Perceptions and experiences of virtual reality in public libraries

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Abstract

Purpose – Virtual reality (VR) is becoming a more available technology including in public spaces like libraries. The value and role of VR as a tool for learning and social engagement are unclear. The purpose of this paper is to explore the ways in which library patrons and librarians perceive VR and experience VR through library drop-in programs.

Design/methodology/approach – This paper is based on research conducted in seven Washington State Libraries where VR was adopted for drop-in programming for the first time. Data was collected between March and June 2018 and involved interviews with librarians and patrons, a patron user experience survey, and observational field notes from researchers on site during library programs.

Findings – Findings are presented in relation to user perceptions of VR compared to their actual VR experiences, and in relation to informal learning and social engagements. The authors frame the analysis and discussion in relation to sociotechnical imaginaries – culturally situated ideas about the relationship between society and technology, and considering the larger cultural landscape that informs collective views about the present and future.

Social implications – The paper discusses pending and potential inequalities related to gender, race and class in conversation with technology industry and VR. Issues discussed include unequal access to technology in public libraries and representation of minoritized groups in VR.

Originality/value – This work takes a critical perspective considering the inequities in relation to mainstreaming VR through public spaces like libraries.

Keywords Virtual reality, Library, Sociotechnical imaginary, Social engagement, Public spaces, Informal learning, Equity and technology

Paper type Research paper

Introduction: virtual reality (VR) in the public domain

Virtual reality (VR) has been imagined as a technology to defy the rules and consequences of the real world and as a means to engage young people in learning and social engagement. Examples of how VR research is developing include studies asking young people to take on the role of a virtual superhero to foster real-world prosocial helping behavior (Rosenberg *et al.*, 2013), teaching kids about safety (Schwebel *et al.*, 2014), and promoting good health management for diabetic women of color (Rosal *et al.*, 2014), to name a few. VR has also been described as an opportunity to experience, witness and engage in the lives of others, such as through public art and outreach virtual experiences like Alejandro G Iñárritu's *Carne y Arena* (Iñárritu, 2017). *Carne y Arena* explores the experience of being a refugee fleeing persecution at the Mexico-US border. VR can also be described as an escapist and elite, cutting-edge tool not yet available to the masses, as it remains out of reach for many individuals and families in North America due to cost and familiarity with the technology.

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Libraries are key locations for exploring the relevance of VR among the public, as libraries are oftentimes access sites for new technology. Libraries are also interested in expanding their patron base and continuing to support education, be it through onsite programs or contemporary means of accessing information, such as using new technology like VR (American Library Association, 2017). In this paper, we present empirical data collected in 2018 across seven Washington State libraries to explore the role of VR as a publicly available tool. Our research asks about the role of VR in the public library to support gender and racial diversity, equity, and inclusion. In particular, this work is related to making VR accessible to the general public and bringing in a more diverse patron base into libraries. We also inquire about what VR experiences librarians and patrons find to be engaging, and discuss these findings in relation to immersion and informal learning, including concepts like developing empathy.

Informal learning can be defined as opportunities for people to learn throughout day-to-day activities related to work, family and leisure. A focus on informal learning opportunities through the public library can help support people no longer in school, young people disengaged from school, the elderly, and otherwise minoritized groups like migrants and LGBTQ + community members (Halliday-Wynes and Beddie, 2009).

People engage and disengage with public libraries at different times in their lives (Costello and Keyser, 2016). Technology programs that target different user groups is something librarians work on daily to reach their patrons, including with new media and technology programs. Libraries already have an established infrastructure as they are embedded in diverse communities from urban to rural. This means that there is potential to reach people in remote areas where there are often less opportunities for learning as well as getting exposed to new tools. In these ways, the relationship between libraries, learning, technology, and equity are embedded in the study.

Literature review: virtual reality, libraries and learning

The world of virtual reality is rapidly expanding, and empirical research on its purpose, value, and effects is emergent and varied (Boyd and Koles, 2019). Like all media, VR has the power to teach, engage, inform, manipulate and coerce. Learning is of interest for youth programming in libraries in particular, and also across programs that reach adults and aim to generate interest and return patronage to access information through the library system. Libraries have been the forefront of the makerspace movement to provide a public space where informal learning can occur and a wide range of patron's can tinker with new technology (Kim *et al.*, 2020; Koh *et al.*, 2018).

Digital media, technology and maker-space programs are important artifacts in the institutional progression of libraries as successful locations for youth engagement (Subramaniam *et al.*, 2018) and for technology access and equity for adults as well. Technology programs and outreach efforts often include people experiencing homelessness, queer communities and immigrant communities, to name a few target groups (Floegel, 2019; Muggleton and Ruthven, 2012; Wang *et al.*, 2020). Known socioeconomic inequities make access to information, education and technology in public libraries important for many people, especially those in low income settings (Horrigan, 2015).

Library maker-spaces and digital programs have increasingly become important initiatives aiming to reach girls/women and other minoritized groups explicitly (Floegel, 2019). These efforts can be seen, in part, as a response to the established understanding of technology as a predominantly masculine domain (Wajcman, 1991, 2004). The idea of technology as masculine culture highlights how social and technological systems related to both creating and using digital technology are understood in both tacit and explicit ways to be under the control of men. This is a well-rehearsed phenomenon, seen in the gender divides

of many tech sectors (Ashcraft *et al.*, 2016). Library programs aim to counter gender, class, and ethnoracial divisions in access to information and technology, and often also target groups based on age as well. The following section addresses the landscape of VR for learning and in relation to libraries.

Virtual reality and public libraries

Prior research regarding VR in libraries has focused on exploring the different platforms of virtual reality such as Hololens, WebstarterKit and Google Cardboards. Literature has outlined the affordances of the different platforms and how they would interact with the diverse range of patrons' technical skills (Clark, 2019). The interest in VR and libraries has been focused on how the selection of one platform to another might change the experience of the patrons.

Libraries have taken different approaches to providing VR experiences. For instance, there have been libraries that offer drop-in sessions using VR for storytelling, travelling, gaming, and the development of new skills (Frost *et al.*, 2020). Other libraries have coordinated lending VR technology to patrons (Smith, 2020). Specifically, in the library and information science field, the opportunities of Virtual Reality have been explored with a focus on "immersive documents". Robinson (2015) for instance, called the need for LIS to explore documents combined with technology that offer multisensory and immersive experiences which would change information behavior. Robinson discusses how such change in information behavior leads to rethinking the role of libraries to patrons by providing the experience as opposed to merely physical artifacts.

Immersion, informal learning, and empathy in virtual reality

Immersion and informal learning experiences through VR are intertwined with technical affordances of the tool. These characteristics of the tool include the quality and fidelity of the representational environment as well as the degree and design of interactivity created within the VR program. Fowler (2015) suggests that these technical qualities also require greater attention to pedagogical design for meaningful experiences to happen and be remembered. This includes having VR experiences created with expressed learning goals, and ensuring that appropriate learning contexts, like dialogue within and perhaps outside of VR experience, exist.

Learning outcomes in VR have been tied to the strength of a VR user's sense of presence within an experience (Fowler, 2015; Huang *et al.*, 2020; Kool, 2016; Shin, 2018). VR that instills a strong sense of presence for the user can influence how individuals learn and exchange information about places, people, things, and experiences by engaging users in simulated "lived experiences." Huang *et al.* (2020) suggest that individual learning styles and importantly a person not being overwhelmed by cognitive immersion of the VR experience are major factors in one's ability to learn through VR.

A sense of presence is also associated with ideas of empathy and embodied cognition, in relation to learning through VR. One element of learning is related to engagement and emotional experience which can also interact with the building of empathy (Fowler, 2015). Shin (2018) argues that "VR can convey another person's experience or feelings to a viewer" (p. 66). Empathy is related to both cognitive and emotional states where a person takes the perspective of another and shares in their feelings (Smith, 2006). Perspective taking tasks have been used to generate empathy with varied success depending on the nature of the activity, where differences in the context and design of the event like imagining self or imagining others can greatly impact an individual's motivation to change their behavior towards other groups (Herrera *et al.*, 2018). Herrera *et al.* (2018) add to a growing body of

research about VR and empathy suggesting that immersive VR experiences can encourage positive changes in perspective towards unknown Others.

In VR experiences, media-makers construct rich virtual environments and build immersive and interactive stories. These narrative and often interactive stories have been described as influential ways to use media for learning and to change perspectives about difficult subjects, including views on people experiencing homelessness or racial stereotypes (Herrera *et al.*, 2018).

At the same time, critiques of VR surface important questions about what is learned and what is acted upon after engaging in a VR film, interactive experience, or game when a VR user is influenced by the experience (Kool, 2016). The erasure of the maker, defined by the strength of the sense of presence for the user, can create "a dangerous illusion in the consumption of media when viewers begin to analyze, relate to, and act on the stories they consume" (Kool, 2016, p. 6).

Nakamura (2019) discusses many of the problems in this VR landscape – and specifically debunks the notion of empathy as emergent from viewing VR films about non-dominant people, such as through VR programs about life as a refugee or the shooting of Trayvon Martin. Facebook CEO Mark Zuckerberg (among others, see Alsever, 2015; Heft-Luthy, 2019) tout VR as the "empathy machine," and recent, more nuanced studies support the possibility of VR's empathy building power in research settings (e.g., Herrera *et al.*, 2018). However, Nakamura identifies the contradictions in VR as being far removed from the realities of experiences of forced migration, minoritization, etc., making the development of long-lasting empathy that leads to individual, community, or systemic behaviral change, a challenge.

In the digital, immersive environment of VR, user engagements with constructed VR stories may be emotional media experiences distant from the in/equities of the material, embodied world. This includes the contradictions of needing high-cost new media technology to tell the stories of the Other at an individual level, removed from structures of power, privilege, and oppression ("identity tourism," see Nakamura, 2019).

As VR increasingly becomes available in public spaces, we take a qualitative approach to investigate individual experiences of VR made available through public libraries in relation to what is learned, what is possible, and what is imagined about the role of VR in society by users. We discuss the power of imagination in relation to VR and also the direct experiences of research participants – librarians and patrons – through a series of drop-in VR programs in public libraries across Washington State. In our discussion and conclusion, we present the notion of the sociotechnical imaginary in relation to the development of perceptions and beliefs about VR, with a focus on how these views intersect with ideas about equity. Empathy, immersion, informal learning, technology and popular media all surface in this closing discussion as related to our developing understanding about how public libraries can harness the power of VR to meet their own interests to promote learning and serve community.

Research design and data collection

Washington State Libraries engaged in a partnership with the VR company Oculus in 2018 to bring VR to public libraries. At this time, the Washington State Librarian sought out external partners to lead a research study about the initiative. Our team proposed a project focused on the value of the initiative for informal learning and community engagement considering what we understood as the interests and needs of local librarians. Similarly, we included a focus on questions of in/equity in relation to patron engagement, learning and access to technology for community members around Washington State where libraries aimed to expand their patron base and/or create more digital literacy programming for low-income and racialized communities.

The guiding research questions for this paper are the following:

(1) How do librarians and patrons perceive the role of VR-based programs to support gender and racial diversity, equity, and inclusion in libraries?

(2) What virtual reality experiences are most engaging according to librarians and patrons, and why?

Our study involved seven library sites across Western Washington. The seven sites were chosen by the Washington State Library to represent the diversity of the libraries in the western region of the State and based on the interest from librarians. These libraries are situated in different communities with various socioeconomic status and race/ethnicity. The field sites chosen reflected some of the diversity and variety of libraries and communities in the state and included urban as well as rural sites. Table 1 presents the basic information about the participating libraries along with Plate 1 showing geographic locations.

We used interviews and surveys to document the experiences and understand the meaning librarians and patrons associated with VR in each setting. Our questions asked

Library location	Estimated population	White only (not Hispanic or Latino)	Median income
King County Library System: Federal Way	96,289	45.4%	$66,011
King County Library System: Tukwila	20,347	33.9%	$57,215
Mount Vernon Public Library	36,006	56.1%	$55,368
Puyallup Public Library	42,361	76.3%	$70,711
Richland Public Library	58,225	77.5%	$74,405
Timberland Library System: Shelton	10,655	72.0%	$40,141
Timberland Library System: Hoquiam	8,655	84.5%	$42,250

Note(s): * = Data retrieved from US Census estimates (United States Census Bureau, 2019a, b)

Table 1. Washington State Library research sites*

Note(s): Image credit: Google Maps

Plate 1. Washington State Library research sites

about the role of VR for learning based on both experiences with VR and perceptions of VR based on preexisting knowledge, popular media, and actual experiences with the tool. We also asked participants about why it is important to have VR in libraries, the relationship between VR and video games, and where they identified any differences in relation to user demographics and characteristics (e.g., age, ethnoracial background, gender). We asked questions about equity related to gender, ethnoracial difference, and class at each library location.

Notably, the VR experiences in use across public libraries in Washington State at the time of this study were considered "educational." The VR experiences available were all-ages friendly and included experiences like *Ocean Rift* (exploring the ocean, ap Cenydd, 2016), *Mission: ISS* (exploring the International Space Station, Magnopus, 2017), *The People's House* (touring Obama's White House, Felix and Paul Studios, 2017), and *Google Earth VR* (Google, Inc. (2017)). The Oculus Rift free training module called First Contact was also popular. *First Contact* orients first-time VR users to the technology by engaging them in an interactive series of activities with a 1980s-inspired robot in an Earth-landed spaceship setting (Oculus, 2016).

Data collection

This qualitative study was conducted with a focus on librarians and also patron experiences of VR. Over a six-month period from January 2018 to June 2018, we conducted 36 interviews with 23 different librarians, some sitting for a second interview at the end of the project to further reflect on their experiences. Participants included librarians who were involved in the creation and implementation of VR programming and a few in higher-level administrative roles. Patron and librarian interview excerpts are identified as "Patron 1" or "Librarian 1" and librarian second interviews are marked with an *X* (e.g. Librarian 1X).

Participating libraries recorded more than 400 VR users during this time period. After experiencing VR, patrons were invited to complete an online survey available on a laptop at the VR station. Through the survey, they were also invited to participate in an interview with one of the researchers. From those 400 users, we collected 186 survey responses and interviewed 39 patrons. We conducted site visits that lasted two to four hours at each location to observe patrons using VR and the overall structure of the programs. Each site visit involved at least one researcher taking field notes and another researcher conducting patron interviews. Librarian interviews were primarily conducted over the telephone or via remote video conferencing. For most librarians and patrons, this VR programming was their first experience with the technology. Table 2 presents a summary of the data collected.

Findings from this research that are focused exclusively on the librarians views about VR, lessons learned in programming, and challenges faced by librarians can be found in Lee *et al* (2020) and the practitioner report written by Dahya *et al* (2019). This paper provides additional information about both patron and librarian perceptions about VR and their experiences with the VR programs.

Data analysis

Interview data were transcribed and coded collaboratively across the research team of six people using Quirkos qualitative coding software. The research team included two faculty,

Table 2. Summary of data collected

Librarian interviews	23 librarians, 36 interviews
Patron interviews	39 interviews
Patron surveys	186 surveys
Site visit field notes	7 sites, 2 visits per site

two PhD candidates, and two undergraduate researchers. We divided the transcripts across two sub-groups, librarian interviews, and patron interviews, with one member from each researcher group (faculty, PhD, undergraduate) engaging in preliminary coding. We each used open coding on two randomly assigned interviews from each sub-group and then collaboratively generated a codebook through discussion of common themes we discovered. After we generated the codebook, we assigned two independent coders to each transcript. Following a consensus model, the two coders compared their results aiming to reach consensus, and where disagreements arose, a third person from the research team acted as a tie-breaker.

Both librarians and patrons discussed their perceptions and beliefs about VR as well as their actual experiences with using VR in the context of this study. We agreed that distinguishing between descriptions of actual experiences with VR and descriptions of what librarians and patrons perceived or believed about VR would serve as top-level categories. We developed sub-categories of these major themes to describe the properties and dimensions of participants' actual experiences as well as their perceptions and beliefs about VR now and in the future.

We developed other categories that were to some degree *a priori* based upon the topics covered in our interview protocol. For example, we asked librarians and participants about their experience with video games in our survey and followed up with further questions in the interview. We also found participants describing video games in relation to their perceptions and beliefs about VR. Video games can be described as related, precedent, or similar technology to VR, and our aim was to capture participants' associations between the two as well as map intersections between video game cultures and VR. We also asked in surveys and then in interviews about learning, community or social engagements, as well as about users – and these were all solidified as codes in our codebook (see Table 3). Once final codes were agreed upon, we compiled a report of coded themes and conducted our analysis using the report.

Top-level thematic categories	Sub-categories within themes
Learning experiences	
	Learning content
	Learning VR technology
	Learning concerns/difficulties
Perceptions/beliefs about VR	
	What VR can/cannot do
	— within libraries
	— for learning
	Prior knowledge
	Perceived psychological and physical effects
	Beliefs about user/audience qualities
	Perceived social
Experience	
	Emotional response
	Physical reactions
	Uniqueness/affordance of VR
	Challenges
	Social
	VR titles
Video games	
Libraries	Practice and programming
User characteristics	

Table 3.
Codebook categories

Interviews provided rich insight into how librarians and library patrons perceived and experienced virtual reality. Survey data is presented descriptively to provide top-level information about demographics and use patterns. For example, respondents had gender identification options (non-binary, male, female, other, prefer not to say) and were asked to self-disclose age range, profession and education level. Interviewee demographics were documented in relation to general categories such as their participation in youth or adult programming. Some characteristics like age and gender were also noted in relation to interviewees' self-disclosure or declaration and/or based on markers of interviewee gender expression.

Limitations to the study

One notable limitation to this study involves VR program design and the VR experiences available for this project. The VR experiences that were recommended for use by Oculus's education team included 26 experiences with public use rights secured directly by Oculus from the developers of each VR program. Many of the VR experiences made available were explicitly educational, like Ocean Rift, which included informational narratives about various undersea creatures. The People's House and Mission: ISS offer a glimpse into The White House and International Space Station. Google Earth allows for the exploration of the world and opportunities to learn more about global geography. A few of these experiences came with educational resource packets to support learning. However, most of the librarians did not have the time or resources to build in the use of these materials (Dahya *et al.* 2019). Many other experiences did not have learning materials to support programming at all.

The structure of using technology in the library was itself a limitation, given that librarians have a range of responsibilities and this pilot VR program did not include significant prep and technology learning time for the librarians. They were sometimes faced with technical difficulties from computer updates to controllers losing their wireless configuration to the VR system, and having to troubleshoot that on the fly with patrons in front of them (Dahya *et al*, 2019; Lee *et al*, 2020). This certainly impacted user experiences and possibly when and which users decided to complete the user experience survey, which we were not always on site to facilitate.

The survey data is valuable in offering a view into some of the patron demographics and user characteristics though the sample of 186/400 is limited. The views of non-VR users in the library on this type of programming is not captured in our dataset. Interviews and on-site observations offered the richest data and greatest insight into the practices of librarians and patrons and are the focus of findings and discussion presented in this paper.

Our analysis centers a few key themes from our coding structure, based on their salience and relevance to the research questions. These themes are about perceptions/beliefs about VR and VR experiences. We also address informal learning experiences and user characteristics throughout. Our findings and discussion highlight how and where perceptions and beliefs about VR and participants' VR experiences surface questions of access and equity in relation to the public availability of this technology in libraries. The findings and discussion presented here invite a broader conversation about why understanding the relationship between libraries and technology programming is important now and in the future.

Survey findings: descriptive survey responses

Descriptive survey responses offer information about participant demographics. In addition, survey responses provide insight to patron views about their own learning through the VR

programs available at the public library. Responses also provide insight to patrons' precedent experience with video games and other media forms in relation to learning.

Participant demographics

Reporting on participant demographics, half of the total respondents were under the age of 29 years. There is a slightly higher representation of male-identified compared to female-identified respondents (with one selecting non-binary and two identifying as transgender). This gender based data will be discussed in more detail in conversation with the interview findings later on in the paper. Our survey also included an open-ended question about ethnoracial background. Half of respondents self-identify ethnoracially as White. This data is represented in Tables 4–6.

Leaning and VR

Participants were asked to use a five-point rating scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) to describe their learning of and through the VR experience at the library. There were three statements about learning through VR. The first was about learning the topic covered in the VR experience, the second focused on learning to use the VR equipment, and the third about learning through educational wrap-around library programming tied to the VR program. Respondents indicated that the strongest learning

Table 4. Survey respondents by self-described ethnoracial designation $n = 186$*

White	92	49.5%
Hispanic	17	9%
Asian	9	5%
Indigenous	8	4%
African American	7	4%
Unclear, unsure, or unknown	9	5%
Skipped	52	28%

Note(s): *Some respondents indicated multiple ethnoracial designations, thus a greater than 100% total represented on this table

Table 5. Survey respondents by gender $n = 186$

Female	69	37%
Male	81	43.5%
Non-binary	1	0.5%
Prefer not to say	0	0%
Custom replies (e.g. trans*)	2	1%
Skipped	33	18%

Table 6. Survey respondents by age $n = 186$

Age 13–17	49	27%
Age 18–29	38	21%
Age 30–39	18	10%
Age 40–49	12	6.5%
Age 50–59	12	6.5%
Age 60+	14	8%
Skipped	38	21%

outcomes were tied to learning VR technology such as putting on headsets, using hand controllers, and simply experiencing the immersive and interactive qualities of VR.

The survey also included questions about participants' knowledge and experience with learning through multimedia formats, beyond their VR experiences in the library. These questions were designed to understand the trajectory of participant experiences with digital media and in relation to learning. Specifically, the question asked respondents to rate digital media tools on their effectiveness for learning, including interactive media like video games, audio-visual materials like film, audio only like podcasts, and text only. Questions were set on a 5-point rating scale (very effective, somewhat effective, neutral, not very effective, not at all effective). Responses indicated audio-visual learning tools such as YouTube videos, documentary films and video games as providing effective opportunities for learning. Audio materials like podcasts were less strongly rated, and text-only materials were also less strongly rated for learning. This trajectory shows preexisting interest and perhaps aptitude among respondents trying VR in the library for multimedia learning.

VR and video games

Eighty-two percent of all survey respondents indicated that they consider themselves to be video game players, defined to include regular and occasional players using phones, computers, or consoles. The finding that most survey respondents were also video game players, along with their preexisting affinity for other forms of interactive and multimedia learning, surfaces the possibility that many of the people drawn to try VR in this public setting were already technologically and media minded.

Together, the survey findings challenge the idea that bringing VR technology in the public space of the library serves as an equalizing force. In this study, a notable group of the participant base was comprised of white boys and men, as well as preexisting video game players and media users. The findings do suggest that participants learned about VR technology through their library experiences, itself an important outcome of the VR programs available. In the next section, we present interview findings related to participants' actual experiences with VR and their perceptions and beliefs about VR.

Interview findings 1: users' actual VR experiences

In this section, the findings relate to actual experiences of study participants with VR, including the self-declared outcomes of using VR in the library related to immersion and a sense of presence. The section also addresses the characteristics of users in relation to reaching a wide and varied range of patrons to use VR (considering race, ethnicity, gender, sexuality, class) as well as the social interactions of participants with VR.

(1a) Experiencing a sense of presence and interactivity

Research participants reported having a strong sense of immersion during their VR time, describing their experience as "feeling like it was real" or "feeling as if they were really there." One of the unique qualities of VR experiences described by interviewees is providing people an opportunity to forget the world around them, if only for a moment, and to engage in something through an intense and visceral media experience. One patron said, "My VR experience is a total high. I really like how you can interact in the VR and it brings a lot more life to the library. Cause you can go into another world, even though you're in one spot, you can go into another world and just experience anything. It's really fun" (Patron 27).

Being immersed in and travel to places of impossibility – outer space, underwater, inside the body and fictional worlds – were discussed as highly enjoyable experiences. Librarians described examples of elderly people and people with motor impairments trying VR and

"doing things" they otherwise could not. Some elderly users expressed excitement about being able to "see" parts of the world they never thought they would be able to see. One participant said, "Something that I learned is that from the normal view of the Earth down here is small and limited, but once I'm inside the Google Earth VR, I feel like I own the world or something" (Patron 24).

Another patron described their experience as follows. "VR allows greater sense of immersion, being surrounded by the environment ... So let's say there's a game where you're near a pond in some forest. Being able to look around with your head, rather than having to move a stick on a controller to look around, again, allows for better immersion and being able to interact with things in a 3D space ... It's being able to fully internalize whatever experience is presented to you" (Patron 28).

Interactivity in VR was mentioned as a favorite element of the experience, with many patrons preferring VR where they could touch and/or control objects and interact with the environment rather than simply watch or follow a story. In some cases, this allowed research participants to experience a stronger sense of presence in the game. One patron was in a wheelchair and described feeling as if she could get up and walk. She described the impact of the experience as follows.

> Patron 31: It was different. It was very different. This was my first time trying VR so I found it kind of thrilling. It almost felt like I'm actually there, to the point where, if my supports of my wheelchair were not around, I would have forgotten that I was actually in a wheelchair.
>
> Interviewer: So it was your very first time using it?
>
> Patron 31: Yes, and it made me very happy.

A few VR users expressed having a sense of empowerment or ownership over the virtual world being in a space where they have control and can imagine being able to do anything. As presented in the literature review opening this paper, a strong sense of presence and high interactivity are also tied to better opportunity for learning.

(1b) User characteristics: gender and ethnoracial differences

One librarian explained her view on VR programming she had facilitated in the library as follows. "We had a lot fewer girls; we had way more boys use it. We did have a couple of girls who were regulars, though, who would come in every chance they could to do it, which was great, but in general I would say they were far outweighed by the boys" (Librarian 3X).

Another female librarian aptly captured some of the historical and well-documented problems related to technology as masculine culture (see Wajcman, 1991, 2004) spilling over into these VR experiences in the public library. "I was excited, I mean several of us were, but a few of the women that I did ask, "Hey, did you wanna try this and stuff?" Those were the ones who told me, everyone who I had tell me no, there was no way they'd be interested in trying something like that or they were not fans of technology, all of them were females that I got that response from" (Librarian 2X).

These common themes across patron and librarian interviews about the dominance of boys and men as VR users in the library program contrast with the survey findings. Survey findings show a near equal representation of male-identified and female-identified users. We question if the survey response shows an over representation of girls/women by way of more women actually completing the survey than men out of the total survey respondent pool. One librarian explained the following. "I will say, though, like any technology things, the first group of power users were definitely like teenage boys. And then we had to sort of expand from that user base, a little bit more" (Librarian 10x).

Many librarians also described challenges with reaching non-dominant and often non-White community members. The most notable exception to this was a library that already

serves a majority non-dominant community (immigrants, refugees, people of color), and so this demographic was also reflected in the VR program participants at that location. For the other research sites, librarians either commented on general challenges in reaching non-White community members or the need for more explicit outreach and initiatives to draw them into programming.

(1c) Social experiences of VR

The social experiences of patrons with VR were clear and generally positive. In some cases, particularly among youth patrons, social interactions around and about VR were influenced by preexisting social dynamics of the group coming into the library. If a group of friends came into the library together, they typically all either did or did not try it out. At the same time, when people did try VR, it generated some conversation around that experience among spectators who might not otherwise have talked to one another.

People also responded and reacted to what was happening in VR as shown on the outward-facing display screen, and spectators had fun interacting with and around the person in VR. This social engagement was described as a happy surprise to patrons and librarians. Importantly, many people commented on the individual and isolating experience of being a single VR user and of being watched while in VR, where you cannot see the people around you. One youth patron described their first VR experience: "It did not make me feel more nervous. They were actually explaining it to me, so I got the hang of it better" (Patron 4). Although the isolation of VR generated some discomfort for certain patrons, overall, most still expressed that the benefits of having VR in a public space where people could get interested in and chat about the experiences surpassed their feelings of self-consciousness.

Interview findings 2: perceptions and beliefs about VR

In this section, we present findings from interviews under the code of "perceptions and beliefs about VR." These findings highlight the ways in which participants imagined VR being used in the future and what they believed VR might be used for. Our iterative and collaborative coding process surfaced this as an important code, applicable to and present across librarian and patron interviews at different locations and of different ages.

(2a) Perceptions about VR and imagined worlds

According to survey responses and interviews, the VR programs at the library were the first hands-on experiences with VR for many of the patrons and librarians involved. As described, many participants expressed amazement related to the sense of presence experienced through the immersive and interactive qualities of VR. With these experiences at hand, participants expressed a belief that VR could also help individuals overcome constraints related to time, money, geography, and the body beyond the experiences they had.

Programs like *Google Earth* were experienced with wonder at the possibility of traveling and visiting places in the world deemed otherwise unattainable due to physical or financial barriers. One participant said, "... I really wanna explore the world and everything, and of course I do not have the money to do that so I thought, 'Well, here's a chance to kind of see some things and to also experience VR at the same time, so two experiences in one'" (Patron 21). Another said, "Being able to go through the caves, the glaciers, the deserts, the places I cannot, the real places I cannot travel to at the moment, due to, for whatever reason. That is absolutely something I would want to do in VR" (Patron 16).

Other ideas included using VR as a means of facilitating school work for school-aged students and as a therapeutic tool for social and emotional learning. Some participants also speculated on how the technology could have a practical use for job training by enabling

users to practice a skill such as building a car or performing surgery. They also talked about VR being used to escape from reality and to simulate a calming environment where one might not otherwise be available.

A number of participants referenced a popular VR movie called *Ready Player One* (Spielberg, 2018). This film seemed to inform some of their perceptions about the role of VR in the future (addressed in more detail in the discussion section of this paper). For example, Patron 1 engaged in the following discussion:

> Interviewer: Can you talk more about in your imagination, how [VR] is going to be [all] used?
>
> Patron: Did you watch the movie, Ready Player One. Have you seen that movie before?
>
> Interviewer: I saw the trailer, but I get you.
>
> Patron: Yes. That's what I imagine...They advanced [VR] where you have like this double, or you have a suit and it's like you can feel everything that's happening to you. And you have a head fused on, and then you just are in this other world where anything could happen and there's this big video game. That could possibly happen, people feel [VR] is a part of them.

Actual VR experiences in this study did not offer immersive experiences of these kinds. Even so, ideas about learning, training, and experiencing the world beyond what was possible for participants now in their lived realities came to mind for many. Patrons and librarians alike showed a lot of imagination around the future of VR that was also more than what the available VR experiences had to offer them. They expressed how VR could be used to overcome limitations of the real world including physical and financial barriers to certain types of experiences.

(2b) Beliefs and perceptions about empathy building through VR

One common theme across participants was a belief in the possibility of developing empathy through VR experiences, and we discuss this in relation to imagined perspectives and actual experiences of VR. As mentioned, the educational VR experiences available at the library were relatively benign in content, presenting opportunities to learn about space science through *Mission ISS* or take a tour of *Obama's White House*. None had any historical, cultural, or socially situated content, nor did VR users embody the experiences of other people in any depth.

Still, research participants talked about how VR could be used for people to visit war zones and refugee camps, or to understand the perspective of people with autism. One participant tried *Google Earth VR* where you cannot interact with people or scenes. You fly around the world and can stand "inside" the Google street view. One participant explained their view of this experience with great imagination about its potential. "It does not just have to be limited to families or friends. You could meet anybody out there. You can see what their lives are like, interact with them, and see their side of the world through their eyes, and actually feel it . . . And it would garner more empathy towards people who are actually in danger, like in the war zones ..." (Patron 24).

A librarian working in a region that serves a local Indigenous community described the ways she believed VR might be used to garner more empathy towards Indigenous people. "Native Americans were not treated great, or whatever group we're talking about. Getting to see living conditions, getting to see artifacts from that, maybe even really well done. I'm not sure how they do anything in VR, honestly. But really well done, getting to like interact with people from that time period, in that clothing, in that setting ... It would be really cool to experience history, kind of, like the actual history, and not just the victor's . . ." (Librarian 19).

Other participants mentioned empathy building as a desire and possibility they imagined for VR. The interest was to "experience" the world through the perspective of a differently-

abled person to distant cultures of immigrant relatives or neighbors. Empathy was never defined by participants explicitly. However, the idea of "walking in another's shoes" in order to learn something about someone who is different surfaced as a common theme.

One librarian commented as follows. "I think the potential there is awesome too, because you're learning about different cultures. I could totally see learning about native culture through the same storytelling type of thing. Where you actually experience what life was like in that culture, in that time period, and even what it's like in that culture today. And, I think it's definitely a good tool for teaching empathy, and showing how life really is, it's a really valuable tool in that way too" (Librarian 13).

In the many comments about empathy building through VR, there lacked a clear definition of what constitutes empathy and empathy building across participants. Rather, participants gravitated towards this type of perceived benefit and potential of VR without really expressing what it might mean or look like to "build empathy," or how that empathy might be used to enact positive social change on problematic social structures.

Discussion: public libraries, equity and the VR imaginary

In this discussion, we draw on the research findings and present our analysis in terms of equity and the idea of a VR imaginary. Equity issues surfaced in relation to how librarians and patrons imagined VR could be used to overcome real world barriers like money and ability, and to develop empathy about marginalized groups. Additionally, participants expressed the power of the tool to create a strong sense of presence and immersion, and this was often tied to perceptions about using VR to learn about experiences of Others. With this in mind, our discussion explores how this type of program, and the experiences of librarians and patrons involved, reflects and informs a larger public imaginary about VR. We are not drawing correlations or causation, rather, we are surfacing an important theoretical discussion to generate conversation related to the evolving world of VR, learning, and libraries.

The sociotechnical imaginary and VR

A sociotechnical analysis of these findings invites us to examine the mutually shaping relationship between society and technology. Specifically, this refers to the ways in which social norms, practices, goals, and desires influence the use and production of particular kinds of technology. And, at the same time, the uptake of popular tools and software programs change and interact with society in terms of our beliefs, activities, and needs. In this way, society and technology are interactive and shape each other in ways that can be difficult to tease apart (Sawyer and Jarrahi, 2014).

The sociotechnical imaginary refers to how people understand the relationship between society and technology at a given time and also how people perceive the evolution of the sociotechnical future (Jasanoff and Kim, 2015). In this paper, we explore how people with shared experiences and "exposed to the same global media, economic institutions, or social practices" (Strauss, 2006, p. 326) imagine the future in relation to VR. We draw on the shared experiences of trying VR in the public library drop-in programs studied. We also consider the broader scope of contemporary, Western, popular media informing participants' views of VR now and in the future. Media old and new have informed and reproduced social imaginaries for centuries (Anderson, 1983). VR has not emerged from nowhere – it has built on its precedent media forms and the social norms around them. Our discussion is situated within this media landscape.

The library is an important actor in the sociotechnical imaginary, working with and against the inequitable forces of neoliberalism to reach people fairly, expand the use and

value of VR for learning, and to benefit the community (see Horrigan, 2015 for discussion on the role of libraries to support learning and low-income communities). Neoliberalism is a doctrine or system of beliefs where market economy and exchange guide and inform human decisions and actions (Harvey, 2007). As a system, it is described as a powerful set of values, beliefs, and practices that promote consumption (Gill, 1995) and perpetuate inequality across race, class, gender, ability, and sexuality. The public library is important in this landscape, given the prominence of maker-spaces as locations for people to use tools they often cannot afford to have at home, or otherwise cannot learn to use. And, in the case of this study setting, the conversation is timely given the relationship between the public library system and the role they can play in mainstreaming VR technology by making it more available to the public.

In this landscape, Jasanoff (2015) has noted the critical role of science fiction consumption in the development of sociotechnical imaginaries. Examples of how public imaginaries intersect with capitalism, commodification, and consumption are evident in contemporary film and television. For example, the literary work of author Philip K. Dick has been cinematically reinvented by corporate producer-distributors, such as Amazon Prime's *Electric Dreams*. In this TV series, dystopian futures are common narrative elements. Sex and race crossing are one example of imaginaries of the future. For example, in Episode 1 of *Electric Dream* ("Real Life"), black actor Terrence Howard and white actor Anna Paquin swap lives using virtual reality to escape their own realities (Reiner, 2017). The structural differences of sex, gender, sexuality, and race in the characters' lives are mostly absent from the episode.

Ready Player One was mentioned by many participants in this study to help describe their understanding of VR. This reference came up in our observations and in interviews. When we asked participants about how they imagine VR being used in the future, several replied with the question, "Have you seen *Ready Player One?*" The research team watched the film to better understand participants' views on the technology and saw more clearly some of the ways in which the interview findings coded as "perceptions and beliefs about VR" may have emerged from participants' exposure to popular media.

Ready Player One depicts an economically divided and depressed future where escapism through VR is a lifeline. The plot engages in a critique and exposure of the capitalist infrastructure of technology industry and the wealth gap, only to have the main white male character succeed in completing VR challenges that lead to "winning" the game, and consequently earning his status as the wealthiest person on Earth.

In this research, the value of VR was described by participants as related to its ability to provide an escape or an unreal "life experience." This particular interest from participants is not itself inherently good or bad. It holds both opportunity and risks. There are imaginings present in the study that are exciting and worthwhile for all. A vision of a future where we can explore the deep ocean or outer space, or enjoy a virtual experience of walking when you are paralyzed, are certainly ideas of interest to many.

At the same time, we share some concern with the way many of the imaginings about the virtual future engaged with ideas of escaping this life, with all its real problems, much like in examples of VR use in some of the popular media described. Study participants imagined engaging in virtual experiences to witness or embody the emotional, physical, and economic struggles and conflict of communities already marginalized from mainstream society. Here, the idea that virtual reality can be used to "experience" the lives of the Other warrants further discussion.

One example of the imaginary we are identifying through these findings reflected in popular media relates to people embodying other physical forms, such as gender and race crossing. Using *Ready Player One* as an example again, Lena Waithe's character Helen, a black woman, takes on a physically large, male, virtual reality avatar named Aech. Moving through virtual bodies is also well-known from the 2009 film *Avatar* (Cameron, 2009) where

paraplegic Marine Jake Sully uses an "avatar" identity through virtual reality to enter and infiltrate a local Indigenous community (for the purpose of commodity extraction).

Postcolonial theory is helpful here to understand the representational Other and "us" vs "them" mentality that permeates much of contemporary political imaginary, and this is visible in participants' VR imaginaries presented in this study. It is notable in our findings that patrons commented about their interest and belief that VR experiences could contribute not only to empathy building, but specifically towards empathy building and learning related to the conceptual Other in Western society. References to VR's role to build empathy about/towards the Other was framed in relation to being or witnessing "historic" Indigenous narratives and "far away" refugees and immigrants, as examples.

Postcolonial theory suggests that a history of colonization has informed current social structures, including those related to how White and Western society perceives, interacts with, and stands apart from Indigenous People, people of color, queer communities, and poor communities, among other groups (Mohanty, 2005; Narayan, 2013; Said, 1979; Loomba, 2005). Colonial ideals are closely tied to capitalist ones as well. Postcolonial theory in media studies (Hall, 1997) explores how and where current practices and tools remain complicit in the work of supporting the underlying values of a colonial agenda (e.g. *Avatar*'s White savorism, colonialism, and capitalism). Ideas already embedded in society can be perpetuated and reified through media and technology systems.

The examples of participants' perceptions about VR presented in this paper represent a turn in the sociotechnical society. Some individuals in this study were willing to consider the curation of emergent lived experiences like travel to the coded and algorithmically defined parameters of virtual reality software. We consider this resignation as related to financial hardship noted by participants or to other reasons making actual travel now or in the future difficult. The likeness of these virtual engagements to actually travelling are hidden in the language of "experiences," as though lived and virtual experiences can be one and the same (Nakamura, 2019).

Participants in this study showed excitement to travel or escape the boundaries of the physical world. Through this analysis, we are asking if the view of virtual reality as the tool to facilitate these experiences may be taking one step closer to the potentially dystopian and neoliberal future(s) of much historical and contemporary science fiction. Relatedly, we question how much revelation of these ideas by participants reflects a system designed to uphold a neoliberal and postcolonial order – a nascent VR imaginary? As all of these VR experiences happened inside public libraries, we are also asking what role the library can or should play in shaping sociotechnical imaginaries with the public.

Concluding remarks

Appadurai (1996) argues that during the current age of globalization, the imagination plays a new role in social life. As technological advances become increasingly intertwined with globalization (Appadurai, 1996; Jasanoff, 2004; Jasanoff and Kim, 2015), there is notable potential for VR to play a role in transitions from communities that we imagine to exist locally and globally, to the creation of global communities with shared beliefs. How and where VR is deployed, taken up, and what kinds of VR experiences are made available is critical to what kind of impact VR will have in local and global settings.

Accepting technology as a social intermediary, we build on Jasanoff's (2004) view that technology "sustains particular structures of established power" (p. 31) and that this relationship between imagined society and the embeddedness of power in technology are intertwined. We argue, also, that these shared ideas about the experienced and potential value and purpose of VR reflect, construct, and reproduce a deeply political, power-laden, and social order. The ideas people have about VR technology and what it can do, and the experiences of

using VR and engaging in narrative virtual worlds, can arguably influence how users see themselves and their local community. This includes perceptions about the self in relation to (or removed from) the (virtually) constructed Other.

And yet, the imaginary is not an obtuse construct. It is a shapeable and changeable cultural framework within which we all may be complicit in and participate in (re)forming. In this analysis, we also continue to question how the library, in promoting this technology, can participate in purposeful (re)construction of the VR imaginary as it reaches the public. Sociotechnical imaginaries are not predetermined – they are enacted by individuals and through the decisions of state and non-state actors defining a desired future (Ruppert, 2018). Each action-interaction contributes to the materialization and formation of the imaginary. This makes the wider availability of VR a potential opportunity for libraries and librarians to structure and inform the direction the sociotechnical imaginary takes, through critical and engaged programming using VR with the community. Particularly so given the powerful experience of many participants with the immersive, interactive, and artful VR programs they did have a chance to try.

The librarians in this study were aware that it requires a lot of care and time to reach out to non-dominant populations in their local communities. The positive experiences of patrons and librarians with VR suggest that the public library remains a great venue to provide opportunities to reach a wider set of potential technology users and makers. Importantly, this study shows the importance of time to construct purposeful interventions that will build on the technologies affordances to reach a diverse patron base *and* to break from the neoliberal and post/colonial ideals that can be embedded in or reified by media and technology.

We have continued our VR research with this focus, working with incarcerated youth, and are continuing our work to involve teens and young adults to develop VR programs to support their mental health and wellbeing. Through the study presented in this paper, we have heard patrons and librarians express their excitement for the VR experiences they had. Even with the limitation on the available programs and other restrictions (like the length of the session or space), participants shared how enjoyable the experience was and how they want to continue using VR. Our hope is to see the critical analysis presented here inform future VR programs and research in ways that take control of the imaginary and proactively construct it in service of the communities libraries aim to reach. Using libraries as venues to teach and engage more users to participate in creating the VR content themselves rather than merely consuming the VR content created for them is a first step in doing so.

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Jin Ha Lee is an Associate Professor and the Founder and Director of the GAMER (GAME Research) Group at the University of Washington Information School. Her research focuses on exploring new ideas and approaches for organizing and providing access to music, multimedia and interactive media, understanding user behavior related to the creation and consumption of these media, and using these media for informal learning in venues such as libraries and museums. Recently, her research has focused on investigating the impact of location-based augmented reality games and virtual reality games on player behavior, in particular, group behavior, intergenerational joint media engagement and impact to health. Her research has been funded by the Institute of Museum and Library Services (IMLS), Washington State Library, Online Computer Library Center (OCLC), Association for Library and Information Science Education (ALISE), Korea Electronics Technology Institute (KETI) and Epic Games.