CHAPTER 17*

Wearable Technologies in Academic Libraries

Fact, Fiction and the Future

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Introduction

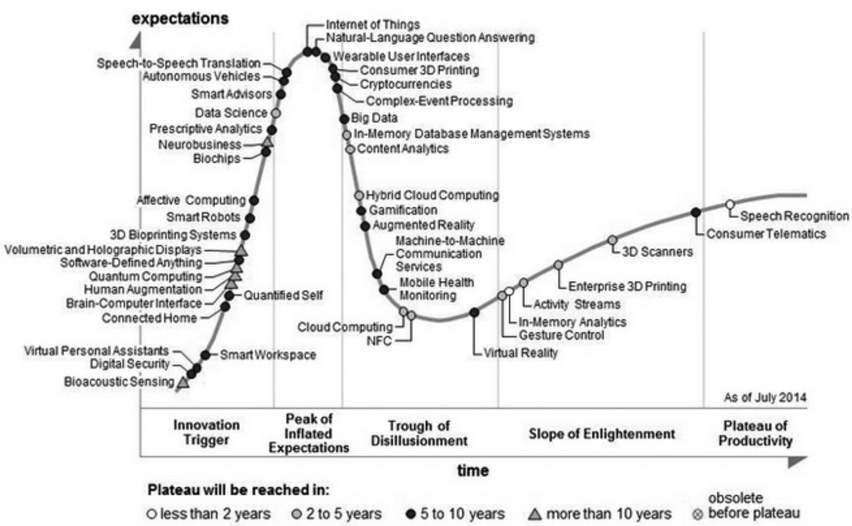
Nick Moline, a developer and early Google Glass Explorer, can still recall Google's mantra when he was first introduced to the wearable device: "If you can bring technology closer to you, you can actually get it out of the way" (Moline, personal communication, December 29, 2015). Similarly, Steve Mann, a researcher and inventor widely known as the father of wearable computing once wrote that "miniaturization of components has enabled systems that are wearable and nearly invisible, so that individuals can move about and interact freely, supported by their personal information domain" (Nichol, 2015). Today's wearable devices are the continuation and evolution of decades of research and development. This transition began with devices designed to be worn as backpacks, such as the 6502 multimedia computer designed by Steve Mann in 1981, evolved to a one-handed keyboard and mouse connected to a head-mounted display produced in 1993, and then advanced further into a wrist computer made available the next year. The first commercially available wearable device, however, was the Trekker, a 120 MHz Pentium computer with support for speech and a head-mounted display, which sold for $10,000 (Sultan, 2015). These early wearable devices, however, were characterized by limited functionality and bulky design. By the mid 2010s, fitness tracker devices emerged with their attractive designs targeting sport and fitness enthusiasts. More recent fitness trackers blend smartwatches with multiple other functionalities, combining health and activity monitoring as well as networking capabilities.

There are many factors that contributed to the rapid proliferation of wearable devices in the last five years. These factors include the advent of more reliable Internet access; the ubiquity of smartphones; decline in cost of sensors, cameras, and processing power; and finally, a flourishing app ecosystem (Mind Commerce, 2014).

Market Analysis

Predicting growth rate in the wearable devices market is difficult, if not impossible. Many of the devices available today are still in prototype format, and many are starting from scratch with a high probability of increasing functionalities as new technological advances occur. According to Gartner's (2015) *Hype Cycle of Emerging Technologies*—an annual report representing the maturity, adoption, and social application of specific technologies—wearable devices are still five to ten years away from their mass adoption. In 2015, they leave the peak of inflated expectations and now slide into the trough of the disillusionment cycle, where interest decreases as experiments and early implementations fail to deliver. While few companies will take action, only those that demonstrate innovative solutions capable of satisfying early adopters needs will succeed in reaching the plateau of productivity (figure 17.1) (Gartner, 2015).

FIGURE 17.1
Hype Cycle for Emerging Technologies 2015



According to Forrester's 2015 consumers and technology report, 21 percent of US adults online use a wearable device (Fleming, 2015). This adoption, concentrated in activity-tracking devices and smartwatches, is mostly driven by the mass adoption of smartphones and the proliferation of applications that created a social engagement that was not available just five years ago.

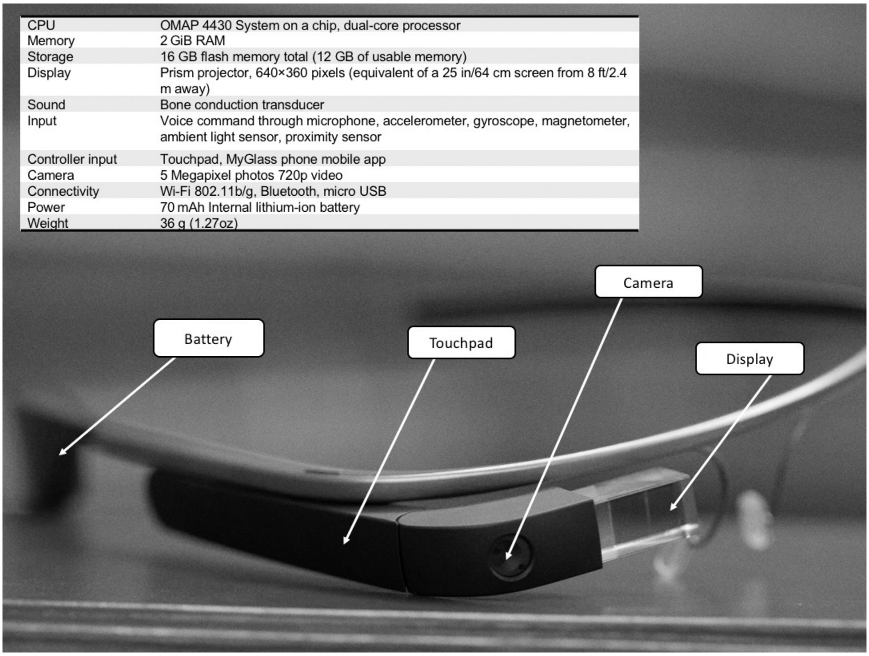
Activity-tracking devices, led by Fitbit, provide easily tracked fitness-related metrics such as steps walked, distance walked or run, sleep and activity time, and other valuable information designed to promote a healthy lifestyle. However, as new products hit the market, the volume of specialized fitness and health-care wearables is expected to shrink from 60 percent of the wearable market in 2014 to 10 percent in 2018, when multifunction consumer wearable products will dominate (Mind Commerce, 2014). Mind Commerce (2014) also projects that the volume of wearable computing devices will grow from under one million units in 2014 to 178 million in 2019, dominated by smart glasses and smartwatches.

Computer technology advanced from mainframes to desktops, then laptops and palmtops, and is now moving onto, and into, the human body by way of wearable computers (Rainie, 2016). This type of gadget provides the ultimate in network access—hands-free, heads-up operation with complete mobility. Among the factors that contributed to the current surge in wearables are the advent of the Internet and broadband connection, proliferation of smartphones and other mobile devices, rapid growth in sensors and other micro-electromechanical systems, and an increasing availability of apps. The success of wearable devices will, in fact, depend tremendously on third-party developers who can integrate wearable devices and their features into existing or purpose-built experiences.

Google Glass Explorer

Google Glass is, without a doubt, the device that brought the discussion of wearable technologies to the public with its innovative design and features, as well as numerous controversies. Google Glass is a head-mounted display that presents data in the wearers' field of vision without the need to look away from their normal viewpoints (Google Glass, 2016). The device is tethered to a smartphone, and most of its functions are voice-activated. Google X, Google's research and development facility that is responsible for the Google Glass and Google driverless cars projects, among others, succeeded in packing a battery, a display, a camera, and all the processing power needed to run the device into a compact 36-gram frame (figure 17.2).

FIGURE 17.2
Google Glass technical characteristics.



CPU	OMAP 4430 System on a chip, dual-core processor
Memory	2 GiB RAM
Storage	16 GB flash memory total (12 GB of usable memory)
Display	Prism projector, 640×360 pixels (equivalent of a 25 in/64 cm screen from 8 ft/2.4 m away)
Sound	Bone conduction transducer
Input	Voice command through microphone, accelerometer, gyroscope, magnetometer, ambient light sensor, proximity sensor
Controller input	Touchpad, MyGlass phone mobile app
Camera	5 Megapixel photos 720p video
Connectivity	Wi-Fi 802.11b/g, Bluetooth, micro USB
Power	70 mAh Internal lithium-ion battery
Weight	36 g (1.27oz)

Google Glass was first demonstrated to the public during the 2012 annual software developer conference (Google I/O). The Explorer Edition was then made available to Google developers only; later, it became available for purchase for selected users during the #ifihadglass Google+ and Twitter contest, for a purchase price of $1,500. From April 15, 2014, to January 19, 2015, the prototype device was available for sale before Google announced the end of its Open Beta Google Explorer Program (Google, 2015).

At the University of Missouri–Kansas City's Leon E. Bloch Law Library, the authors joined the Google Explorer Program in April 2014 with the goal of testing and exploring the potential of the device in academic libraries. Before entering the Open Beta program, the authors brainstormed a few use cases in which they believed the device could improve productivity and collaboration. Due to the lack of applications dedicated to education or that can serve an obvious purpose in a library environment, the use cases were solely focused on the first-person perspective experience that the device provides using its built-in camera. When the law library joined the program, Google already had many promotional videos demonstrating Google Glass, among them, a virtual field trip to the Large Hadron Collider of CERN (the European Organization for Nuclear Research) using

Google Glass (Google Glass, 2013). The video absolutely inspired the authors to immediately consider using the device to offer virtual tours for potential students and other live fieldtrips. However, the video feature was later dropped during the XE16 firmware update. Nevertheless, the library produced a hands-free video tour of the library using Google Glass, but not without a few workarounds.

The Explorer Edition of Google Glass is set to record ten seconds of video as a default. A user can manually extend the duration of the video indefinitely, or as long as there is battery power left, which is a maximum of forty-five minutes of video recording in a single full charge. However, the limitations of the videos produced through Google Glass are not related only to the short battery life, but also to other noticeable drawbacks in the software and hardware. Rice University published a study of Glass's power and thermal characteristics in which it found that the device can easily reach 50 degrees Celsius when using power-hungry applications such as video and GPS navigation (LiKamwa, Wang, Carroll, Xiaozhu Lin, & Zhong, 2014), making the wearer unlikely to record video for an extended period of time. Other issues encountered when creating library video tours were the poor quality of the picture when the device is used in low-lighting situations and the video instability (think bobblehead dolls) when the wearer is moving. In a different use case, students used Google Glass to record their interviews with potential clients in a role-playing exercise. Students expressed their satisfaction with the device as its hands-free feature enabled them to focus more on their assignments rather than being distracted with the technology. Despite a limited interaction with Google Glass, the authors remain confident that, paired with the right applications, it can offer benefits for both libraries and their users. The technical limitations reported in the early versions of Google Glass can eventually be fixed over time by Google.

Among the first Explorers who participated in the Google+ and Twitter #ifihadglass contest, many educators and librarians shared how they could use Google Glass to improve the learning experience inside and outside the classroom. Google also maintained an online discussion forum for Google Glass Explorers where ideas were shared and many connections were made. Adam Winkle, a K–6 science teacher from Florida who received the first edition of Google Glass with the help of an after-school program grant, has been very active within the Explorer Community. Winkle used Google Glass on a daily basis and also used it to produce science, technology, engineering, and mathematics (STEM) videos for his students. His experience was very positive as it helped him to create educational material quickly and efficiently without affecting his teaching ability and the time he spends helping students in class (Winkle, 2015). In addition to exploring Google Glass at a personal level, Winkle also works closely with EduGlasses, a start-up specialized in developing educational applications and services for administrators, teachers, and students through the use of smart glasses such as Google Glass and Epson Moverio (Winkle, 2015).

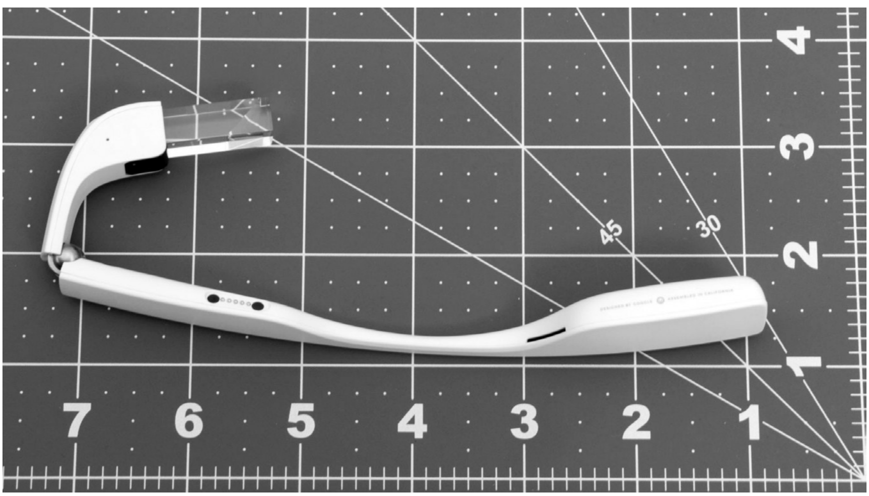
While developing custom applications to solve real-life problems is the best way to take advantage of Google Glass features, not every Explorer has the knowledge or technical capability do so. Many of the early Google Glass Explorers were limited to the few applications that Google made available through its app store. Others were able to side-load third-party applications, such as those of EduGlasses, which requires some expertise and risks voiding the warranty on the device. Jenn Waller is one of the early adopters who used the device as-is, out of the box. Waller, a librarian at Miami University in Ohio, enjoys demonstrating Google Glass to her students and colleagues. She acquired the first edition of Google Glass with the help of her library's innovation grant, and she has used it in her library instruction classes and individual office appointments to introduce students to wearable technologies and to discuss concepts of privacy and sharing in the digital age. Waller also helped her library purchase additional devices through a technology grant. The new devices have been added to the circulation collection, and students are encouraged to check them out and explore ways they can use the devices or develop new apps for them. However, Waller didn't have a great experience using Google Glass personally, as many hardware and software obstacles prevented her from fully utilizing its features. Nevertheless, she believes that, as a librarian, her role is to help users find information in whatever medium or format fits their needs (Waller, 2016).

Roxann Riskin, on the other hand, a library technology specialist at Fairfield University, embraced Google Glass in both personal and professional contexts in many creative ways. Riskin, who acquired the first edition of Google Glass with her personal funds, finds the device very intuitive and easy to use. She uses Glass on a daily basis for communication and collaboration, as well as sharing its potential with students and colleagues. Her interest in Glass opened the door to other creative collaborations. With her project partner Rick Sare, who is a professional truck driver and also an early Google Glass Explorer, they published four educational books for children using unedited photos captured through Glass while collaborating through Google Cloud platforms. Riskin also used her Google Glass to capture photographs for her personal poetry book *Glass on the Beach* (Riskin, 2016).

Google Glass Explorer was Google's Open Beta program, which offered the device to consumers and individual developers. In two years, Google amassed an incredible amount of feedback from thousands of users testing the device in real-life situations. When Google ended the program in January 2015, it also ended its collaboration platform, support, and hardware and software releases for the consumer version of the device. Google stated that the end of the Explorer Program is a graduation of Google Glass from a proof of concept to real product and that the team will take what they learned from the early adopters to focus on an enterprise version of the device (Google, 2015). The focus has shifted now to Glass at Work and what smart glasses can bring to the workplace through its Glass Certified Partners. These partners have direct access to Google's technical support and unlimited inventory of Google Glass devices. Among the companies Google has partnered with for its Glass at Work initiative are Pristine, the creator of EyeSight, a secure two-way video communication platform for Glass dedicated to health care; GuidiGO, the creator of virtual tour guides for museums and cultural institutions; and the American Medical Association, specialized in medical field solutions in telemedicine. While the partners are working on new innovative solutions that will bring unique experiences to Glass users, Google is also working on a new iteration of its hardware in order to overcome the issues reported by users of its first edition, such as weak connection, small prism, and short battery life.

In December 2015, Google filed an application for equipment authorization with the Federal Communications Commission detailing what appears to be an Enterprise Edition of Google Glass (OET Exhibits List, 2016). The photos attached to the filing shows a foldable device with a larger prism (see figure 17.3). Other upgrades are expected to improve the connectivity of the device to better support video transmission as well as efficient processing power to improve its battery life. After all, if the device is to be used in fast-moving and rough industrial or emergency situations, short battery life or weak signal won't be tolerated.

FIGURE 17.3
View of a foldable version of Google Glass.



With the emergence of Google Glass, Google deserves the credit for bringing smart glasses technology, and wearables in general, to the consumer market. However, every player in consumer electronics is working on some version of a wearable device. Other manufactures are also taking advantage of this increased awareness and working hard to secure a share in the market.

Other Smart Glasses

Sony released its own developer edition of smart glasses called SmartEyeglass featuring holographic binocular eyewear capable of providing an augmented reality experience by superimposing text and images onto the users' natural field of view. While this device has similar functionalities to Google Glass in term of connectivity, its camera, and its plethora of sensors, it also includes a detached controller/battery pack and currently works with Android-based smartphones only (SmartEyeglass, n.d.). At the 2015 Consumer Electronics Show (CES), Sony revealed a concept model of a single-lens display that can be mounted to existing eyewear under the working title of SmartEyeglass Attach! While the modular version is still in proof of concept, it is currently available in the market for developers and interested users (Sony, 2015).

Epson is another manufacturer working on wearable technologies coming in a variety of shapes and formats. Its smart glasses line of products Moverio BT-100, BT-200, and BT-300 are similar to Sony's smart glasses in term of features and hardware, with a holographic dual display and external controller. Epson also released Moverio BT-2000, a smart headset with a robust design and advanced features optimized for industrial applications (Epson, n.d.).

Vuzix, a developer and manufacturer of smart glasses and video eyewear products, released the first commercially available smart glasses, Vuzix M100. The M100 features a monocular display and functionalities similar to Google Glass. Vuzix is also working on other types of smart glasses targeting enterprise and consumers with a newly updated version of its monocular display and new augmented reality smart glasses, AR3000 (Vuzix, n.d.).

Other big names are also working on their own versions of smart glasses. Amazon, Apple, and Baidu, China's most used search engine, have all received patents for devices that enable users to access information or entertainment directly in their line of sight. Amazon was granted a patent for a special smart glasses that enable users to stream content from other devices right through the lens of the glasses (Kim, 2015). Apple's iGlass regulates the use of LCD displays of the glasses to cover the user's direct and peripheral vision (Mind Commerce, 2014). Baidu's prototype device, known as Baidu Eye, will leverage the company's strengths in image search and facial recognition (Lee, 2013).

Activity Trackers

While manufacturers are still experimenting and trying to figure out what functions and design elements will improve smart glasses and increase their adoption, activity trackers have already reached a large set of the population with their basic functionality and appeal to niche audiences interested in health and exercise.

These devices, generally worn on the wrist, track wellness and sync wirelessly with a phone to send data about step counts, calories burned, distance, pace, activity time, sleep patterns, and other vital information from the wearer. Among the most popular activity trackers on the market today are the Jawbone UP band, Fitbit Flex band, and Nike+ FuelBand. However, with Google's and Apple's introduction of smartwatches, which offer, among other features, similar fitness tracking functionality, it is becoming difficult to distinguish between fitness-specific devices and smartwatches

Smartwatches

Many industry players have ventured into the market of smartwatches in the past; however, due to technological constraints at the time, they failed to capture the imagination and interest of the mainstream consumer. Today's smartwatches are seen as an extension of smartphones, displaying notifications, calls, calendars, news, and other smartphone-like applications, in addition to displaying time. Moreover, analysts argue that many smartwatch manufacturers simply attempt to replicate smartphone functions on a miniaturized screen, without taking into consideration that consumers wear watches as accessories and fashion, which could mean that manufacturers may secure a niche market for a short time, but that it will eventually lead to both user frustration and an inferior user experience (Mind Commerce, 2014). The proliferation of smartphones today and the dominance of Apple and Google in this sector, combined making up 90 percent of the mobile market, it is likely that smartwatches will also be dominated by these two players. Apple released its smartwatch in spring 2015, targeting the luxury end of the market. With its existing large customer base, the Apple Watch easily secured a leading spot in the market. On other hand, Google released its own operating system, Android Wear, designed for smartwatches to complement smartphones running on the Android platform. Google partnered with several hardware manufacturing companies to release an armada of smartwatches unique in their design and function, targeting all sorts of applications and user groups.

Pebble is another breed of smartwatches competing with Apple and Google. This smartwatch is compatible with both Apple and Android-based smartphones and features an e-paper display technology, providing a longer battery life, an always-on feature, and a lower price tag than its competitors (Wikipedia, 2016).

Other Wearable Devices

So far, this chapter has focused on consumer wearable technologies with immediate and direct impact on users, such as smart glasses, smartwatches, and activity-tracking devices. However, there are industries where wearables are making a considerable impact, and many industry players are competing to secure their place in niche markets such as gaming, health care, and the military.

From smart glasses to virtual reality headsets and smart clothing to simulate virtual environments for players, wearables for gaming are available in many shapes and formats. Gaming is one of the largest drivers of innovation in the wearable market, with a potential growth of $1.5 billion in sales revenue by 2019 according to Mind Commerce's mid-range forecast for gaming devices (Mind Commerce, 2014). In recent years, the health-care market has seen an increase in the adoption of wearable devices targeting the monitoring of physiological and vital signals, on-site personal patient care, and remote health care, all encouraged by recent advances in sensors, connection, and other technologies. Wearable health-related devices are expected to produce groundbreaking innovations that will help patients manage their chronic diseases as well as prevent medical complications. Wearables in the military have the same characteristics as the ones available on the consumer market. However, the military devices are built to operate under harsh conditions and provide the wearers with enhanced tactical awareness and advantages on the battlefield.

Wearables in Academic Libraries

Libraries in general, and academic libraries in particular, play a role in introducing their communities to a variety of new technologies that they otherwise can't afford or know little about. In the absence of clearly understanding how these new technologies can be used in libraries, due to their novelty, in many cases librarians themselves are learning as they use the technologies. Tom Bruno from Yale University libraries introduced Google Glass to his community and sat back to see what they would make of the technology (Bruno, 2015). He introduced a program during the summer break in which members of the Yale community submitted project ideas. These projects were reviewed, and based on the practicality, technological feasibility, and merit of their submitted projects, the community members were able to check out Google Glass devices from the library (Bruno, 2015). The novelty of the technology, combined with the curiosity of students, allowed for unique opportunities to introduce other library services and information research concepts otherwise difficult to promote. Waller (2016), for example, used her Google Glass to introduce students to copyright challenges surrounding wearables and mobile devices in general.

Many academic institutions are also experimenting with wearables as instructional devices. The University of California, Irvine School of Medicine collaborated with Prestine, one of the Google Glass for Business partners, to launch a pilot program using the wearable device in anatomy courses and clinical skills training (Irvine, 2014). Students and instructors were expected to take advantage of the hands-free and voice command feature to access patients' information and record students' activities. At the authors' institution, the University of Missouri–Kansas City School of Law, students used Google Glass for similar purposes to record their health law course assignment. The students were required to select a friend, classmate, or family member to act as a simulated client for whom they were to provide end-of-life decision-making documents. The first person perspective of the video recording helped students improve their communication skills by allowing them to see their interviewees' reactions, which are otherwise very difficult to capture using regular cameras. Smart glasses have found a particular niche market in visual and demonstration-based education. The potential of bringing live experiments and demonstrations to learners in real time, or on demand, can positively impact the learning outcome. In a unique experiment, a group of surgeons from Queen Mary University of London's Medical School used Google Glass to record and live stream a surgical teaching session to more than 13,000 health-care professionals and members of the public from around 115 countries (Sultan, 2015). As wearable technologies become more reliable and reach mass adoption, academic libraries will again be asked to help bridge the gap between the haves and the have-nots in the same manner they are currently providing access to laptops, e-readers, digital cameras, and all sorts of devices through technology "petting zoos" and instructional courses.

Wearable devices can also help to improve staff productivity in libraries. Compared to mobile scanning units popular among libraries, smart glasses such as Google Glass can represent a cheaper alternative. Bruno (2015) argues that staff members can create new workflows for library work. For example, book returns, and other library processes requiring barcode scanning can potentially be expedited because the wearable can serve as the check-in scanner and require fewer steps in the shelving process. Other applications can also find their place in a library setting, such as Word Lens, an app that provides real-time translation of text captured through smart glasses that can potentially be used to help identify foreign language material or help break the language barrier with library users.

Perhaps the biggest potential of wearable devices in libraries is the ability to engage users by creating content suitable for these new mediums. Users can immerse themselves in library collections through smart glasses by simply glancing at a book cover. Abstracts, reviews, video excerpts, and all types of related content harvested from multiple sources can be displayed in the user's line of sight. Wearable devices, when combined with location-based information and services such as Apple's iBeacon technology, QR codes, or near-field communication (NFC) tags can allow for the broadcasting of targeted messages and information to users in locations where Wi-Fi and cell phone signals are nonexistent. Libraries have been using these services to push notifications to users, who opted into the service, about events, new books, items due, and other highly customizable messages. While research has been centered around wearable devices from the user's perspective, wearables can also come in the form of wireless sensors that can be embedded in the library's physical space, allowing for monitoring of vital information such as occupancy, noise level, temperature, usage, foot traffic, and traffic flow. Data logged can help in decision making and can also be shared back with users through their wearables in a readable and aggregated format.

Challenges

Wearable devices are still in their early stages of development and adoption. While health tracker devices have shown a great potential in the fitness and health-care fields, smart glasses, smartwatches, and other wearables are still missing a killer application that can boost their adoption in the same way that iTunes helped drive iPod sales (Mind Commerce, 2014). Early adopters of wearables in libraries are then limited to out-of-the-box applications, and the use cases presented mostly remain hypothetical or part of pilot initiatives. On the other hand, manufacturers are relying on users to come up with cutting-edge solutions that serve their needs through the use of APIs (application programming interfaces). The rise of APIs is reflected in the number of applications available for wearable devices, including facial recognition, translation, photo manipulation, health monitoring, and social networks. However, developing new applications for each device requires capital and human resources that most libraries can't afford, and in the absence of a culture of innovation and experimentation among librarians and libraries, any custom integration of wearables in libraries will have to come from vendors or other third-party developers. If libraries would consider working together and pooling resources, there might an opportunity for creating an R&D consortium that would be able to focus on building and profiting from this technology.

Privacy and protection of users' data remain the greatest challenges of wearable devices. When Yale libraries introduced Google Glass to its community, privacy concerns related to HIPAA (Health Insurance Portability and Accountability Act) were raised regarding the possibility of the device being used by the medical community in which records or sensitive patient information might be shared (Bruno, 2015). Google Glass and other wearables are not HIPAA-compliant out of the box. Third-party developers are required to build custom operating systems to add an extra layer of security to these devices before they can be used in health care, or in any other situation where privacy and security are of concern. Smart glasses and wearable devices with embedded cameras are also subject to many controversies when used in public spaces (Sultan, 2015). Even before its release, Google Glass was seen as a threat to users' privacy, which fueled strong reactions, including a letter sent by a group of US Congressmen to Google's CEO in June 2013 inquiring about security, data collection, and privacy policy, among other concerns (Mind Commerce, 2014).

Of somewhat lesser concern, but still important to consider, the smaller size of wearable devices tends to impact negatively the processing power, battery capacity, and overall user experience. This can be a problematic issue if the devices are to be used in an extreme environment or for longer periods of time. However, some manufacturers are already offering industrial versions of their consumer devices, such as Vuzix's 3000 series for smart glasses, which targets enterprise users by offering longer battery life, comfortable head mounts, and larger displays to meet their professional needs.

Conclusion

Mobile devices have the capacity to change how we learn and how we access information. We have just begun to see the opportunities for this technology in the education field as manifested by new policies and approaches adopted to embed users' personal mobile devices into school and workplace. Wearable technologies are a new frontier for educators; we can expect greater impact as the wearables go through different iterations and become increasingly smaller and less intrusive. However, as we have demonstrated in this chapter, education in general, and the library field in particular, don't always offer an attractive return on investment for developers and manufacturers in the same way as health, fitness, or other industries. This lack of financial incentive could impact and delay the benefits this new technology can bring to faculty and students. Therefore, it is important that librarians work at creating opportunities for innovation and experimentation with new devices and technologies to explore their potential in supporting faculty and students as a way of encouraging investment in the technology. Having innovators from the library field with an understanding of the needs and problems that our users are facing will help to ensure the development of adequate solutions more prone to succeed in an educational context, rather than relying on attempts to adapt solutions from other industries to make them fit into our profession. By providing access to these technologies in their early stages, libraries also help to democratize access to information among users of lesser means, increasing their likelihood of being fully engaged with different concepts of connectivity within their learning environment.

Wearables are here, and the future is bright. However, like all technology, they will continue to evolve in ways that are not clear today. At the very least, wearables offer an opportunity for librarians to think about new and improved ways to provide access to their diverse content. Librarians must embrace these technological developments and use every opportunity to experiment and share results. While the future holds great promise, librarians also need to be mindful and proactive in thinking through the still very serious issues surrounding security and privacy. In a world where wearable devices exist and are empowered by sensors and detectors, librarians should also expect to exchange other types of information and data with their users, such as location information, personal information, and physical space and environmental information. These additional streams of information will require new approaches to handle security, safety hazards, copyright, and privacy concerns. Wearables in the academic library will bring neither dystopia nor utopia but rather many exciting new opportunities.

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