

SPORTS FANS IN THE DIGITAL AGE: WILL VIRTUAL REALITY INTEGRATE INTO
THE SPORTS SPACE?

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ABSTRACT

Virtual reality (VR) is an immersive technology that is increasingly considered for use in the sports media space. With the proliferation of digital media, stakeholders in the sports ecosystem are looking to leverage new technology as part of their distribution strategy. This paper will seek to investigate the potential for virtual reality as a sports broadcasting medium. Through an exploration of various points of view in the field, use cases, and theoretical frameworks, this research will attempt to understand the various barriers to mainstream adoption. This MRP concludes that virtual reality for sport viewing is still in its infancy, but will pervade the market as a complementary broadcasting offering in the future. It will furthermore seek to outline a business model for virtual reality sports to monetize content.

Table of Contents

Authors Declaration.....	i
Abstract.....	ii
Table of Contents.....	iii
List of Figures.....	iv
1. Introduction	1
2. The Field of Virtual Reality.....	3
2.1 What is Virtual Reality.....	3
2.2 Immersive Technology Spectrum.....	5
2.3 History of Virtual Reality.....	6
2.4 Virtual Reality and Sport.....	8
3. Sports Broadcasting Industry.....	10
3.1 Collision of Technology & Sport.....	10
3.2 Sport Broadcasting Trends.....	10
3.3 The Modern Sports Fan.....	12
3.4 Modern Sports Fan Trends.....	13
4. Intersection of VR & Sports.....	16
4.1 Case Studies.....	16
4.2 Discussion: SWOT Framework.....	18
4.3 What Sports are Best?.....	25
5. The Future of VR & Sports.....	27
5.1 User Adoption.....	28
5.2 Content Model.....	29
5.3 Business Model.....	30
6. Conclusions.....	31
7. References.....	33

List of Figures

FIGURE 1: Mixed Reality Spectrum.....	5
FIGURE 2: Reality Matrix.....	6
FIGURE 3: Eight Fan Motivations.....	13
FIGURE 4: Average Sports Ticket Prices.....	15
FIGURE 5: NextVr and NBA Game Views.....	17
FIGURE 6: LiveLike VR.....	18
FIGURE 7: Change in Advertising Spend.....	23
FIGURE 8: VR For America's Cup.....	26
FIGURE 9: Focal, Planar Action for Sports.....	26
FIGURE 10: Adoption Rates of Major Adoptions.....	28
FIGURE 11: What Fans Want Out of Season.....	29
FIGURE 12: Digital Content Monetization Frameworks.....	31

1. Introduction

Since the first commercial radio broadcast of a sports game in 1921, sports broadcasting has permeated worldwide households and has become a primary revenue driver within the sports industry. The sports media landscape is evolving rapidly as cord-cutting trends accelerate, streaming becomes the norm and over-the-top content systems become the norm. Driven largely by the digital age, the modern sports fan now expects a more visceral, engrossed and personalized sport experience (Performance Communications, 2016). This taste for immersion, coupled with motivations to produce user-generated media, is changing the way sports fans consume content.

Sports teams with the highest fan engagement scores tend to rank in the top of their leagues for revenue and valuation (Hopscotch, 2014). Historically, competitors in the sports ecosystem have adapted to what they consider the pressuring issues of fan attraction and engagement (Deloitte, 2015). Virtual reality (VR), a type of immersive video, is a relatively new sports broadcasting medium used to bolster fan attraction and engagement. This paper will seek to determine the potential for virtual reality as a sport broadcasting tool and the likelihood for consumers to adopt it as part of their technology arsenal to watch games. It will additionally aim to outline the obstacles before mainstream adoption. As a \$620 billion global industry, it will be interesting to discuss the plausability of a nascent technology to disrupt the market (Performance Communications, 2016).

The introductory section will provide an overview to the 4 sections explored in this paper. These sections include:

1. The field of virtual reality
2. The sports broadcasting industry
3. The intersection of virtual reality and sports
4. The future of virtual reality in sports

Through an extensive literature review, Section 1 will provide an overview of the field of virtual reality, related concepts, and will briefly discuss the application of VR in sports. Section 2 will examine the current sports media landscape, and trends in sports fandom, in an attempt to understand market opportunities. Section 3 will investigate detailed industry reports, use cases, and subject matter expertise from leaders in the sports industry. The use cases explored are NextVR and the National Basketball Association (NBA), Molson Canadian and the National Hockey League (NHL), and LiveLike VR and the Union of European Football (UEFA) Champions League. Moreover, a SWOT framework will be utilized to discuss Strengths, Weaknesses, Opportunities and Threats to address a potential fit for the technology and barriers to mainstream adoption. Lastly, Section 4 will conclude on the future of virtual reality as a ubiquitous sports media platform, with considerations on the future business model.

It should be noted that for the purpose of this research, there will be a focus on five major professional sports: (1) football; (2) baseball; (3) soccer; (4) basketball; (5) hockey.

2. The Field of Virtual Reality

2.1 What is Virtual Reality?

The term ‘virtual reality’ conjures up several different meanings. In the broadest sense, virtual reality is the use of computer technology to create a simulated environment. Fuchs (2011) discusses the objective of virtual reality:

The purpose of virtual reality is to make possible a sensorimotor and cognitive activity for a person (or persons) in a digitally created artificial world, which can be imaginary, symbolic or a simulation of certain aspects of the real world. (p.13)

Virtual reality has four inherent characteristics, it is: (1) immersive; (2) interactive; (3) multi-sensory; and (4) imaginative (Liwei, 2012).

Immersion

Immersion refers to the degree that users feel present in an artificial world. With influences in theatre and narrative theory, one objective of storytelling is to create a mimetic world. For instance, the directors of *The Game of Thrones* created visually mimetic cities, such as King’s Landing and Dragonstone, by using real milieus in Croatia and Malta, respectively (Redman, 2017). In virtual reality, the degree by which the artistry is told is superior to state-of-the-art graphics in creating an immersive and mimetic experience.

Originating from the word telepresence, presence is the idea that a user no longer inhabits his/her physical surroundings but rather occupies the virtual environment as a ‘place’ (Sheridan, 1992). For users, it is better to use exaggerated and stylized avatars, as opposed to life-like ones, in order to augment this feeling of presence. The ‘Uncanny Valley’ refers to the idea that our brain is capable of accepting abstract and imaginative ideas, such as an overly stylized avatar; however, the inability to accept small discrepancies between the observed and real worlds (Mori, 2012, p 98).

Interaction

Interaction is the ability for users to alter a virtual environment, typically by using different input devices, such as motion tracking or haptic gloves. It is imperative in VR that the system provides a low-latency, immediate and constant feedback loop (Mihelj & Podobnik, 2012). For instance, if a user conveys that they want to watch a Major League Baseball (MLB) game behind home plate, the VR system needs to alter the environment instantaneously. It further needs to provide the user with immediate feedback (Mihelj & Podobnik, 2012), such as a new vantage point of the game. If this interaction loop is not realized, user experience will be consequently hindered. While output devices attribute to the feeling of immersion, input devices are pivotal for enhanced user interaction (Mihelj & Podobnik, 2012).

Multi-Sensation

Virtual reality requires the transmission of sensory stimuli through various channels, in order to amplify immersion. A multi-modal experience (Sherman & Craig, 1995) is created as a result, by which the virtual system engages the user's different senses. It is important to note that virtual reality focuses on the visual and auditory senses first, as they are the primary and secondary senses respectively, followed by the sense of touch (Carr & England, 1995).

Imagination

Imagination, the fourth characteristic of virtual reality, refers to the fact that users can experience an "imagined reality" (Sherman & Craig, 1995) in a virtual environment. An individual can envision a second-hand experience, from a film or a game, and have it fulfilled so they exist within the diegetic world. While someone might never experience playing in a Champions League soccer match, this possibility could be realized through virtual reality.

2.2 Immersive Technology Spectrum

There are various immersive technologies that subsist on a mixed reality spectrum (Miligram & Kishino, 1994), ranging from the real world to an artificial world. As shown in Figure 1, 360-degree video and 2D video exist in the ‘Real Environment’ and are the least immersive, yet most accessible to consumers. In the middle of the spectrum includes ‘Augmented Reality’, ‘Augmented Virtuality’, and 360-degree videos with headsets. Augmented reality (AR) superimposes virtual information on top of the physical world, differing from virtual reality as it does not require users to inhabit an entirely virtual environment (Housel, 2017). One of the earliest forms of AR was the projected first line down in football, as well as puck tracking in hockey known as the FoxTrax¹. Presently, many note Pokémon Go and Google Glass as the innovations that drove AR into the mainstream (Merel, 2017). Furthermore, virtual reality and other sensory technologies live at the end of the spectrum, in a ‘Virtual Environment’ with high immersion, yet low accessibility to consumers. All of the aforementioned technologies have leveraged by sports companies as part of their digital strategy.



Source: Milgram, P., & Kishino, F. (1994). A Taxonomy of Mixed Reality Visual Displays.
IEICE Transactions on Information Systems, 77(12).

FIGURE 1: Mixed Reality Spectrum (Miligram & Kishino, 1994, p. 1322)

Digi-Capital (2015) has created a reality matrix to compare the prevalent brands across the dimensions of immersion, ambience, virtual and augmented reality, as shown in Figure 2. This research will focus on VR technology that requires a head-mounted display (HMD); thus, the brands that exist within the ‘Immersive VR’ and ‘Virtual Reality’ quadrants of the reality matrix (Digi-Capital, 2015). PwC (2017) states that virtual reality video is anticipated to climb at a rate of 87.8

¹ The FoxTrax is a highlighted puck that allows viewers to track the hockey puck in NHL games.

² Cord cutting is an expression that refers to the fact that people are getting rid of their cable television subscriptions.

percent through 2021, likely to surpass interactive experiences and VR game revenue by 2019. It is, therefore, a significant segment of the virtual reality market to examine.

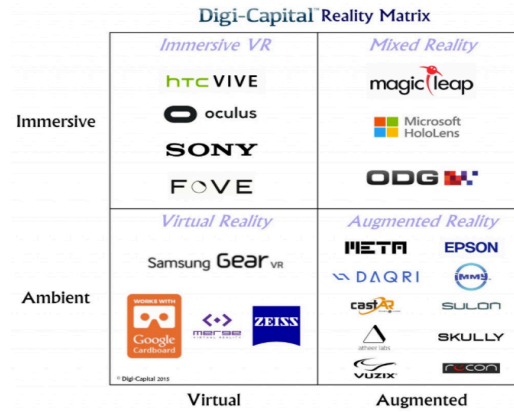


FIGURE 2: Reality Matrix (Digi-Capital, 2015, p.1)

2.3 History of Virtual Reality

There is an extremely comprehensive history of virtual reality (VR), with influences ranging from computer graphics to stereoscopic television. This section will highlight a few of the many individuals and innovations that have impacted the field.

The field of virtual reality was heavily influenced by Morton Heilig's quest for 'experience theatre', which was presence-evoking and could engage multiple human senses (Heilig, 1969, p.13). Heilig constructed a multi-sensory simulator called *Sensorama* in 1962 that took the audience on a motorcycle ride through Manhattan, augmented by sensory stimuli like wind and sound (Ijsselsteijn, 2003). Ivan Sutherland, referred to as the 'godfather of VR', further developed this idea by incorporating the characteristic of interaction (Ijsselsteijn, 2003). Sutherland proposed an artificial world with interactive graphics, force-feedback, sound, smell and taste (Kour, 2015). Alongside his student Bob Sproull, Sutherland was instrumental in creating the first viable head-mounted display (HMD) system in VR, called *The Sword of Damocles* (Ijsselsteijn, 2003, p.19).

The 1970s saw the introduction of the first force-feedback system at the University of North Carolina and the creation of an artificial reality system by Myron Krueger called *Videoplace* (Ijsselstein, 2003). The first data glove was developed by AT&T Bell Labs in 1979 and greatly influenced later input devices (Ijsselsteijn, 2003). Over the next decade, VR was largely applied in the military, government, automobile and healthcare industries (Ijsselstein, 2003). Virtual I/O broke the \$1,000 price barrier for an HMD in the 1990s, a decade that saw a boom in VR as a new archetype of user interface (Sherman & Craig, 2003). However, the technology failed to penetrate the mass market due to the hardware's high price point.

More recently, HMD's have been widely available to the public, ranging from the simplistic Google Cardboard, a smartphone VR, to the more advanced Oculus Rift, a high-end PC VR. Price of the VR experience usually corresponds to the inherent level of immersion in the device. In addition, real-time rendering software to produce VR content has become more affordable and user friendly. Goldman Sachs predicts that the virtual and augmented reality consumer market will exceed a value of \$80 billion by 2021 (Goldman Sachs, 2016, p.8). While PwC estimates that the United States entertainment industry will see modest-to-slow growth over the next five years, forecast data shows that VR is one segment expected to expand with 68 million headsets in use by 2021 (Curran, 2016, p.1). Additional research predicts that 96 million headsets will be in commercial use by consumers in 2020 (Rolls, 2016, p.1).

2.4 Virtual Reality and Sport

Within recent years, virtual reality has slowly been incorporated into the sports media ecosystem. The technology has become a player in advanced training, in-game fan attractions, and live broadcasting (Benjamin, 2014).

Advanced Training

STRIVR Labs is one company “revolutionizing training software by allowing players to train realistically and safely through VR, without breaking some leagues’ stringent rules on practice times (Housel, 2017). Currently, the company is working with 25 teams across the major North American professional sports leagues. While coaches and players have traditionally leveraged game footage for training purposes, the ability to recreate plays from the players’ view is unprecedented. Liwei (2012) notes that there is a niche opportunity for technology firms to build a direct interaction with sports skills learning, in virtual spaces. Wolfgang Niersbach, president of the German Football Association, has stated that VR for training can increase the recall of information, quicken reaction time, and speed up the learning curve (Smith, 2017).

In-Game Fan Attractions

Virtual reality is also disrupting the in-game fan experience. In 2016, Fenway Park brought fans exclusive VR coverage of training camp as a spectator in their various dugouts. STRIVR Labs also partnered with Madison Square Gardens to allow fans “to step into the shoes of [New York Rangers goalie] Henrik Lundqvist to block 100 mile per hour slap-shots” (Time, 2016, p.1). Many of these in-venue installations have been leveraged to gauge fan interest in the new technology, in order to evaluate market demand.

Live Broadcasting

A third area of virtual reality disruption in sports is the use of VR as a sports broadcasting medium. Examples of implementation are broad, ranging from the Rio 2016 Summer Olympics, to NASCAR races, to national cricket games in India, with some stakeholders embracing the technology more than others. According to research firm Piper Jaffrays, United States sports leagues could generate \$4 billion per year by 2025 on VR broadcasts (Piper Jaffrays, 2016, p. 26), which is extremely promising for a nascent technology. The firm cites embedded advertising, sponsorship, broadcast licenses and premium fan experiences as the likely revenue drivers (Gaudiosi, 2015).

3. The Sports Broadcasting Industry

3.1 Collision of Technology and Sport

Sport has always been at the forefront of media innovation. Historically, the relationship between media and sport has been linked to the popularization of television as a distribution medium (Boyle & Haynes, 2010). In the 1930s, only 400 televisions had the ability to receive the first sports telecast from NBC (Business Insider, 2011). In the 1950s, trends toward colour programming, instant replays, and slow motion were all quickly applied to sports in order to amplify viewer experience (Business Insider, 2011). In the 1960s, on-screen graphics were born and replaced the information of key information, like number of strikes, via cue-cards (Nachman, 2011). By the 1990s, this evolved into the “Fox Box”; a static, on-screen graphic box that displayed the key information to viewers (Business Insider, 2011).

The 21st century saw the rise of high-definition (HD) television and online streaming, experimentation with 3D television, and even the use of drones to record aerial footage for games. These highlights fail to mention the various technologies that have impacted other aspects of sport, including training, analytics, in-game attractions, and wearable advancements.

3.2 Sports Broadcasting Industry Trends

For sport organizations, broadcast revenues are starting to outweigh gate receipts in importance (Noll, 2007). An insatiable demand for sports programming, from fans across the world, is evidenced by the 110 million people who watch the Super Bowl 51 game in 2017 (Nielson, 2017, p.1). In addition, the National Basketball Association (NBA) recorded the highest audience in history in 2016 of 31 million viewers (Nielson, 2017, p.1). The industry, however, is facing several obstacles as: (1) cord-cutting² trends accelerate; (2) live streaming becomes the norm; and (3) over-the-top (OTT)

² Cord cutting is an expression that refers to the fact that people are getting rid of their cable television subscriptions.

content delivery systems through non-traditional mediums like social media pervade the video ecosystem. The future of sports broadcasting is uniquely positioned between the analogue paradigm of long-standing television networks and the digital prototype of agile new entrants (Gonzalez, 2017).

Cord-Cutting Trends

Currently, approximately 26 percent of Canadians do not have a traditional television subscription, with a cable or satellite TV provider (CBC, 2017, p.1). In the United States, this figure is lower with 22 percent of households without a traditional television subscription (CBC, 2017, p.1). With vast differences across generations, Generation Z was the first group born exclusively in the digital age. As a result, Echelon Insights (2017) refers to those a part of Generation Z as not cord-cutters but “cord-nevers”, who prefer to consume content online.

Research from Charlton Insights illustrates that people are watching unparalleled amounts of video content, with Canadians consuming 29 hours of video per week, up from 27 hours per week in 2013 (CBC, 2017, p.1). General broadcasting trends coincide with trends in sport broadcasting viewership. Elder (2017) states that viewing figures for Premier League telecasts have decreased 22 percent per game since the 2010 to 2011 season. However, interest in sports content is not waning.

Online Streaming

Streaming content is increasingly becoming the viewing method of choice, exemplified by the 473 percent year-over-year increase in sports video streams watched (Nielson, 2015). Stafford, Stafford and Schkade (2004) outline three gratifications for streaming content: (1) accessibility; (2) convenience; and (3) cost benefit (p.4). During the renewal of rights for the NFL’s Thursday night games, the league decided to separate television and streaming rights (Wagner, 2016). It can thus be concluded that distribution frameworks are changing, providing leagues with additional revenue streams on which to capitalize. The window of exclusive broadcasting rights for traditional

broadcasters is quickly closing. Furthermore, as online streaming proliferates, viewership of online subscription video has increased from 7 hours per week in 2013 to 11 hours per week in 2017 (Perez, 2017, p.1). DAZN, an over-the-top content system, is one new player in the streaming space that offers a \$10 monthly fee for unlimited access to on-demand sport (Global Sports Jobs, 2016). As the streaming market becomes increasingly more fragmented, media consumption patterns are changing as well as relationships among sport stakeholders.

Over-The-Top (OTT) Content

Sports leagues, franchises, and television networks have historically enjoyed an unchallenged dominion over sports content. The shift towards over-the-top (OTT) content is exemplified by Twitter's deal to stream 10 Thursday night NFL games (Wagner, 2016). Twitter's NFL live stream debut was viewed by 2.1 million people, 70 percent of whom were under the age of 35, compared to the 14 million television viewers (Wagner, 2016, p1.1). Other social media platforms, including Facebook and Instagram among others, are trying to penetrate this direct-to-consumer sports streaming space. In the future, there will be increasing acquisitions of OTT from traditional broadcasters, in an attempt to provide a competitive advantage.

3.3 The Modern Sports Fan

With a rise in globalization, a more diverse fan base, opportunities for new niche sports, and evolving patterns in media consumption, the world of the sports fan is evolving (Performance Communications, 2016, p.3). When creating immersive fan experiences, it is essential to have a clear understanding of fandom principles. While fandom itself is an old concept, the influences driven by the digital age are relatively new (Performance Communications, 2016), showing a consistent trend of wanting to be more absorbed and engrossed with media.

Fan Motivations

As shown in Figure 3, there are 8 fan motivations: (1) entertainment; (2) escape; (3) eustress; (4) aesthetic; (5) learning; (6) achievement; (7) connected; and (8) bonding (Performance Communications, 2016, p.3). With a fan intensity spectrum ranging from casual armchair fans to super-fans, qualified by the amount of engagement with sports, these 8 motives should assist in explaining why individuals engage in fan experiences. Depending on the particular sport, certain motives are more prominent than others. For example, eustress is a greater fan motive for boxing fandom, while aesthetic is a more prominent motive for gymnastics (Performance Communications, 2016).

Fig. 2 The eight fan motivations

MOTIVE	EXPLANATION
ENTERTAINMENT	<i>The enjoyment that comes from watching sports as a leisure activity.</i>
ESCAPE	<i>The use of sports as a diversion from everyday stress or boredom.</i>
EUSTRESS	<i>The highs (and lows) fans experience as teams are winning (and losing).</i>
AESTHETIC	<i>The beauty of watching a highly skilled athlete perform.</i>
LEARNING	<i>The fan watching to learn from and be inspired by the participants.</i>
ACHIEVEMENT	<i>The feelings of vicarious achievement fans share when their team wins.</i>
CONNECTING	<i>The sense of belonging fans feel by being connected to a larger group.</i>
BONDING	<i>The use of sports to bond and spend quality time with family.</i>

FIGURE 3: The Eight Fan Motivations (Performance Communications, 2017, p.3)

3.4 Trends in the Modern Sports Fan

Performance Communications (2017) used environmental screening to “review over 300 innovations and [subsequently] ran a series of in-depth interviews with 14 experts across sports, sponsorship and a number of specialist areas”. The authors then cross-referenced these underlying shifts with the 8 fan motivations and grouped them into trends in order to create a framework to understand the future of sports broadcasting (Performance Communications, 2017). The firm outlines 8 trends impacting the future of sports. Most notable for this paper are: (1) post-passive fan behavior; (2) 24/7 engagement; and (3) live sport as a luxury (Performance Communications, 2017).

Post-Passive Behaviour

The historical one-way dialogue from producer to end-user is evolving as sports fans want to extend their influence “on ticket prices, ownership and broadcast decisions” (Performance Communications, 2017, p.5). As noted by Pine and Gilmore (1998), customer expectations have shifted from traditional customer service expectations to a more individualized experience (Pine & Gilmore, 1998). The prevalence and use of social media, for example, represents this newly active and engaged viewer base. AT&T figures (2016) show that fans consumed 205% more data in the Superbowl 50 than the previous year (p.1). “This represents millions of status updates, videos, photos and live video” (TechCrunch, 2016, p.1).

The 24/7 Fan

Fans expect to access real-time sport content across their various digital platforms and devices. 73 percent of fans think it is important to access content “wherever, whenever”, with 83% of fans interested in attaining off-season content (Performance Communications, 2017). Nielson Sports (2017) illustrates that as fans become more fully connected, there will be “multiple access points for greater connection and engagement with fans” (p.3). Billings and Brown (2017) discuss how fans can now concomitantly engage in multiple media to obtain optimal media gratification. This means that fans now want to engage with multiple digital devices simultaneously, including television, phone and social media, in order to feel fulfilled.

Live Sport as a Luxury

As shown in Figure 4, the average ticket prices in major North American sports leagues for the 2015-2016 season, range from \$93 per ticket for NFL games to \$33 per ticket for MLB games, with average National Hockey League (NHL) and National Basketball Association

(NBA) tickets residing in the middle of the range (Statista, 2017, p.1). It is important to note that approximately 76 percent of fans would attend more live events if tickets were cheaper (Performance Communications, 2017, p.4). As live sporting events become more of a luxury experience, fans might look to new technologies to emulate the live experience.

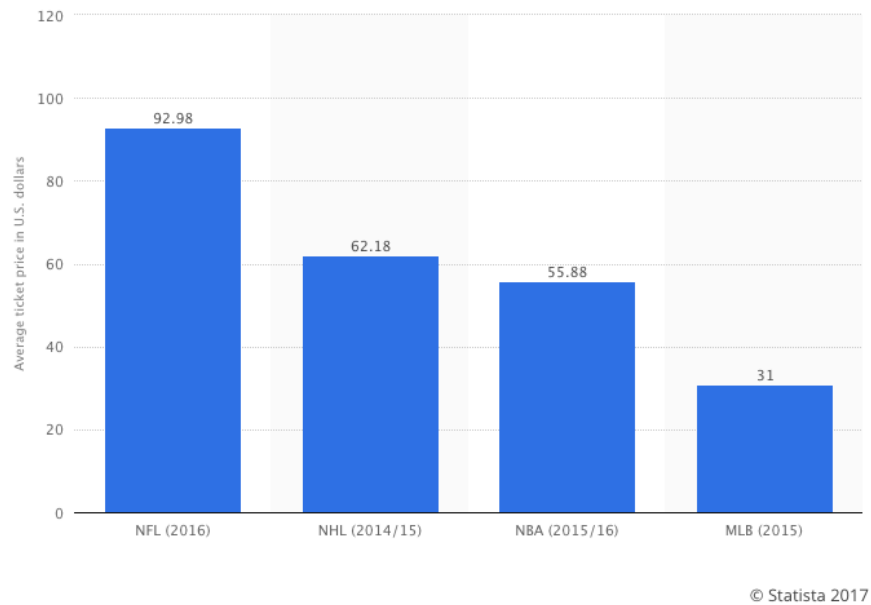


FIGURE 4: Average Professional Sports Ticket Prices (Statista, 2017, p.1)

4. The Intersection of Virtual Reality and Sports

4.1 Case Studies

This section will outline three case studies of virtual reality in sports broadcasting. These examples will serve as references for the remainder of the paper. The justification for using these use cases is diversity in end-user, sport, technology and implementation.

Next VR and the National Basketball Association (NBA)

In 2016, the NBA partnered with NextVR to offer one live game per week in virtual reality to fans that purchase an NBA League Pass, retailing at \$7 per game or \$29 per month (Kalmenson, 2016). The virtual experience involves premium vantage points of the action around the court, including “designated announcers, multiple camera angles, statistics, analytics and graphics” (Kalmenson, 2016, p.1), as shown in Figure 5. The content is currently available on Samsung VR headsets, which cost approximately \$100, for compatible use with a Samsung phone, as well with Google Daydream headsets. One stream between the Warriors and Timberwolves “utilized four cameras...one on each basket, one at midcourt, and one roaming the stadium” (Sarconi, 2017), with the producers determining the camera angles and timing of cuts based on action, giving the producer the control over the experience. One early adopter claims, “I should have found the frequent cuts disorienting, but I didn’t have any trouble once I figured out when and how the camera angle would change based on the action on the court” (Wired, 2017, p.1). It should be further noted that these VR streams are subject to broadcasting blackout restrictions.



FIGURE 5: NextVR and NBA Game Sideline and Net View (Nafarrete, 2016, p.1)

Molson Canadian and Sportsnet

In 2016, Molson Canadian partnered with Sportsnet to broadcast 6 National Hockey League (NHL) games in virtual reality (Sportsnet, 2017). Three-hundred-and-fifty thousand cases of beer sold to consumers contained cardboard viewfinders, as well as a unique pin to access the virtual content in the Sportsnet mobile application for either iOS or Android (Sportsnet, 2017). Three 360-degree cameras were set up around the respective arenas, from center ice and behind the two nets, with the ability to switch between the multiple camera angles (Sportsnet, 2017). The brand partnership motivated Sportsnet to create additional and exclusive content, to provide incentive for consumers to purchase Molson Canadian products. For example, “fans can access behind-the-scenes footage from select NHL clubs and watch on-demand highlights” (Sportsnet, 2017, p.1). This example can serve as an archetype of brand activations providing accessible and free virtual reality content to consumers.

LiveLike VR and UEFA Champions League Final

Launched in 2016, LiveLike offers a way for fans to experience sports games with Facebook friends in “a virtual suite” that overlooks games (TechCrunch, 2017), like the UEFA

Champions League final. This is an example of how a major sports broadcaster, Fox Sports, will partner with virtual reality content companies to attain a competitive advantage. The network paired with LiveLike to live stream the match between Real Madrid and Juventus on the Fox Sports application, free to those who login with their TV subscription credentials (TechCrunch, 2017).

LiveLike is exploiting the opportunity to bring the fan motivations of connecting and bonding to virtual reality sport experiences, by providing fans with unique avatars and the ability to engage with other fans to create a collaborative environment, with multi-presence. As shown in Figure 6, users can create a virtual community of sorts, while interacting with virtual objects, such as player/team statistics and a virtual cell phone with access to social media.

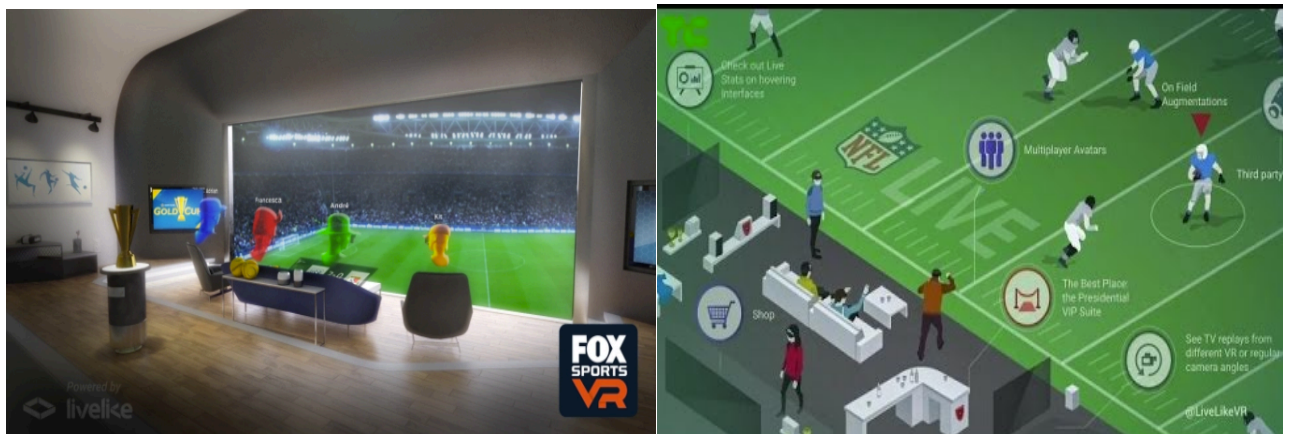


FIGURE 6: LiveLike Virtual Reality Offerings (TechCrunch, 2017)

4.2 Discussion: SWOT Framework

A SWOT framework will be utilized to address both the micro and macro level impacts of virtual reality sport. A SWOT analysis is a business framework that charts the strengths and weaknesses of an offering, as well as the larger opportunities and threats. For the purpose of this

paper, the framework should help to uncover the fit in the market as well as barriers to mainstream adoption.

4.3 Strengths

The YouVisit VR Appetite Index suggests that 23 million Americans have tried virtual reality by 2015, with 63 percent of consumers believing that immersive video is “the next big thing” (YouVisit, 2015, p.1) A recent report from Intel shows that 60 percent of polled Major League Baseball (MLB) fans think that technology would improve the fan experience (Intel, 2017, p.2). In addition, 71 percent of respondents stated they would be interested in watching a game in VR that they are unable to attend live (Intel, 2017, p.2). With limited in-person tickets, global fan bases, and growing broadcast audiences, sports teams are looking for new ways to attract and retain fans (Performance Communications, 2016). The following section will seek to analyze virtual reality sport offerings across the virtual reality characteristics of immersion, interaction, multi-sensation and imagination.

Immersion

The most attractive quality of virtual reality for sports is its immersive nature not possible in a 2D environment (TechCrunch, 2016). Eric Shanks, president of Fox Sports, stated, “Fans want to be a part of the action and virtual reality takes the fan experience to the next level” (TechCrunch, 2016, p.1). Popat (2011) states that the desire of audiences has increased to enter into the performance. Sports are emotional experiences, and virtual reality can act as a highly emotive medium to experience sports viscerally. Organizations can leverage the fan motives of escape and entertainment to engage fans in an unparalleled way. The flexibility of immersion is evident from Molson Canadian’s cardboard viewfinder to LiveLike’s VR feed on a Samsung

Gear headset, ranging from low immersion yet high accessibility to high immersion yet low accessibility, respectively. In addition, this virtual reality content can be offered to satisfy the 24/7 fan who wants to access content on-demand, wherever they are located.

Interaction

Through virtual reality, there is a participatory element for fans to disrupt the traditional role of the producer and to create their own viewing experience. Capitalizing on the post-passive behavior inherent in the modern sports fan, virtual reality offers the opportunity to interact with viewing angles, virtual objects and even others' avatars in LiveLike VR. For lower cost offerings, such as the free Molson Canadian experience, a phone can act as the input device rather than more sophisticated input controllers.

Furthermore, 90 percent of polled MLB fans think that the ability to flip between perspectives in VR is the most attractive feature (Intel, 2017). In the future, we will likely see the ability for users to step into the shoes of a player, at half time for instance, and engage in the game themselves to experience taking a penalty shot. For instance, NFL Next is a VR based gaming experience that could allow fans to participate in NFL play (Sheehy, 2017); however, the project is still in its infancy. "Soon, emotional and mood recognition technology, like gesture interfaces will become part of the TV-experience; wave your hand for a replay, shout to show anger, pinch to zoom" (Performance Communications, 2016, p.17).

Multi-Sensory

Parallel to most virtual reality offerings, VR sports viewing experiences target the visual and auditory senses first, followed by the sense of touch, or haptic touch. VR broadcasters are experimenting with ways to offer different commentary streams based on different views of the

sport narrative, for instance. The deeper we tap into the five senses, the deeper the engagement level of the audience and more appealing the product offering (Michaelian, 2013).

Imaginative

Virtual reality offers the opportunity to transport a fan into the sport narrative and have “imagined realities” realized. This is a key strength for sport stakeholders, who have the opportunity to disrupt the traditional sport viewing experience in other markets, for fans that are otherwise unable to attend games.

It is important to note that fans who are interested in virtual reality spectator experiences favor cost over “a true virtual reality experience” (Billings & Brown, 2017, p.239). Pickup (2017) agrees by adding, “Success in the field will be less about building VR elements into live broadcasts and more about giving viewers a ‘money-can’t-buy experience” (p.1). For example, the ability to offer exclusive content might be the driving force to mainstream adoption for the innovation. Perspectives that NBA consumers currently desire, include viewing the locker room pre-game, mid-court during practice, courtside games, and being at the table with on-air commentators (Billings & Brown, 2017).

4.4 Weaknesses

As expected from a relatively infant technology, virtual reality is facing several obstacles, particularly surrounding hardware and software limitations.

Hardware Limitations

A Deloitte report (2016) states that while head-mounted displays (HMDs) for virtual reality are predicted to be more successful than smart and 3D glasses, technology that requires

consumers to wear something on their face requires a set of behavioural changes. Stanford research demonstrates that people tend to get tired of wearing an HMD in approximately 8 minutes (2016). However, experts agree that this will increase as frequency of use increases, and people adopt it as part of their media consumption. As a relatively new hardware, consumers have reported concern about trying head-mounted displays. One study demonstrated that 23 percent of respondents fretted about their health, 11 percent about “losing touch with the real world” and 5 percent about becoming addicted (Housel, 2017, p.1). Huge companies, like Google and Facebook, are currently investing in the hardware to create a more seamless viewing experience.

Software Limitations

Virtual reality for sport is also facing specific challenges for producing and distributing content. As a result, content offerings for VR sport offerings are still quite limited. In *Time Magazine*, Sean Gregory commented on his VR experiences citing resolution currently as the bottleneck for live VR sport experiences (Time Magazine, 2016). First, there is the challenge of handling real-time video capture to create a high-quality, smooth experience for bandwidth intensive content. Second, VR disrupts the role of the producer, challenging traditional TV and user interface (UI) conventions. If creating an experience like NextVR’s NBA stream, the producer has to determine the timing of cuts between camera angles and announcers must determine whether a standard or custom commentary based on camera angle will exist. Furthermore, most live VR sport experiences are still lacking social interactions to appeal to the fandom motives. NextVR CEO stated, “There are some tricky issues in getting social interaction right for live VR broadcasts. Conventional, segmented streaming infrastructure does not allow for precise synchronization of video across multiple users” (Lang, 2017, p.1).

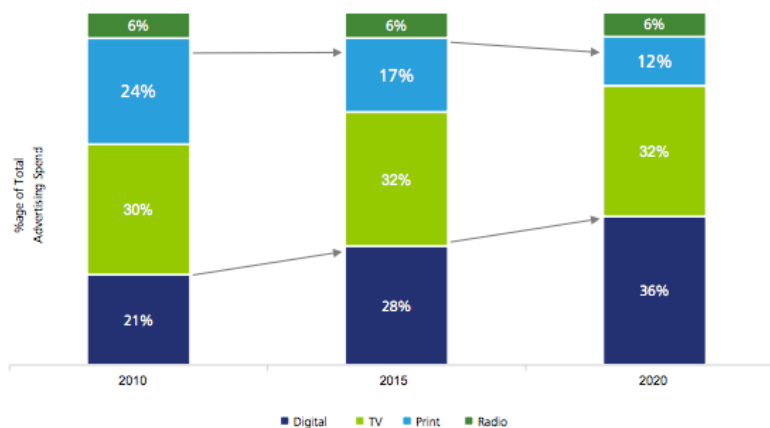
4.5 Opportunities

There are several adjacent possibilities for virtual reality sports broadcasts, including new advertising opportunities and new target segments.

Advertising

Virtual reality has been found to elicit higher engagement and longer engagement periods than traditional 2D mediums (Cipresso et al, 2017), making it a desirable advertising platform. As the advertising space becomes saturated, adoption for ad blocking technologies increases, and an aversion to advertising persists (TechCrunch, 2016) advertisers are likely to embrace VR. As shown in Figure 7, global advertising media spend is shifting toward digital mediums. By 2020, 36 percent of total advertising expenditures will focus on digital media, up from 21 percent in 2010 (Deloitte, 2016, p.7). It should be noted from the Deloitte report (2016) that advertising expenditures on television are predicted to remain unchanged, representing 32% of global media spend in both 2015 and 2020 (p.7).

Figure 4 : Change in global advertising media spend



Source: Deloitte Analysis

FIGURE 7: Change in Global Advertising Media Spend (Deloitte, 2016, p.7)

The *Virtual Reality Consumer Study* indicated that only 10 percent of Americans know a lot about virtual reality. The report stated, “Lack of familiarity and VR brand awareness may result in slow VR adoption over the near-term if brands don’t ramp up marketing communications” (Virtual Reality Consumer Study, 2015, p.1). In the future, we are likely to see free brand activations with a plethora of up-sell and cross-sell opportunities. For advertisers, this provides a new opportunity to mine data insights from virtual reality to provide consumers with personalized and targeted promotions, and to strengthen brand affiliations with sport.

Demographic Changes

The 2015 *Virtual Reality Consumer Report* suggested that Millennials and Generation Z are most likely to embrace VR, with 73 percent and 79 percent most excited respectively (Business Insider, 2015, p.1). Fifty percent of Millennials expressed favorable purchase intent for a VR headset connected to a game system rather than one connected to a computer or mobile device. Furthermore, the report cited that on average, Asians, Hispanics and African Americans score 5 percent higher than Caucasians in terms of their positivity and excitement (Business Insider, 2015, p.1). In another study from the Media Technology Monitor states that VR users are significantly more likely to own a gaming console and over-index in digital media consumption like Netflix and Sirius XM (Media Technology Monitor, 2016). It can thus be concluded that virtual reality for sports has the potential to be more successful across gamers, younger generations, and potentially certain minorities.

4.6 Threats

Legal Threats

Housel (2017) discusses the potential legal implications for virtual reality sports content that need to be considered before mainstream adoption. Housel addresses the various concerns in contract law, tort liability, intellectual property and privacy (Housel, 2017). These include complex broadcast rights frameworks, potential government regulation, product safety concerns, and even various ethical concerns (Housel, 2017). Housel uses the example of a gruesome boxing match to explain that consumers might be overwhelmed in the immersive environment to handle the sights. In addition, the technology might impact sport itself, charting new territory in positions for camera angles, that might see resistant from leagues and players.

Economic Threats

The economic threats prevalent include low switching costs, low barriers to entry, and high competition. If a consumer obtains a cardboard viewfinder, for example, their ‘stickiness’ to the hardware is low since they have not invested much money. As a result, the cost to switch to a new product, such as back to television, to view sports is quite low. Furthermore, as workflows become standardized, the cost to produce content decreases and economies of scale become realized, barriers to enter the industry will also fall. As barriers to enter the industry fall, competitive pressures from companies will rise, augmented by the greater competitive pressures from the television broadcast market, as well as from other pervasive technologies like augmented reality.

4.7 What Sports are Best?

Different sports have different playing areas. For instance, baseball’s large size of field combined with a small ball size presents several sport-specific obstacles. While this paper focused on 5 major professional sports, VR might be better suited for sports with ‘spatial action’

(Sheehy, 2017), engaging the user in the six spatial directions (up/down, left/right, front/back).

As shown in Figure 8, virtual reality engages all of the spatial directions in America Cup for yacht sailing. However, it should be noted that these are niche sports that are unlikely to garner a prominent audience and new revenue streams for broadcasters. Figure 9 further demonstrates the sport-specific spatial, planar, linear and focal action (Sheehy, 2017, p.43).

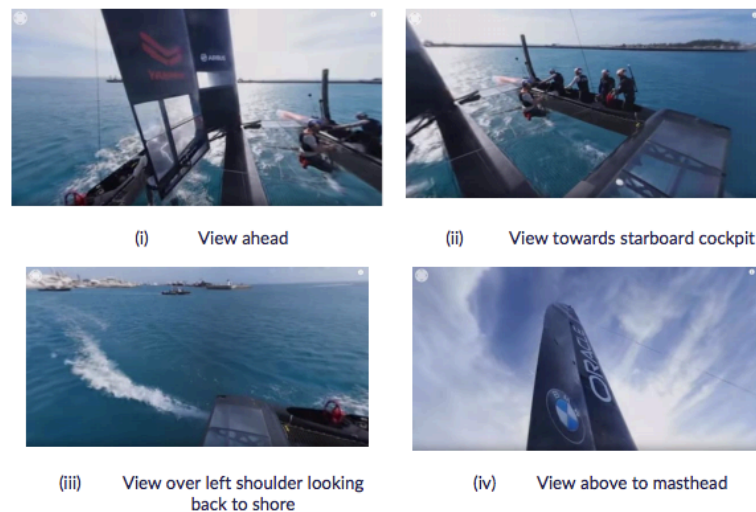


Figure 25: Illustration of the additional value that can be delivered using 360-degree video (Images: [VRtually There/USA Today](#)).

FIGURE 8: America's Cup Using 360-degree Video (Sheehy, 2017, p. 44)

- **Spatial action which action takes place in all 6 directions:** reef diving, yacht racing, acrobatics
- **Planar action which takes place on a planar surface:** football, basketball, baseball
- **Linear action which unfolds in one direction:** athletics, cycling, rowing
- **Focal action which is focused on one point:** boxing, shooting

FIGURE 9: Spatial, Planar, Linear and Focal Action for Sports (Sheehy, 2017, p.44)

5. Future of Virtual Reality in Sports

5.1 User Adoption

The success of virtual reality for sport will coincide with the consumer appetite for virtual reality experiences in general. Digi-Capital outlined the 7 drivers of augmented and virtual reality user adoption. : (1) mobility; (2) vision; (3) immersion; (4) usability; (5) flexibility; (6) wearability; and (7) affordability (Digi-Capital, 2015, p.1). The success of VR will be closely tied to the success in AR as part of a broader immersive computing paradigm. At Google I/O in May 2017, Google stated it is planning to integrate AR and VR functionalities into all of its digital assets, developer frameworks, APIs, and cloud services (Sheehy, 2017). For VR in particular, until HMDs become more affordable and wearable, the VR industry will see slow user adoption rates.

As shown in Figure 10, Llamas (2016) depicts the adoption rates by household of major technologies. With a 6% user adoption currently, virtual reality is expected to cross the ‘chasm’ of product innovation before 2020, meaning that it will attain more than 16 percent product adoption and enter into the early majority adoption (Llamas, 2016). By 2020, it is predicted that 15 percent of households will own a VR device (Llamas, 2016). It should be noted that even modest demand for the medium, will result in a very profitable market opportunity for sports stakeholders. The trend toward immersive computing technologies is evident.

Figure 7 - Adoption Rates of Major Technologies (Llamas, 2016)

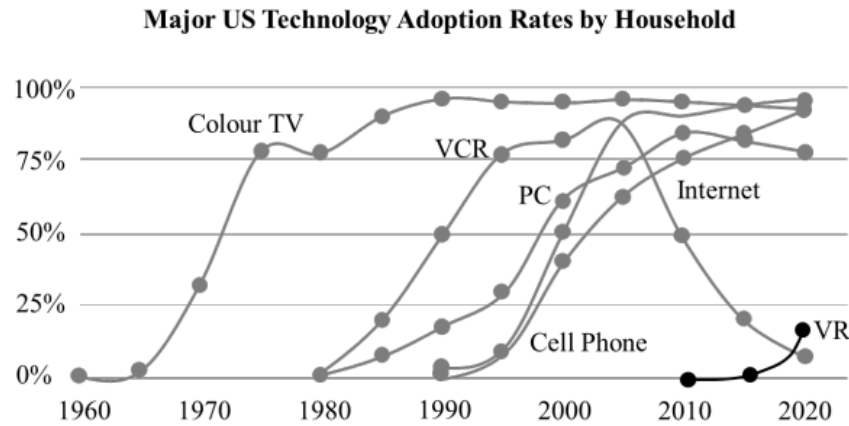


FIGURE 10: Adoption Rates of Major US Technologies by Household (Llamas, 2016)

Virtual reality is currently in the ‘Slope of Enlightenment’ stage of the Gartner Hype Cycle (2016), which outlines the key phases of a technologies life cycle (p.1). This refers to the fact that applications for VR are currently being affirmed, with more second and third generation products (Gartner, 2017). Augmented reality is in the ‘Trough of Disillusionment’ phase, which consists of experiments and implementations, that weed out unsuccessful producers of the technology (Gartner, 2017)

5.2 Content Model

Virtual reality will have to develop engaging content in order to maintain viewers’ interest. As demonstrated by the aforementioned use cases, there will be a spectrum of VR offerings for sports ranging from a typical television broadcast in a virtual environment, to one containing the range of VR elements. Approximately 51 percent of MLB fans want full game coverage, 33 percent want full highlights, and 16 percent want to watch condensed games (Intel, 2016, p.2). There is even the opportunity for content producers to show out-of-season material. As shown in

Figure 11, this could constitute in-depth season analysis, athletes' lives beyond sport, historical sporting moments, games and quizzes and managers' views and tactics (Performance Communications, 2016). VR content producers are still experimenting with creating different experiences, with the challenge of creating sustainable content that will bring users back once the “awe” factor ends. While we will likely see more mobile and PC-based virtual reality in the future, stakeholders will likely use 360-degree video initially as it is more accessible.

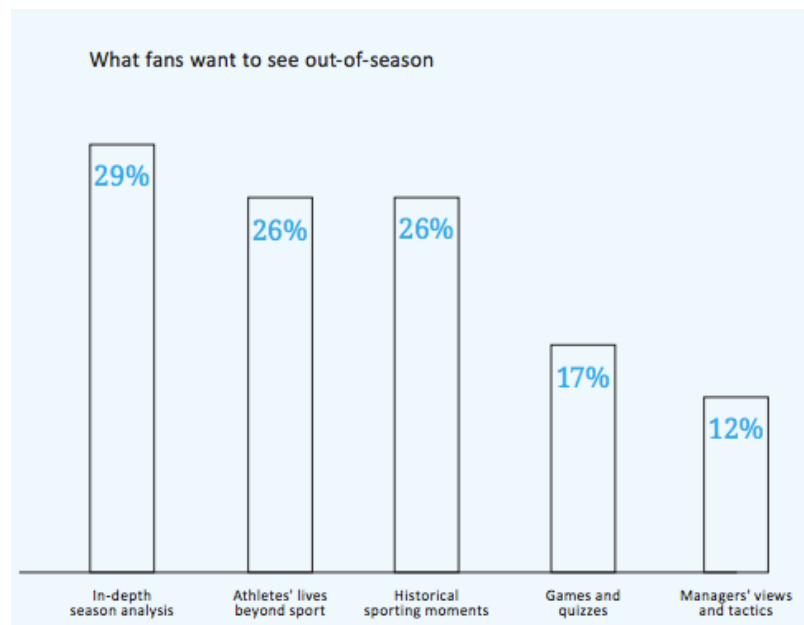


FIGURE 11: What Fans Want to See Out-Of-Season (Performance Communications, 2016, p.13)

5.3 Business Model

As shown in Figure 12, the two predominant monetization models for on-demand digital content are subscriptions and advertising. Deloitte suggests that players in the digital space are experimenting with different flexible subscription models, deriving subscription fees either daily, weekly, monthly or on a long-term basis (Deloitte, 2016, p.15). Content service providers drive maximum value from subscription models by offering premium content, that is exclusive to the

platform (Deloitte, 2016). “VR has the potential to create new revenue pools in the form of ticketing and subscription fees charged to sports fans that want to watch events in VR they cannot attend live” (Goldman Sachs, 2016, p.19). Goldman Sachs (2016) estimates that users will initially watch 2 events per year, which will increase to 4 live events in VR per year, by 2025, assuming an initial \$10 per event price point (p.19). On the contrary, advertising based revenue models exploit the opportunity to mine data insights, providing advertisers with rich targeted advertisements (Deloitte, 2016).

In addition to selling “digital seats” for incremental revenue VR will increase TV rights revenues, as shown through LiveLike and Fox Sports, creating new package bundles for traditional broadcasters. In the future, this could justify an increase in annual TV-based subscription fees (Sheehy, 2017). In the short-term, however, sports media executives need to commit to virtual reality with the understanding that they might not make a profit for the next several years. Until the period of exclusive broadcast rights concludes, virtual reality will exist for incremental audiences and revenues.

The key levers that drive monetization in digital space are listed below:

Figure 11 : Digital Content Monetization framework

Dimensions	Key Levers					
Revenue source	Subscription			Advertising		
Subscription considerations	Lever A	Term	Daily	Weekly	Monthly	
	Lever B	Type	Including data	Excluding data	Limited Use	Unlimited use
	Lever C	Structure	Niche content	Limited content	All content on one platform	
Pricing	ARPU			Revenue per Hour		
Usage	Free Subscriber Usage			Paid Subscriber Usage		
Renewal rate	Fraction of Subscribers who renew the Service					
Leveraging ecosystem	Leverage Data Analysis	Partnership Alliances	Deals Sponsorship	Related Products/ Services		

Source: Deloitte Analysis

FIGURE 12: Digital Content Monetization Framework (Deloitte, 2016, p.15)

6. Conclusions

The rise of cross-media usage among fans is not a zero-sum game (Performance Communications, 2016, p.4), meaning that compelling new technology like VR will exist as a complementary offering and will not make past technologies obsolete. While it is too early to say whether or not virtual reality is the next ubiquitous sports broadcasting platform, the looming potential is evident from fan demand for these early experiences.

This paper focused on the five largest professional sports by revenue, as these will likely be the large-scale uses for virtual reality broadcasting in the future. However, VR has greater application in niche sports where there is actual spatial action, such as yacht racing, skydiving, or drag racing. Imagine being completely and viscerally engaged in the virtual environment, looking around at multiple points of actions within the game or competition. These extreme or niche sports do not have the same traditional viewing experience and are likely to embrace VR as a medium; however, do not have the large-scale fan base to make it worthwhile for many producers. Furthermore, the difficulty for the five large sports is that the action exists on a planar surface and at particular moments there is only one focal point. These VR experiences might have an “awe” moment for the user’s first experience; however, the challenge will be creating compelling content that does not provide the same experience as watching a planar surface on television.

The differentiator for success for the five aforementioned sports will be providing VR experiences that allow fans to experience the game as players or participants. We are likely to soon see microscopic cameras embedded into player and referee uniforms so that VR users can switch between vantage points of the game, including players’ perspectives. This could even result in a quasi-gaming experience whereby at half-time users can actually participate in the game by attempting a penalty shot or throwing a pitch, for instance.

The earliest forms of virtual reality in the sports broadcasting market date back to early 2016; thus, the technology is still in its infancy and has several barriers to mainstream adoption. Until product adoption rates increase, sports leagues and teams need to leverage brand partnerships in order to create an initial market demand with accessible and affordable content. The first experiences will likely be free and primitive in nature to give users a taste and demand

however not uncover the entire offering. Until commercially viable, content creators will likely gain revenue from advertising-based monetization frameworks. Organizations can gauge interest in these early brand activations and consequently craft business models tailored to the sport and team. It is imperative to focus on producing low-cost content and later focusing on incorporating the aforementioned virtual reality characteristics.

It is going to take several years before VR production processes become standardized and good quality HMD's become affordable to the mainstream. In the next few years, VR technology is expected to be incorporated into a large percentage of people's technology arsenal. However, it is going to take even more time for people to adopt the behavior of putting on their VR headset to potentially watch the game. In the interim, the technology provides an excellent complementary viewing experience. A user can watch highlights in VR, take off the headset and watch the game on their TV, later putting back on the headset to watch exclusive content or post-game commentary.

This paper concludes that there is a fit for virtual reality in the sports media ecosystem. Fan attraction and engagement need to be prioritized and virtual reality provides a new medium to augment the long-standing television and fan experience. Virtual reality and other immersive video technologies are likely to change the way people consume content and interact with media in the coming years.

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