why new consumers are adopting these products so rapidly. I will expand on this research and use this theory to describe how the devices in the Internet of Things provide gratifications, and what needs customers expect to be filled by these devices

Needs Fulfilled by the Internet of Things:

Utilitarian Needs:

The first point I will argue is that users adopt Internet of Things products because they are useful and make life more efficient. One way they do this is by allowing people to control things remotely. For example, with the Google Home device, you can control the lights and door locks while you are away. This would mean never wondering if you remembered to lock the door when you left, or if you accidently left a light on. They also allow users to multi-task.[8] With voice activated products users can continue working on their current task, while also controlling

their environment or other things.[18] This allows users to gratify needs more quickly and address several needs simultaneously.[18] For example, a user could be chopping up vegetables and searching recipes at the same time or purchase a spice when they run out while cooking.[12] They could even make a to do list for the rest of the night.[12]

Users also adopt Internet of Things technology for the convenience it offers. The internet of things is very good at allowing users to be more passive in their lives. For example, in the introduction story Alex was automatically told to drive to work, routed to an empty parking spot, and when she was routed home her house was the right temperature and the correct lights and appliances were on. These things would usually take time and cause stress, so she was free to focus on other thoughts during her commute. In home assistants can also take the stress out of grocery shopping and other repeated tasks by automatically scheduling appointments or ordering products.[12]

Some researchers may find this to be a negative aspect of the products, because this takes the actions required to make purchases away from the user.[19] This might be negative because when going through the act of making the purchase it gives the user time to think about the value versus of the cost of the item.[19] When ordering with an in-home assistant, the device goes through the process of purchasing so the human does not have to think about this as much.[19] Without this extra step, a user is more likely to buy something than they would be if they were purchasing it themselves.[19] These devices can even impact what store users purchase from.[20] A study of Amazon customers revealed that after 12 months of owning the Amazon echo, customers spent 29% more on Amazon.com.[20] For customers who did not own an echo, this amount only increased 19%.[20] This larger jump is important, and more so when it is shown that

18. Weinberg, Bruce, George Milne, Yana Andonova and Fatima Hajjat. "Internet of Things: Convenience vs. privacy and secrecy." *Business Horizons* 58, (2015): 615-624.
19. Jan Nolen and Nasrine Olson, “The Internet of Things and convenience” *Internet Research*, 26 no. 2 (2016): 360.
20. Koetsier, John. “Research Shows Amazon Echo Owners Buy 29% More from Amazon.”. *Forbes.* May 30, 2018.

these consumers actually bought less from other stores.[20] This could be a large impact on competing businesses, especially those who do not have or collaborate with a smart in-home assistant.[20] It was also predicted that since purchase tended to be lower priced consumer packaged goods, that it was likely that many of these additional purchases were impulse buys.[20]

Another way the Internet of Things makes lives easier is by providing feedback. One example is the Fitbit, which monitors our heart rate, our sleep cycle, and many users track their calorie intake. Rather than just collecting this data, Fitbits also give feedback about it. This feedback can be incredibly useful. It can be effective in encouraging people to exercise by competing with groups to see who can get the most steps, and it can make diet recommendations instead of the user needing to take the time to research what they should be doing to eat healthier. A recent study showed that Fitbits were engaging, fun and motivating enough to help overweight participants lose weight effectively.[21] Fitbits are also often used in clinical trials for research in a lot of different areas including cancer research. [22] 95% of NIH research that used consumer activity monitors used Fitbits, and they helped keep patients accountable to exercise plans, and helped researchers and doctors understand how things were going.[22] This reliable feedback from the Fitbits helps both groups understand the process and results better.

Some argue that this feedback takes things too far.[19] They are concerned about mind changing feedback specifically because as users depend more on their machines to tell them how to behave, they stop taking an active role in important parts of their lives like health.[19] Also, they are concerned about the ability for feedback to change the mind of users in ways that may not be beneficial to them.[19] For example, the sleep schedule that society says is the best for productivity may not work for someone who is a night owl, and the algorithm may not be able to predict what is right as well as a person.

21. Randriambelonoro, Marana, Yu Chen and Pearl Pu. "Can Fitness Trackers Help Diabetic and Obese Users Make and Sustain Lifestyle Changes?" *Computer* 50 no. 3 (March 2017): pages 20-29.
22.“Bored with your Fitbit? These Cancer Researchers Aren’t” *Wired.* September 19, 2017.

There are also examples where tracking health data too closely can be problematic for users.[23] One woman, Bri Cawsey, became so involved in tracking her calorie intake that she became anxious if she had to eat out and did not know the exact nutrition information about her food.[23] For many users like Bri, Internet of Things devices related to health can increase stress and, "contribute to a culture of health anxiety.'[23] These concerns are valid and serious, but I do not believe they warrant throwing out health technologies, since they do have so many benefits. The researchers who use Fitbits to help patients admit that a Fitbit alone is not enough to make a positive change in someone's life, but with support and other systems of incentive there are stronger effects.[22] I think using these concerns to educate users and start social conversations about the limitations of these technologies would be a better way forward. Then society could work towards using Internet of Things products as a set of tools that can work for some users, in a system with other things, to create positive changes.

Integrative Needs:

Users also expect the Internet of Things to fulfill integrative needs. Technology can be an effective way to boost one's self-esteem due to the way it fits into society.[12] Smart watches, in home assistants, and many other smart devices are often sold as luxury items, and owning such items can make consumers feel better about themselves.[12] Products can also make "favorable impressions" on others, and they can be considered a way to show social status.[12] These would both assist with fulfilling users' integrative needs.

Another integrative need that Internet of Things products may assist with is identity formation. Social media has been paramount to identity development, especially in younger generations, because many things in their lives are recorded.[17] This gives them more frequent

23. "Is our obsession with health data making us crazy?" *Time.* May 30, 2019. https://time.com/5066561/health-data-tracking-obsession/
24. Hoffman, Donna and Thomas Novak, "Consumer and Object Experience in the Internet of Things: An Assemblage Theory Approach." Journal of Consumer Research 44 no. 6 (April 2018): pages 1178-1204.

reminders of who they used to be, and allows them to remember events as they were when memories might otherwise skew them.[17] There is the potential for a similar type of influence from Internet of Things devices, due to the amount of data collected. A user will now know exactly how many steps they took last week, and what time they really got off of work. This could influence identity because it erases the possibility for a person to exaggerate their exercise routine to themselves and may also help people recognize their achievements.

Social Needs:

Products in the Internet of Things can also make it easier to connect to others.[12] For example, a smart camera can follow a pet around and connect you to them during the workday,[24] and home assistants can make it easier to schedule in time with friends and family.[12] Studies have shown that social aspects have influenced current users' decisions to purchase Internet of Things devices.[12] In addition to connecting to other people, it has been shown that many users see computers as a sort of social being.[12] For example, when communicating with in home assistants' people are usually courteous, pause for a response, and use niceties even though this really is not necessary.[12] So, in a way, even the interaction with the device itself represents a social interaction.

The Internet of Things is especially good at creating social interactions between itself and the user because it has the ability to create different interactions for different users. Some users may interact with the Internet of Things in a very limited way, saying commands and connecting only a few devices together.[24] Other users can get a much more social experience out of the products.[24] For example, a user may use their device to turn on and off their lights, control the thermostat and other things they believe add value to their life, and they can begin to connect IoT products to more and more aspects of their life, creating a more seamless experience.[24] They may

also feel emotions towards the assistant, and sometimes converse with it for fun.[24] Although the users technically experience the same device, one user has a much more expanded and multidimensional experience.[24] The IoT devices do not determine these experiences, but instead the user does by their interactions, so it is an especially personalized and powerful way to satisfy user needs. Devices can even become more active as they are present with the same user longer.[24] For example, Nest Thermostats collect data on what temperature you like at certain times.[25] After a few weeks it will automatically set the temperature correctly, so there is no need to take the time to adjust it anymore.[25] There are similar systems present in many devices.

Affective Needs:

Many users also enjoy interacting with IoT products. They ask the in-home assistants questions just to see if they can confuse them, or ask them social questions to see how they respond.[24] It can even be enjoyable, although problematic, to interact in an unpleasant way with Internet of Things devices.[26] One user explains that she, "loves to scream at robots…" as there is, "no one else in my life I can scream at so unreservedly."[26] In this way the devices are scapegoats and provide relaxation and escape by allowing users to vent feelings of frustration.[26]

Researchers argue that as the Internet of Things continues, humans will generate less satisfaction from interacting with devices because as algorithms, they will necessarily place humans in more "sterile boxes" than another human would.[19] I do believe this is one possibility for the future.[19] Also, I acknowledge that there are serious flaws with machine learning especially in regard to sexism, racism, and other areas where the stereotypes of the relatively small and non-diverse group of developers come through in the products they create. I will

25. "Home" *Nest.*
26. Dreyfuss, Emily. "The Terrible Joy of Yelling at Alexa." *Wired.* December 27, 2018. https://www.wired.com/story/amazon-echo-alexa-yelling/
27. Crawford, Kate, "A.I.'s White Guy Problem" *New York Times*. June 26, 2016.
28. "How to Reboot Sexist Robots" *Unladylike.* July 3, 2018.

discuss this problem in greater detail in the next section of the paper. However, I feel like this underestimates the possibility both that algorithms and intelligent machines can become more complex and human-like over time, and that tech companies and society can take active steps to make systems less biased.

The Gap Between Expectations and Reality:

Uses and gratifications theory mentions that user satisfaction hinges on the ability for products to deliver the gratifications expected by users.[10] While the Internet of Things does this is many ways, it falls short in some major areas.

Bias:

When users look to the Internet of Things to fulfil their needs, it is reasonable to expect that they want the interactions and technology to be relevant and enjoyable to them. However, it can be difficult to have relevant and enjoyable content when there is a lack of diversity, and AI and technology can be unfortunately non-diverse fields. There have been many problems with biased software so far in the fields of artificial intelligence and machine learning, the back bones for the Internet of Things. The problem with these machines is that the algorithms running them create a world based off of training data.[27] Training data is data containing the "right answers" about the real world. For example, for a software that recognizes faces in photographs, that software was given hundreds or thousands of images of faces, labeled as faces, and also photos of things that were not faces labeled as not faces.[27] Through going through all of these images, the algorithm learns to detect what is a face, and what is not a face.[27] The problem arises when the engineer developing the software, and selecting the training data, only uses photos of white

29. Cohen, Noam. "Why Siri and Alexa Weren't Built to Smack Down Harrasment." *Wired*. June 6, 2019. https://www.wired.com/story/why-siri-and-alexa-werent-built-to-smack-down-harassment/
30. Mclean, Grace, and Kofi Osei-Frimpong, "Hey Alexa...examine the variables influencing the use of artificial intelligent in-home voice assistants," *Computers in Human Behavior* 99, (October 2019): 31,
31. Weinberg, Bruce, George Milne, Yana Andonova and Fatima Hajjat. "Internet of Things: Convenience vs. privacy and secrecy." *Business Horizons*58, (2015): 621.

faces to train the algorithm, leading to a software that does not recognize non-white faces as faces.[27] There have already been examples of bias in algorithms including when it was recently revealed that Amazon's same day delivery was not available in predominantly black neighborhoods, and that the map of where the service was available was very similar to redlining maps.[27] For in-home assistants, this may mean that they only recognize certain tones, and contain other biases that would make using the product much less enjoyable and useful than expected. It is important that companies work on addressing these biases and increasing diversity in the field.[27] One potential solution is an idea from Heather Ross, of a bias "spell check" that does not allow code to compile until diverse training data is used.[28]

Another problem, specifically related to in-home voice assistants, is the way that the female voices and names of assistants genders them.[26] This continues the stereotypes that females are assistants, and that they are helpful and submissive.[29] These voice assistants have also not handled demeaning comments well.[29] Siri used to respond, "I would blush if I could," to being called an inappropriate name.[29] Alexa's response to being called hot was, "that's nice of you to say."[29] More recently these devices have been updated with more neutral responses, but they still do not stand up against harassment or fully shut down.[29] There may be many reasons for this including sexism, and the need to keep users engaged with their devices no matter what to retain popularity and convince users to buy more products.[29] However, this submission can have negative impacts for real women, and seeing the sexism and docile nature of these devices may make them less appealing to female users.[29]

32. Chung, Hyunji, Michaela Iorga, Jeffery Voas, and Sangjin Lee. "Alexa, Can I Trust You?" *Computer* 50 no. 9, (September 2017): pages 100-104.
33. Newman, Peter, "IoT Report: How Internet of Things technology growth is reaching mainstream companies and consumers" *Business Insider*. January 28, 2019.

Privacy and Security:

Users who entrust their information in products in the Internet of Things, want this information to be kept securely. These devices track massive amounts of data related to health, finances, schedules and many other things.[30] Privacy risks have a negative impact on user satisfaction with the Internet of Things, as benefits are lessened by the chance that information could be stolen.[30] There have been many successful data breaches at seemingly secure companies, releasing important personal information.[31] However, with Internet of Things devices the potential for theft and damage would be at a much higher level. Since some devices are physically around users, there is the potential to cause physical harm.[31] For example if someone were to hack a self-driving car, they could injure the driver and others.[31] Also, with the amount of devices connected to one another, there is the potential to gather a lot of information about a person by just connecting to one network. For example, if a person hacked into Alex's smart car, they would know where she lived, what time she was getting of work, what route she would use to get home, and lots of other information related to her health and finances since everything is linked. When users hope to have their needs fulfilled by the Internet of Things, having their data stolen is not a part of their expectations. Experiencing data breaches, or even knowing there is a possibility of one, will decrease user satisfaction.

In addition to data breaches, there are ways that voice activated systems can accidently be taken advantage of.[32] For example, a young girl who was unaware of how Alexa operated, accidently ordered a $160 doll house and four pounds of cookies.[32] In another incident, a whopper ad asked Google devices to read more information about the ad, and that information was eventually tampered with, so the devices read a fake article.[32] These are examples of how voice activated commands can lack security.[32] Even though there are now password options for

purchases, devices are still vulnerable to outside prompts that ask them to answer questions and do other things.[32]

Discussion:

There are also likely many more situations where products are not what the user was hoping for. User dissatisfaction is likely to happen no matter what, especially for technologies that are new and not yet totally understood. However, I do not think this user dissatisfaction overwhelms the benefits of the products. Uses and gratifications theory implies that when a user becomes dissatisfied with a type of media, they stop using it.[10] However, this is not true for the Internet of Things. Business Insider predicts "there will be over 64 billion Internet of Things devices in 2025", a large increase from the approximately 10 billion in 2018.[33] With this many users, and this incredible growth, I believe, despite some areas that need grave improvements, that most users are satisfied enough to make the Internet of Things a habit.

Conclusion:

In conclusion, the Internet of Things is growing, and will continue to impact more and more areas of our life. In her smart city Alex has adopted these products because she is able to better fulfill her needs, and is often able to do so passively, freeing her up to pursue more wants and needs than before. Certain steps may not be perfect, like when her automatic purchase of parking discourages her from leaving work early. She also has to rely on the developers of her machines not to be biased, and to create complex systems that do not over generalize users. However, despite these flaws the technology makes her day easier and more enjoyable.

We should care about how this technology affects Alex and all of us because it is being developed whether we examine it or not. These new and connected technologies will impact our lives, and how our society operates. There is also a possibility that as these Internet of Things technologies are implemented on a workplace and city-wide level, that there will be less ability to opt out of them.[19] This means that we will be involved with these technologies and likely interact with them in many aspects of our lives. Learning about why users are adopting these things can teach us both how we can make our own lives better and help us know what things to push developers towards. If we are more educated, we can call for more less biased algorithms, more security, and more required purchasing steps, while still being able to utilize the benefits of these devices. It will help us prepare to live in smart cities.

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