Star Trek and the Metaverse:
An Analysis of Foresight for Augmented Reality in Science Fiction

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The IAFOR International Conference on Arts & Humanities in Hawaii 2022
Official Conference Proceedings

Abstract
An analysis combining viewpoints of futurism, strategic foresight, computer science, learning technology, and film studies to compare and contrast themes found related to Augmented Reality in Star Trek to trends found in the development and commercialization of these technologies. The use and proliferation of immersive media such as augmented and virtual reality is increasing, with new terms like 'metaverse' and 'digital twins' being used to describe a blending of human experience into media like never before. This study looks to examine the predicting capabilities of science fiction, most specifically Star Trek and all of its iterations, and compare/contrast with current trends in immersive technology media development. There are examples that can be seen in current trends from several decades before commercial availability in Star Trek. The stories and themes discussed surrounding these technologies within the context of this fiction can inform emerging conversations of how these technologies will impact human communication, our perception of reality, and society as a whole. This study relates signals and themes from Star Trek surrounding augmented reality and matches them with current research topics. It also provides an idea of how these technologies can alter or modify our lives and mainly guides us on handling them correctly. Introducing a new technology affects society; Star Trek tries its best to make those impacts of technology a more positive one.

Keywords: Augmented Reality, Star Trek, Foresight, Predictive Fiction, Technology in Society

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Introduction

In the field of futurism and foresight, signals are studied and analyzed to tell stories and highlight possible trends moving to the future (Golden 2020; Hiltunen 2008). Star Trek since it's first iteration in the 1960's has been a wonderful source of signal interpretation of technology through the lens of science fiction storytelling. Some of the first well known glimpses of technologies like the cell phone, tablets, transparent aluminum, automatic doors, teleconferencing, and many more were shown in the various Star Trek shows and movies (Lasbury 2016). This analysis seeks to focus on augmented reality, a technology that still largely is not realized but is increasingly viewed as a technology that will be used widely and in all aspects of life, much like the smartphone today. There are many instances of Star Trek depicting the use of augmented reality from as far back as Star Trek: The Next Generation in the 1980's and many of these depictions were predictive of current trends but also highly descriptive of themes, issues, and trends around the effects of people and society. In the following passages, let's look at three of these telling portrayals of the use of augmented reality in Star Trek.

Retina Projection and Cognitive Effects

The first example is from Star Trek: The Next Generation: Season 5, Episode 7; The Game. In this episode, Commander William Riker, first officer of the Enterprise in Star Trek, goes to a pleasure planet where he is given an augmented reality headset. The headset turned out to be a video game that was also a mind control device to be used in a plot to take control of the ship. Basically, it was a plot set up for aliens using the headsets to implant commands into the minds of the Enterprise crew and to take over their ship. It is impressive how the device in this episode interprets all the brain's thoughts and stimulates its pleasure center. It actually mind-controls the crew through subliminal messages using the projection right into the retina that are interpreted by the brain subconsciously. Scary and also outlandish, right? But from what we are learning about what happens to users of augmented and virtual reality, it points out how we might use these headsets to influence behavior, much like the software in our smartphones are competing for our attention for targeted advertising (E. Hawkinson and Klaphake 2020). There is little consensus yet on the mental and physical effects of AR/VR use, especially for children or over extended years of use, we still require to know a lot of the physiological effects on every individual using immersive technology. Still, there is already a lot of research and evidence that points to virtual reality and augmented reality having a greater ability to influence us more profoundly than any other traditional media we have encountered before (Kang et al. 2012; Bekele et al. 2013; Wu et al. 2013). Having extra agency in the use and consumption in our media opens us up to be more empathetic to the content, and connected to the story (Schutte and Stilinović 2017; Herrera et al. 2018; Shin 2018). In my opinion, if the content the augmented reality is designed in a way that resembles how we are designing current online content to maximize engagement, I think the use of AR/VR can exasperate many physiological issues we see in smartphone use like compulsion loops, sleeplessness, and issues of self-esteem.

As far as the design of the headset is concerned, it also seems indicative of the trends and goals in the development of augmented reality capable headsets, eye glasses, or other optical technologies. Often headsets are fond of using a lot of glass, a lot of projection, or we try to make use of very pixel dense displays as they can give us that feeling as if the proximity between our eyes and the screen is really narrowing or some projected glass image. But Virtual Retinal Display, which can be called the retinal projector, is a technology that has started to

make its way from engineering labs to consumer facing products (Kleweno et al. 2001). It is a display technology that draws a raster display directly onto the eye's retina. The user sees what apparently a conventional display is floating in space in front of them. It has been frequently discussed in recent papers, sometimes called 'screenless displays', implying it is just around the corner (Lohchab and Sadaf 2017; Shinde and Others, n.d.; Sugawara, Suzuki, and Miyauchi 2017). It might be possible to utilize this type of display with the problem of eye strain, eye discomfort, eye fatigue, and blurred vision, and cybersickness that might be felt from many of today's headsets. One of the current leading headsets include recent HoloLens from Microsoft, which is probably the most common headsets used for augmented reality. With HoloLens, the user experiences 3D holographic images as though they are a part of their environment (Liu et al. 2018). Moreover, these headsets were sent for military tests, too, where Microsoft earned contracts from the US military worth billions of dollars (Ji et al. 2019; Wang et al. 2020). So, with so many incoming demands, it is safe to say that the use of AR headsets will only increase and the use cases will broaden. Somebody actually recreated a scene from this episode of Star Trek using HoloLens.

This episode does not only examine the device but also the possible effects to our behaviors. This depiction implies we might need to have more social and behavioral considerations in the design of AR/VR hardware as well as content. Also the need for much more research on the lasting effects and possible dangers of influence. This is not only influenced by what you are shown with AR/VR but the influence from real world entities that seek to exploit the data collected from users as they use AR/VR connected to other internet connected services.

Diminished Reality and Biological Calibrations

The concept of an AR headset was also seen in an episode of Star Trek: Deep Space 9, season 6, episode 1; A time to stand. This is where the crew of space 9 steals a Jem'hadar warship during the ongoing war with The Dominion. Usually, starships contain a window or a view screen to watch what is going on outside the ship. But, this stolen ship has a very different way of actually viewing the space from inside the bridge.

The command structure set for this alien race is very hierarchical and thus only a few in charge are allowed to get most information, thus only one or two people can peek outside the ship. This social structure has highly influenced the design of the ship and technology in it. There are no windows on the bridge and only those in charge get headsets that allow outside viewing. This kind of cultural influence on technology design has been observed often, one example being the 'Galapagos Syndrome' in technology design in Japan (Eric Hawkinson 2017; Hobo 2014). The few in command put these headsets on and it allows them to look through the hull of the ship. As the ship is stolen, during the mission the only one who was able to look outside was the mission leader Captain Sisko. This concept of using augmented reality to remove parts of the physical world has been in development for some time and is known as diminished reality. Diminished Reality is one kind of computer-aided reality where objects are recognized and removed from view, sometimes in real-time (Nakajima, Mori, and Saito 2017; Mori, Ikeda, and Saito 2017). When you put on an augmented reality headset or view the world through a digital lens, it can help you remove, conceal, or eliminate real-life objects from your surroundings. Its applications can be found all around you. It has been happening for many years now in Google Street view, like people are automatically removed from 360 images for privacy reasons mostly. This is achieved through a combination of software programs and hardware devices, and in some implementations allow headset users to remove objects from view in real-time, like a coffee cup from a table top or a building in a view of nature. In the

episode, the characters are using this type of real-time diminished reality, wherever you look the hull of the ship is removed from view to allow the user to see in 360 degrees anywhere outside, likely with the aid of positional and head-tracking. The view outside is likely provided using an array of cameras placed on the outside of the ship, possibly taking in 360 or stereoscopic video and displaying it to the user. Some commercial uses of this technology can be seen currently, such as home furniture smartphone applications that allow users to take out the furniture currently in a room and replace it with digital versions of items for sale. This allows users to 'try' the items to see if they fit and match the room configuration. Diminished Reality is also used by hairstyling and makeup apps. For instance, users can now try any hairstyle such as curls or bangs and see how that works without using scissors or machinery to get the look.

We also saw diminished reality portrayed in an episode of Black Mirror called White Christmas where the main protagonist played by John Hamm was sentenced to not being able to interact with people, so wherever he looked, wherever he went, the people were not only erased from his view, but voices were also removed or 'diminished' from his reality, that way he couldn't hear what people around him are talking about throughout his life. So, his interaction with people was diminished in this case.

One other very predictive theme in the use of this technology in this episode of Star Trek was that using these technologies might cause cybersickness, headache, and fatigue. If we delve deeper, we will realize how gradually augmented reality alters the way our brain understands information. It can cause you to misjudge the speed of oncoming cars, underestimate your reaction time, and unintentionally ignore the hazards of navigating in the real world. I have discovered this in my research here, where students are curating and creating virtual tours as a part of vocational training. They couldn't last more than a couple of minutes before getting a little bit exhausted in virtual reality as the cheap glasses were not correctly calibrated to the eyes of the individual students (Alizadeh and Hawkinson 2021). Due to the distance, their eyesight can get strained as well. Augmented reality is also quite expensive when used this way, and it might be less accessible for small businesses or harder to use in schools with little technology infrastructure like reliable broadband internet access.

AR Board Games and Holograms

Finally, we are coming to our 3rd example from Star Trek: The Next Generation, Season 2-Episode 21; Peak Performance. This episode shows a lot of the crew engaged in a type of electronic board game called Stratagem. It's basically like a puzzle game, a two-person game where the holographic grid is displayed in front of the two players. The elements are controlled by their hand and finger movements, and one person moves, another person moves. Points are scored for each claimed space that survives and is converted to a controlled space. The board is represented in three-dimensional space in front of the players, like a hologram. Controllers were placed on the fingers of the players to interact with the game. This feature is unique and compelling in numerous ways, because in many immersive media devices we see a lot of hand tracking with a camera to interact. The need for the technology to put things onto your fingers maybe isn't so necessary to interact as motion is captured with a camera, but there is a whole field of haptics that has arisen that facilitates physical feedback from a digital environment. That is what might be happening in this depiction of gameplay in Star Trek. Some headset controllers have finger placement sensors to project finger movement into virtual constructs as well.

The holographic technology depicted in this episode isn't available, but using projected light in different ways to perceive digital additions to one's physical surroundings is already being developed for commercial AR board gaming. In this implementation light is actually projected from the user's headset to be reflected back from a specially coated gameboard (Hartmann, Yeh, and Vogel 2020). A company is set to release an augmented reality board and headset to allow augmented reality to be paired with in-person and online gaming. Using this setup, no matter where you move or position your head, the projection of light coming out of your headset to be reflected onto the board is being changed. This allows for the perspective of the media to adapt to the position of each player and thus each person sees a three-dimensional image based on their vantage point of the gameboard.

The market for mobile computer games is constantly growing and prospering with recent developments in smartphones. The current generation of smartphones has the hardware to allow more advanced use of AR applications to be available that closely resemble this case use seen in Star Trek.

Similarly, AR can be used for many other purposes such as in certain events it could be used in theaters and cinemas, making movies and shows' billboards as an opportunity to gain access to all the extra details that can catch users' interest such as immersive media, trailers and connected social media. It could be an efficient way to make the fans' experience much more engaging, accepting and mitigating the privacy concerns being one possible obstacle.

Discussion

There is much to gain from these depictions of augmented reality in Star Trek that could help inform a more responsible design approach and implementation at a broader scale. These examples from Star Trek are very positive and very optimistic about the future. Many of the directions of this technology in science fiction turn to more dystopian themes. Even Star Trek has somehow given us hints about all the possible hazards and genuine ill effects we could face as this technology becomes more widespread. They have also portrayed physiological concerns, connections to functioning democracy, or maybe addictive issues, which we are uncovering with research in mobile technology and media (Sun and Zhang 2021; Deibert 2019). Lack of privacy can be a growing concern in AR-based applications. It has the ability, much like social media, to show one person something of the real world or take out something from the real world that other people have no sense of what's happening, making our common base of knowledge more fragmented (Alshaabi et al. 2020; Cinelli et al. 2021). Augmented Reality can convince people to miss out on significant moments in their lives, diverting our attention to our personal augmented version of events. Let's not forget how wonderful of a creation it is. If used widely, properly acknowledging the technology and following all the necessary precautions can be a real breakthrough for humanity in many ways. I hope the examples in Star Trek can help us gain more benefit and avoid more pitfalls of how we put AR to use overall in our society.

Conclusions

Star Trek continues to be a predictor and source of conversation for technology in society, and as the web goes through another evolution from mobile computing and the mobile web to immersive technology and web 3.0. Some of the themes discussed as these technologies were introduced in Star Trek can be good indicators of how these technologies will integrate in different ways with humanity. In the examples discussed in this study, themes of moving

devices from our pockets to our face and the implications of having a constant digital display in our field were apparent. Asking questions about the psychological and physiological effects of use and the mental and physical health of prolonged use. Diminished reality and not just augmented reality to be utilized in different ways and having it connected to status points to an already growing trend in the digital divide. Within years even more of the technology introduced in Star Trek is likely to be a reality, perhaps we should continue to examine these themes from Star Trek and other science fiction to bring out the best practices and outcomes while minimizing the risks and potential damages as we implement augmented reality more ubiquitously.

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