Apple's Face ID

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February 12, 2023

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Introduction

I owned the iPhone 6 for the longest time, so once I bought the iPhone X, I noticed a massive difference. The home screen button had vanished, and I could no longer unlock my iPhone with my fingers. Apple had asked me to look at the camera and turn my face in clockwise and counterclockwise circular motions. Once my face ID was verified, I was able to unlock my phone and download apps simply by looking at the screen.

Face ID stands for facial-recognition technology developed by Apple. Apple's face ID was introduced in 2017, through the iPhone X (pronounced 10). Apple Face ID changed the way Apple devices work and is known to be one of the best features to date. Since the release of the Iphone X, Apple has continuously included Face ID in: the Iphone X, the IPhone XR, the iPhone XS and XS Max, the Iphone 11, the iPhone 11 Pro and the 11 Pro Max, the Iphone 12 and 12 Mini, the Iphone 12 and 13 Mini, and the Iphone 13 Max. Apple Face ID not only unlocks your phone, but it is also used to authenticate downloads, certify payments, and verify Safari autofill. In this paper, we will be exploring the technology, ethical, legal, and social implications of Apple's Face ID.

The History of Face ID

Woodrow W. Bledsoe, Helen Chan, and Charles Bission, computer scientists, pioneered facial recognition nearly 50 years ago. From 1964–1966, Bledsole, Chan, and Bisson attempted to program computers to recognize faces. Bledson was the leading researcher and is known to be one of the founding fathers of facial recognition. The experiment included the following: "Using a Graftcon or Rand tablet, the operator would extract the coordinates of the feature, such as the center of the pupil, the inside of the corner of the eye, the outside corner of the eye, points of the

window peak, and so on" (Bledsole, 1966). Their research was limited as they used handmade proportions, which were then transferred to a computer and compared to various faces from different angles and distances. Bledosle concluded the experiment as a failure: "The facial recognition problem is made difficult by the great variability in head, rotation, and tilt, lighting intensity, and angle of facial expression, etc.."

The National Institute of Standards and Technology and the Defense Advanced Research Project laid the groundwork for automatic facial recognition. By the 1990s, they could rely solely on computer programming to expand databases. In 2010, Facebook started to use facial recognition to automatically tag users identified in the photo. In 2011, Android allowed users to unlock their phones with their faces. However, it wasn't as accurate because it relied on 2D pictures stored on your device, so when you wore a mask or changed your appearance, the system wouldn't be able to recognize your face. In 2017, Apple became the first company to develop effective facial unlocking technology with the iPhone X.

How does it work?

The true-depth camera is attached to the top of the screen and is used for facial recognition. The true depth camera consists of the ambient light sensor, speaker, proximity sensor, and flood illuminator. infrared camera, microphone, front camera, and dot projector. Once you look at your phone, the IR camera and the dot projector work together to create a mathematical model of your face. It is then compared to the face ID that was stored on your device. "The neuron engine of the Iphones or Ipad chips combines these two elements" (McElhearn & Long, 2022). If the models match, you will be able to unlock your iPhone. The ambient light allows you to unlock your phone during the night. The dot projector dispatches over 30,000 invisible dots onto your face.

To set up your face ID, you will simply have to look at the camera and move your head slowly two times. Apple will then store your data for future use.

Security Concerns

Apple assures users that they value their security. However, there is a debate on whether or not Apple Face ID is secure. Apple states". The probability that a random person in the population could look at your iPhone or iPad Pro and unlock it using Face ID is less than 1 in 100,000 with a single enrolled appearance, whether or not you are wearing a mask. Apple warns users that the probability increases if they are wearing a mask, are a twin, have a sibling that looks like them, or are under the age of 13. Apple allows users to use a passcode to unlock their phones if they do not feel comfortable with Face ID. Apple also forces you to unlock your phone with a password if there are five failed attempts and allows you to only unlock your phone when your eyes are open. Apple affirms to users that "Face ID data, including the mathematical representation of your face, is encrypted and protected with a key available only to the secure enclave." It is easier to replicate touch ID through 3D printing than it is with Face ID. Face ID has also improved during the pandemic, as many people struggled to unlock their devices. You can now unlock your phone while wearing a mask, thanks to an improved Trudepth camera around your eyes.

However, some people argue that an intruder could easily unlock your phone simply by pointing the camera towards you. Even a friend or family member could easily unlock your phone, more so than the touch ID or password, and not many people are comfortable with that. The touch ID and the password require a bit more physical and mental work. Despite these concerns and the slight statistical increase that someone will open your phone if you are a twin, etc. Apple Face ID is generally known to be trustworthy.

Ethical, Legal, and Social implications

Apple Face ID is known to be safe because Apple takes the necessary measures to protect users' privacy and security. However, for some people, the emphasis on using people's faces leaves them weary, as faces (for some people) are meant to be intimate and private. There is a great rise in the beauty and cosmetic industry, and many people profit off people's physical insecurities. Many people are concerned about what they look like and how they are perceived by others; could Apple's Face ID play a role in that? Rather than using your memory or finger to unlock your phone, the author pushes users to use their faces; does this imply that Apple values people's faces?

Moresoe, Facial recognition at large encompasses many ethical and legal issues. Facial recognition technology companies will often hide information from users. They could also be tracking and storing your data without consent; however, Apple Face ID is known to be fairly transparent with its users. Additionally, Apple allows third-party companies to access your face ID data through Safari autofill. Although you have the choice to opt in or out of Safari autofill, you might blindly turn it on, thinking you can trust other companies. You might be able to trust Apple with your Face ID, but how do you feel about other companies holding your Face ID? Some may argue that Apple's Face ID technology is harmful to children and twins. Although these are all hypothetical concerns towards Apple Face ID, there are legitimate concerns regarding discrimination and biases towards facial recognition technology at large. There is evidence that supports the inequalities of facial recognition: "A growing body of research exposes divergent error rates across demographic groups, with the poorest accuracy in subjects who are female, black, and 18–30 years old" (Nanjibhai, 2020).

Future Uses

Apple plans to continue to use face ID on all new iPhone and tablet devices. Apple also intends to incorporate face ID into the Mac. If Apple adds facial recognition technology to the Mac, this would change the way computers work forever. The expansion of facial recognition within the classroom could substantially prevent students from cheating and plagiarism. For example, if someone were to take a test, facial recognition technology would make sure that the person taking the test is really the person they are saying they are. Facial recognition could also detect certain movements that could possibly mean they are cheating. Facial recognition could be used in various ways in classroom settings to ensure student learning. Facial recognition technology could also be used to prevent school shootings and trespassers. Facial recognition technology could also be used in airports throughout the world in order to increase boarding efficiency and security. Facial recognition technology could also be used in buildings or workplaces. Facial recognition is slowly being used in different settings (as listed above); however, this is only the beginning. Facial recognition is used in small settings, so hopefully we get to a time where facial recognition is being used on large scales throughout the country and the world.

Conclusion

In conclusion, Apple Face ID is different from other forms of facial recognition technology as it uses a true-depth camera to create a mathematical model. It is also the safest and most reliable form of facial recognition technology. Apple face ID is unique from other forms of facial recognition. Although face ID is one of the newer forms of facial recognition technology, it has changed the history of the field. I didn't know what facial recognition technology was until Apple's Face ID.

References & Annotated Bibliography (APA):

Rowlands, C. (2023, January 6). Apple Face ID: What is it and how does it work? *Stuff*. Retrieved February 20, 2023, from, https://www.stuff.tv/features/apple-face-id-explained/

- This is an online newsletter published by Chris Rowland. Rowland is known for writing about technology. The author provided images, videos, and subheadings such as "Which Apple devices have face ID?" The author provides links to Apple devices and uses positive language. This source would be useful in several subheadings throughout my paper, including introduction, security concerts, and how Face ID works.This is a great source because the author is clear and concise and touches on multiple topics.

Norman, J. (n.d.) *Woodrow Bledsoe, "Originates of Automated Facial Recognition: A History of Information,"* HistoryInformation. Retrieved February 4, 2023, from https://www.historyofinformation.com/detail.php?entryid=2495

- This is a website published by Jermy Norman. The author explains how Woodrow Bledisloe and a few others researched facial recognition. The author summarizes his research and includes numerous quotes from Bledsoe that explain his process and findings.This source would be helpful when discussing the history of Face ID. This source provides an in-depth analysis of Bles's achievements, which would be helpful when highlighting his contribution to facial recognition, as he is one of the pioneers.

(2022, May 12). *A brief history of facial recognition,* NEC Retrieved February 20, 2023, from https://www.nec.co.nz/market-leadership/publications-media/a-brief-history-of-facial-recognition/

- This is a newsletter written by NEC, a news publishing company located in New Zealand. This company has written many newsletters regarding facial recognition. The author provides a timeline of facial recognition. The publisher uses a professional and positive tone. The author supports facial recognition technology. The article would be helpful in the subheading:History of Face ID.

Alreja, K. (2019, June 5). *Face Unlock in Phones – From 2011 to 2019!* Retrieved February 20 ,2023, from https://www.linkedin.com/pulse/face-unlock-phones-from-2011-2019-kirat-alreja

- This article is published by Kirat Alreja, on Linkedin. Already has received a Bachelors in Advance Computing at Australian National University. The article shows how Face ID technology was used in android in 2014. The article analyzes the pros and cons of Face ID in Android 4. The article uses a skeptical tone. This article would be helpful when discussing the history of Face ID.

Apple (2022b, April 27). *About Face ID's advanced technology* Apple Support. Retrieved February 17, 2023, from, https://support.apple.com/en-us/HT208108

- This is an article posted by Apple. The article highlights some of the concerns users might have. The author uses a positive and reassuring tone. This source allows me to learn about this technology directly from its creator.The article provides insightful

foundational information. The article would be especially helpful when discussing the security concerns.

CNET (2017, September 12). *[Video] Apple explains Face ID on the iPhone X (CNET News).* YouTube.Retrived February 12, 2023, from, https://www.youtube.com/watch?v=z-t1h0Y8vuM

- This is a video narrated by Phil Schiller from Apple. He is responsible for the Apple Store and events. He explains how Face ID works through a series of demonstrations. There's a monitor that protects a series of videos and images of Face iD. At one point, the monitor displays how Apple uses the dot projector to transmit invisible dots onto the user's face. The monitors allow viewers to visualize how Face ID works. The video is short, and the language used is clear. The author uses a joyful tone. This would be helpful when discussing how Face ID works.

Ujaley, M. (2017). Cybersecurity experts take a cautious view on Apple's iPhone X face ID security. Express Computer, Retrieved from February 12 ,2023, from, http://mutex.gmu.edu/login?url=https://www.proquest.com/trade-journals/cybersecurity-experts-take-a-cautious-view-on/docview/1942614371/se-2

- This is a trade journal published by Mohd Ujaley. The article states the potential risk of Apple's Face ID. The author criticizes Apple's response regarding security concerns. The author uses a skeptical tone. This article would be helpful when discussing the security risk. This allows me to highlight the cons of Apple's Face ID.