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Blurred Lines—between virtual reality games, research, and education

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Abstract:

Immersive computing technologies, such as virtual and augmented reality headsets, are increasingly being adopted by library makerspaces and technology commons in both public and academic libraries. Through the use of HMDs (head-mounted displays), these technologies allow users to be transported to places real or imagined (VR) or to overlay convincing digital objects onto the real world (AR). However, do VR and AR truly have a place in the library context? Do these technologies simply provide new ways to play video games, or do they offer something more? Is the purchase of this often expensive equipment yet justified?

In our paper, we argue that AR and VR technologies have a major potential to impact the library services of the future by introducing radical new forms of immersive media, and by also providing new ways to interact with existing forms of media. For this reason, we believe that libraries and librarians are justified in experimenting with virtual and augmented reality in their current, nascent forms, so that they might avoid playing catch-up in the future. We then discuss the ways in which the line between education and entertainment is blurred, and how the new immersive and participatory media enabled by VR and AR further contribute to breaking down this false dichotomy. In conclusion, we provide practical advice to libraries of all types and budgets for how to implement a VR/AR service based on our experience establishing one at the McGill University Library.

Keywords: Virtual reality; augmented reality; video games; library; services.

Introduction

Virtual and augmented reality headsets—emerging technologies which offer users radically new and immersive ways of interacting with computers, documents, and video games—are beginning to be acquired by many public and academic libraries. Although the current wave of headsets (including Oculus Rift, HTC Vive, Microsoft HoloLens, among others) has been available to the public for just a few short years, libraries have been quick to seize on the opportunity to experiment with integrating them into their services in various ways. A simple Google search provides ample evidence of the adoption in particular of virtual reality by North American libraries, especially public libraries, among whom includes Toronto Public Library (Toronto Public Library 2018) and the California State Libraries (Lambert 2017). The range of services being provided using this technology is already quite broad and is expanding rapidly. These include technical demonstrations, gaming nights, technology lending programs, virtual exhibitions and more (Everett-Green 2017; Toronto Public Library 2018). Augmented reality apps are also showing much potential for libraries (Massis 2015).

However exciting these new technologies may be, it would be prudent for librarians to take a step back and critically assess them before fully investing. Not only can the higher-end systems be very costly, but they can be complicated to set up and maintain, have health and safety issues associated with their use, and it remains to be seen who will be most interested in using them and for what purpose. This makes building an effective VR/AR service a mighty challenge for libraries. In spite of all the surrounding enthusiasm, librarians would be justified in wondering whether it is worth the investment, particularly at institutions with limited resources.

Many questions remain to be answered regarding how exactly immersive technologies will impact library services. However, it will be clear to anyone who has the opportunity to use them that they provide a means of breaking media out of their traditional confines in a way that radically transforms how we consume and interact with them, which has major implications for libraries. Virtual and augmented reality allow for the blurring of lines: between media and the "real world," between document and experience, and between entertainment and education. In this paper, we argue why experimenting with virtual and augmented reality is a valuable exercise for today's libraries in spite of the various barriers to entry and describe our experience with establishing a VR/AR service at McGill University Libraries in Montreal, Canada, as well as share some of the important lessons we learned along the way.

Why AR/VR in the library?

Although educated guesses can be made, it is impossible to fully predict which emerging technologies will shape the future and in what ways. However, as Kenneth Varnum argues in a 2017 column regarding emerging technologies in libraries for *International Information & Library Review*, the very process of considering how new technologies will impact libraries and their services helps to prepare them for the inevitable changes the future will bring about by putting libraries in "a mode of operation in which change can happen." It is obvious when reflecting on the past few decades just how much of an impact the computer, the internet, and social media have had on library services, and so it is a useful exercise to anticipate what might come next and to experiment with new technologies.

Immersive computing technologies like virtual and augmented reality headsets are particularly good candidates for consideration when anticipating disruptive trends because of the high degree to which they change the experience of interacting with media. Basic assumptions about human-computer interaction—that visuals appear on a rectangular screen and interacted with via an abstracted input device like a mouse and keyboard—fall away when using these systems. Rather than being simply passive and voyeuristic observers of media such as news reports, the media consumers become media participants, being thrust into the event that they are learning about. This is not merely conjecture; major news outlets such as the New York Times and BBC have already embraced virtual reality (New York Times 2018; BBC 2018).

Should immersive technologies become mainstream, they will bring about new and very different kinds of interactive media experiences that libraries will need to contend with as responsible gatekeepers of educational and cultural material. Professor Lyn Robinson observes that even the concept of the document, central to library and information science theory and practice, becomes disrupted by these technologies, introducing a new class of participatory document that she dubs the "immersive document" (Robinson 2015a). She calls in particular for research into the information behaviour of users of these documents, but also points to the importance of investigating how immersive documents will be organized, retrieved, stored and managed (Robinson 2015b). We believe that practical experimentation with virtual and augmented reality by librarians from a service perspective is equally important.

Libraries are ideal institutions for providing access to immersive software to the community at large because of the technical challenges, high cost, and space requirements for the top-of-the line systems which might prohibit the average user from making use of them. Furthermore, there is already precedent for providing access to interactive media in the form of video games, which are being collected by both public and academic libraries (Charbonneau, 2015). It is useful to look to the LIS literature on video game collections, equipment lending and service provision when preparing for virtual and augmented reality because many of the challenges associated with collecting and providing access to video games as a service may carry over (Harris & Rice, 2008). However, it is important not to peg a VR and AR service as simply an extension of a video game service. Because of the blurring lines between entertainment, education and research, the use cases for immersive technologies are likely to end up being quite different.

Many technology experts, such as Robert Scroble and Shel Israel, believe that immersive technologies will have at least as big an impact on our lives as previous computing paradigm shifts such as the introduction of graphical user interfaces, the internet, social media and mobile computing. Although it is understandable that some may be skeptical about the expensive, bulky, and largely experimental systems available to us today, these experts believe that within a decade, much more streamlined and user-friendly versions of these headsets will be pervasive (Scroble & Israel 2017). If this indeed comes to pass, libraries of all kinds must be prepared to adapt. This is why we believe that early experimentation is a useful exercise, and is one that we decided to undertake.

Our experience establishing, promoting, and maintaining the new service

In late 2016, significant funding was provided for the establishment of a virtual and augmented reality service as an extension of the McGill Library Research Commons, which

provided library patrons access to technologies such as 3D printers and a data visualization wall. The funding allowed for the purchase of the HTC Vive virtual reality headset, a high-end gaming computer (necessary to run the Vive), the Microsoft Hololens augmented reality headset, and software for each. The VR/AR service was then launched in early 2017. Over the year and a half that the service has been active, it has gone through extensive changes in an effort to increase the user base and improve security.

Leading up to the launch of the service, the HTC Vive was installed in a study room at the far end of McGill's Humanities and Social Sciences Library, near where the library's 3D printers and data visualization wall were also located. The converted study room also doubled as the space where the Microsoft Hololens would be used. Information about the service was shared via a LibGuide and a number of workshops demonstrating different software, such as Google Earth, were scheduled and advertised through the library's social media accounts. Any students or faculty members interested in booking the technology would submit their requests via email and one of the two librarians responsible for the services would respond based on their own availability and, together, they would find a time to meet and then the librarian would have the user sign a liability waiver and help them get started. With the liability waiver users acknowledged and accepted the risk that they might experience motion sickness, nausea or other types of discomfort, as well as the risk of walking around a closed space without complete visibility. The waiver was based on the waivers that were used at other virtual reality experiences across Canada.

A few weeks following the launch of the virtual and augmented reality service, problems emerged due to the limited availability of the two responsible librarians, who also had subject reference responsibilities. In some cases users became discouraged due the limited availability, and did not follow through with their booking requests. In other cases users would make a request to book the technology, a librarian would set up the space and the requested software - which could be quite time consuming - but then the user would not show up for their booking, resulting in a significant amount of wasted time.

Outside of staffing issues, there were additional problems with the study room where the HTC Vive had been installed. The room was located in an area that was not easily visible, which allowed users privacy during their bookings but also meant that users could not be easily supervised. Because of this, very early into the launch of service, the two expensive HTC Vive sensors were removed from the walls and stolen. These were thankfully returned a few days later but, had they not been, this would have put a sudden and early end to the new service.

This lack of visibility also made it difficult to market the service. Overall, during these early stages of the launch, it was found that despite the fact that walk-up demonstrations of the virtual and augmented reality proved very popular with students, it was much more difficult to encourage students and faculty members to follow-up with bookings for the technology. The first eight months of the service saw a low number of bookings - just eight overall, only three of whom showed up.

Following this early dry period, while moving towards the start of a new school year in September a number of changes were made to the service in regards to booking procedures and the physical location of the technology. The HTC Vive installation was moved to a different study room that, while smaller in size, was in a more highly trafficked area and had a glass panel that allowed others to see inside the room and see the technology in use. This

change was meant to help prevent people for stealing or damaging the equipment, and also as a means of increasing visibility and attracting more users. Furthermore, a LibGuide was created that provided a better description of the available software for both the Microsoft Hololens and the HTC Vive and also discussed potential applications for the technology. The job description for the students who managed the 3D printing service was changed service was changed to include support for both the HTC Vive and the Microsoft HoloLens to help address the availability problem. Both the HTC Vive and the Hololens were made bookable through the library's LibCalendar booking system, streamlining the booking process and creating a better user experience.

By allowing users to more easily book their own times with both the HTC Vive and the Microsoft HoloLens, the number of bookings increased significantly. While there were still users who did not show up for their bookings, and a lot of time was still wasted where staff members set up for bookings that were left vacant, overall both technologies received much higher usage after implementing these changes. Where in the previous eight months there were only eight bookings, for the following eight months after the service changes this number increased to forty-seven. The user base was a mix of undergraduate students from all departments, with a noticeable number from engineering and computer science departments.

Software Collection

Developing the software collection

When the decision was made to bring virtual and augmented reality into the McGill University Library, an important aspect of this project was to develop a collection of related software to be used alongside the technology. In building this software collection a priority was placed on acquiring software that could be demonstrated as having educational value, or that could potentially be used in relation to, or in support of, university courses. Another factor considered when purchasing software was the price. While there were many free or low cost software options, most larger, fully developed virtual experiences were fairly expensive, at a cost of around one hundred dollars USD. To assist with the process of building a software collection, a practicum student from McGill's School of Information Studies (SIS) was hired. The practicum project involved aggregating a list of available augmented and virtual reality software and their prices. The student also described what educational subjects the software related to, and provided an overview of reviews for the software and whether or not it was well-received by users.

For the Microsoft Hololens, all software was acquired through Microsoft's Online Store. The store has a number of educationally relevant HoloLens apps available for purchase. The app ARchitect, for example, gives a basic sense of how augmented reality could be used for viewing new building designs. The app Robotics BIW allows user to simulate robotic functions. A select number of apps, such as Land of the Dinosaurs and Boulevard, provide applications for natural history and art. There were a select number of apps related to science, mathematics and medicine, and others with artistic applications. All of the HoloLens applications were free but, compared to what is available for virtual reality, the experiences were much smaller in size and scope.

For the HTC Vive, all software was acquired through the Steam and Viveport platforms. There were many software programs that had applications for educations.

Software such as Symmetry and Home Architect had potential applications for architecture students. A fair number of software programs related to medicine and anatomy was available too, such as The Body and The Physiology of the Eye. There were also many related to art and art creation. A small number of applications related to space, physics, history, travel, and many other areas of interest. Overall, Steam and Viveport had much larger software libraries than Microsoft's online store.

The software collection available through the McGill Library, as well as a description of each program, can be found on the Virtual and Augmented Reality LibGuide created by the practicum student: http://libraryguides.mcgill.ca/vr-ar/home. The LibGuide was also used as a tool to promote the HTC Vive and HoloLens to students, with the software descriptions providing an idea of potential applications for class or research-based projects.

Access to Software Library

After building the software library, the next step was giving users who booked either the HTC Vive or HoloLens access to the software. This was a challenge because our software collection was not accessed through our library catalogue, but rather using proprietary platforms associated with the equipment.

For the HoloLens, a generic user account was created and shared with person who booked the HoloLens at the time of their booking. After logging into this account - which could sometimes prove to be a challenge because typing is done using the headset's gesture controls - the user could select a floating tile which would reveal a list of available software. An unresolved problem was that users would then need to refer to the HoloLens LibGuide for a detailed description of the software, or else choose software based on name alone, and the names were not always helpful.

For the HTC Vive, the system to access the software collection was a little more complicated. For purchases were made through the library Steam account, users need access to this account. After arriving for their booking, users would first log into the high-powered gaming PC connected to the HTC Vive by using their normal McGill login credentials. They would then log into the library's Steam account using a shared username and password. For security reasons, the library's Steam account was stripped of any credit card information in order to prevent users from making software purchases. It was not possible to prevent users from installing free software, but users were informed that this was not allowed and to direct any software requests to staff members. To ensure no unauthorized software was installed, staff members would occasionally need log into the library Stream account for verification. During this time staff members would also install any required software updates. For Viveport software, users would simply open the Viveport software and then launch any of the experiences they were interested in.

Software Usage Statistics

By far the most popular game used alongside the HTC Vive was the The Lab. Shipping alongside the Vive, The Lab is introductory software created for the system by its developer, Valve. It includes a number of mini-games demonstrating different features of the Vive. The software was a very popular choice for those trying the Vive for the first time. After The Lab, Google Earth VR was the second most popular choice. Below these two

programs, other software from the virtual reality library was not used much. Of the programs used, these included music software called Audio Factory, virtual reality art software The Night Cafe and The VR Museum of Fine Art, and then a mix of entertainment-based games like Raygun Commando and Quanero. Compared to The Lab and Google Earth VR, these other programs had been launched at most two times and in most cases only once. Usage statistics, including how many times a program was opened and the overall time each program was used for, were available through the library's Steam account.

For the Microsoft HoloLens, the three most popular software programs were Land of the Dinosaurs, Palmyra and Insight Heart. Insight Heart allow users to view and manipulate a 3D rendering of a high-resolution human heart, Land of the Dinosaurs provided an augment reality experience featuring 3D renderings of dinosaurs, and Palmyra gave an augmented reality tour of the ancient city of Palmyra. Overall these experiences were short and gave a good introduction to augmented reality technology. Users would often try all three software programs during the same booking. Unlike the library's Steam software library, statistics for the software usage on the HoloLens were not readily available. In this case, the staff member assisting the person who had booked the HoloLens would manually record what software they used.

Overall the augmented reality software usage seemed to be geared towards experimentation with the technology. Aside from a PhD student who was studying music, the technology was not directly used for any research related projects. A number of students who used the technology asked about the availability of software related to their research. Though many students had ideas for research projects that could make use of the technology, there was no available software that would have allowed them to use augmented reality in the way they wanted. There were no students interested in developing their own software to be used with the technology either.

Equipment advice for libraries considering developing a VR/AR service

Depending on a library's needs, budget, and anticipated level of investment in terms of time and staffing, there are different approaches one could take with respect to purchasing equipment. While it is true that high-end virtual reality systems can be very expensive, rudimentary VR headsets can be purchased at very low cost. This is made possible by the fact that modern headsets have been made possible in the first place by advances in smartphone technology, in particular their screens and sensors. In fact, low- to mid-range VR headsets all currently rely on smartphones themselves for their screens and positional tracking, meaning that if a library's users have smartphones the cost to the library can be greatly offset.

If a library is interested in experimenting with VR but has limited resources, a good option to consider would be Google Cardboard. These inexpensive headsets can be paired with any modern smartphone, which could be supplied by the user, who would install an app on their phone in order to use it. They are best used for VR experiences with relatively low levels of immersion and interactivity, such as 360 videos.

For a significantly more immersive experience than Google Cardboard that remains affordable, libraries might consider mid-tier mobile virtual reality headsets such as Samsung's Gear VR and Google's Daydream View. These offer a wider field of view and better lenses to enhance immersion, have much higher quality software available for use, and usually include a rudimentary motion controller (remote) as in input device which will allow

users to interact with the virtual world rather than simply experience it passively. The headsets themselves are relatively inexpensive, but the catch is that they each require specific high-end smartphones to operate. While these do not offer the same level of immersion or quality of software of high-end systems, their mobility can be a draw depending on the use case.

High-end virtual reality systems (e.g. HTC Vive, Oculus Rift, Windows Mixed Reality) are much more expensive than other options, as they require not only the headsets, sensors and precision motion controllers, but also a high-end computer in order to run them. While a lot of software is available for free, the highest quality games and experiences can be expensive as well. It is important to factor in the cost not only the equipment itself, but of staff time that will be required to set up it, secure it, and train patrons on their use. It also has significant space requirements to consider to allow for free movement through the digital environment. All this being said, these systems provide by far the most immersive experiences available and are worth the cost if a library is considering seriously investing in a virtual reality service.

Augmented reality headsets continue to remain available only as "development kits" targeting early adopters of the technology rather than the general public. These technologies are very expensive indeed, and software availability remains limited. While we found that the Microsoft HoloLens received significant use from our patrons, we would recommend the purchase of one only for libraries serving researchers and developers.

Finally, it should be noted that these technologies are constantly improving and it may be worth waiting for the release of updated equipment to ensure the most value for money spent. The Oculus Rift and HTC Vive have both been on the market since 2016 and it is likely that updated hardware will be released in the near future (Muncy, 2018). There are also a number of self-contained, mobile virtual reality headsets which will be released imminently that will eliminate the need for specific high-end smartphones to power the mid-range mobile headsets as described above.

Conclusion

Technology experts have argued that both virtual and augmented related are technologies have the potential to make a significant impact on education and research (Marley, 2016). In their traditional role of providing people with access to information, it can also be argued that virtual and augmented reality makes sense in a library as tools that allow library users to access a growing collection of virtual and augmented reality content.

Based on the experience of the McGill University Library, however, despite the fact that there is a large interest in virtual and augmented related technologies as well as a quickly growing collection of related software and other content, it is a challenge to offer virtual and augmented reality services within a library setting. Not only is it very time consuming process to assist users in using the technology, and have them sign legal waivers, it is also a large amount of work to ensure that all related software is updated and that all physical components are charged, updated and functioning too. In addition, there is the added challenge of securing the technology, and ensuring that no physical components are stolen or damaged. That being said, these technologies are becoming increasingly accessible, and with careful consideration of the associated costs and challenges it is worthwhile to begin considering and experimenting with how libraries might begin to integrate immersive

technologies into their services. What is currently needed is experimentation with different service models to prepare libraries for the future as immersive media become increasingly important.

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