Wearables and Mobile Graphics: Shaping the Future of Data Visualization

By: Jacob Leboeuf

Abstract:

As "wearable" technology such as the Fitbit and Apple Watch took the world by storm in the past decade, breakthroughs in mobile computer graphics only look to continue that trend. Through virtual and augmented reality, such technology can provide significant improvement to data visualization in modern society.

Introduction:

"Wearable" technology has had a presence in daily society for longer than some might expect, as by its definition a wearable device could be as simple as a cheap electronic watch that displays the time. However, like how the public typically does not immediately associate the term "phone" with the first one ever created, the term "wearable" when used is often alluded to various smartwatches and other complex mobile devices. Considering that the latter is far more likely to offer greater impact on data visualization, and overall yields higher value to society by public opinion and by their capabilities, that is how it will be defined in the context of this work.

On top of this, a primary focus will be made on the devices' impact on the health industry, due to its strong association and resulting effects on current and future society. The mobile health industry may be on track to gross $500 billion by 2025 (Hicks), but wearables have not always been able to obtain (or be projected to obtain) such success. As with many industries, wearable technology is not prone to disappointment or failure, with the introduction of Google Glass in 2013 being a key example of that. Over time, the issues that came with such a product were likely noted, and in turn have and should help produce better products for the present and future, as shown by the more efficient catering to the market since then.

The Rise and Fall of Google Glass:

On paper, the Google Glass looked like a glimpse into the future, as users could receive real-time notifications without having to look at their smartphone, or have to put one of their everyday activities on pause to do so. It was advertised in 2012 as a pair of glasses capable of allowing the user to record videos, take pictures, use the Google search engine, and do other tasks while the user was busy skydiving, flying a plane, or simply living in the moment. Given that the device at that time period was still fairly new, Google X launched it at a fairly high price point, and also looked to have the product depicted as a luxury fashion item. As it turned out, the Google Glass ended up not being able to do either of those things as well as the company hoped.

A common argument that could be used to defend the wearable's lack of success was that society at that point in time was simply not ready for that level of technology. Although it could be true that the Google Glass' futuristic image may have been off-putting to some, the many flaws of the product cannot simply go without being stated. On a consumer level, the $1,500 price point was one too

steep for the time and in general for the common person, yet at the same time the company lacked the luxury brand recognition companies such as Gucci and Chanel have to generate enough sales by those wanting to have the product just to say that they have it. This would generally leave a market of those willing to buy it for what the smart-glasses bring to the table, and unfortunately what it brought was considered relatively lackluster by the masses, and even brought controversy with it.

The Google Glass had significant connectivity, image reception, and latency issues, partially due to the design of the product and the limitations of cellular data, as the product required a bluetooth connection to a cellular device to function. The virtual and augmented reality experience for the user was limited, along with the device's battery life, that did not exceed 5 hours. Despite these reasons, the medical industry still attempted to use the devices for data visualization, but unfortunately continued to run into the previously mentioned issues (Martinez-Millana). Considering that the item can directly affect others around them due to the device's visible camera, the topic of privacy became a hot-button issue, and put the entire company in political heat because of it. Although the product was designed to be one of designer or luxury taste, people often viewed those wearing Google Glass in a bad light. While people often view those in expensive clothing and accessories as those of higher class, a term used for those wearing Google Glass by the public was "Glasshole." Privacy became such a concern that a casino in Las Vegas banned customers from wearing the product, and even Congress got in contact with Google regarding their various applications using facial recognition (Klein). The product continues to be modified and produced as of 2021, but it does not appear that the company has had much success making the public overlook its negative past.

Impacting Society Through Visualization:

The Google Glass' issues certainly should not go without stating, yet at the same time fails in comparison to the vast amount of success and impact wearable technology has achieved over the past decade. The consumer market before and after the introduction of the controversial Google Glass has desired wearables, and as a result various companies have not only abided to such demands and become successful, but have provided genuine value to society. The visualization of data is an integral part of the significance of computer graphics, as industries that use graphics often need to convey their messages and information to their audience, as well as to other members of said industries.

One industry heavily dependent on data, as well as the way it is conveyed is the health and medical industry. It is crucial for a patient or a doctor to receive and understand important medical data, as if not there could be serious consequences. As a result, computer graphics have been heavily integrated into the field, as well as wearables, due to their ability to collect data and improve and encourage data visualization. A simple example of this is a wearable device that detects your heartbeat, displays such data to the user in a way they can easily comprehend it, and provides said information to their doctor to effectively monitor and hopefully draw conclusions about their potential cardiovascular problems. Without such a

device, the only way to perform all of these tasks would be a physical doctor's visit, and also would not be feasibly done at any time recursively.

The collaboration between this field and wearables even attempts to look into medical conditions the medical world still has questions about, and see if these devices can assist in discovering answers. As of 2021, there is not a cure to Parkinson's disease, and doctors often look to closely monitor a patient's motor system's fluctuations for data tracking and to accurately assign dosage of treatment and medication. Through the usage of wearable sensors, medical professionals can receive real-time information and statistics regarding the on/off states of the PD patients wearing them, and through machine learning techniques hope to find solutions for the very complex problems at hand. Testing is in its early stages, but the overall goal for the medical world and those conducting the tests is to gather a better understanding of the disease and take any step closer to finding a cure (Barrachina-Fernández).

This seems not to be limited to physical disorders, as it even looks to explore complicated neurological disorders as well. Autism Spectrum Disorder, or ASD, has made leaps and bounds in terms of research since the start of the twenty-first century, but society is still looking to gain more knowledge regarding its early symptoms and how to make those further on the spectrum more comfortable dealing with everyday life. Scientific organizations are aware of the potential that wearable sensors could provide for research on the disease, and hope that such technology can reach such potential as it continues to improve in the future (Koumpouros).

Conclusion - Looking Towards the Future:

The possibilities that arise from the advancements in mobile and wearable technology for future society truly could be endless. The need for a frequent physical visit to the doctor may become a thing of the past, as those needing regular testing could receive such at any point in time through wearables. Breakthroughs in disease study could be made, as the amount of data being collected through these devices would trump any prior method of collecting medical information. Future global pandemics could receive much faster responses, and even potentially be avoided altogether, as the influx of data could decrease the stages of confusion felt with such unknown problems.

Of course, none of this would be useful without proper data visualization. The idea of being able to gather so much more data may sound promising, but if said data is not able to be distributed in a fashion so that its audience can interpret it as desired, the value of the data is essentially nonexistent. That is where computer graphics and this mobile technology go hand-in-hand, as the subject helps allow such information to be presented in a way that is best suited to whoever it is going to. If a doctor has issues understanding the data being presented to them, then potential confusion could arise, and negative consequences could occur such as the incorrect treatment of a patient. If the public received such data in a difficult to understand way, they could have issues prioritizing the potential importance of the topic at hand, and overall ruining the impact it could have caused on society.

The introduction and future potential improvements upon virtual and augmented reality only provide a greater assist in conveying such data effectively. The Google Glass, though infrequently used by everyday individuals (which went against its overall intention), is being used to this day by surgeons as a "hands-free" checklist to avoid stopping their work to view necessary information, and overall making their job more efficient. The device looks to have an even greater role with actual transplant operations in the future, possibly even improving the accuracy of the work being done (Trampleasure). The recent introduction of 5G technology only looks to improve the strength of mobile devices capable of implementing VR, as the stronger connection capabilities allow such programs to maximize the potential of the hardware it is operating on. The ever-growing popularity of wearable technology by both the public and other supporting industries has allowed efficient data collection, and its usage of graphics, including virtual and augmented reality, have helped create a new foundation for how it can be visualized today and for years to come.

Bibliography:

Klein, Amarolinda et al. "Understanding controversies in digital platform innovation processes: The Google Glass case". Technological Forecasting and Social Change 152. (2020): 119883.

Barrachina-Fernández, Mercedes, et al. "Wearable Technology to Detect Motor Fluctuations in Parkinson's Disease Patients: Current State and Challenges." Sensors (Basel, Switzerland), vol. 21, no. 12, June 2021. EBSCOhost, doi:10.3390/s21124188.

Hicks, J.L., Althoff, T., Sosic, R. et al. Best practices for analyzing large-scale health data from wearables and smartphone apps. npj Digit. Med. 2, 45 (2019). https://doi.org/10.1038/s41746-019-0121-1

Martinez-Millana, Antonio et al. "Evaluation of Google Glass Technical Limitations on Their Integration in Medical Systems." Sensors 16.12 (2016): 2142. Crossref. Web.

Trampleasure O., Jawad, A., Buckle, V., Ahmed, S.,"Technology in Health: Wearables, Augmented Reality and Virtual Reality." The Bulletin of the Royal College of Surgeons of England, 31 Oct. 2015, https://publishing.rcseng.ac.uk/doi/abs/10.1308/rcsbull.2015.435.

Koumpouros, Yiannis et al. "Wearables and mobile technologies in Autism Spectrum Disorder interventions: A systematic literature review". Research in Autism Spectrum Disorders 66. (2019): 101405.