Mixed Reality in Japanese Pop Culture

Landon Carter

21G.067 Final Project – 5/18/17

Virtual Reality (VR) and Augmented Reality (AR) (or in general, mixed reality) are hot topics in today's world – Facebook is pushing VR through Oculus, while Google and Amazon are pushing AR through Alexa and Google Home. Microsoft has Hololens as its foray into the AR space. The exploration of mixed reality as a useful tool is still in its infancy, but Japanese pop culture has already embraced a full spectrum of mixed reality, from the "real" such as Hatsune Miku to the fully virtual, such as *Sword Art Online* (*SAO*). Furthermore, Japanese pop culture has adopted a refreshingly nuanced view on mixed reality. In general, Japanese pop culture has been accepting of mixed reality, as evidenced by the widespread popularity and success of Vocaloids such as Hatsune Miku as well as anime involving mixed reality such as *SAO*. In this paper, I will be discussing the variety of positions Japanese pop culture has taken on various forms of mixed reality by analyzing primary source material. To attempt to summarize the wide-ranging views of mixed reality taken by Japanese pop culture is a difficult task, but I will attempt to draw attention to a few common themes – the representation of mixed reality in relation to reality, the extra connectedness offered by a digital world, and finally the cautionary but optimistic tone taken by various pop culture sources.

To discuss the variety of positions Japanese pop culture has taken on mixed reality, I will be referring to Hatsune Miku, *Summer Wars*, *Dennō Coil*, and *SAO* representing a spectrum of mixed reality, from virtual presence to full-immersion virtual reality. Hatsune Miku is a "virtual pop idol", who is actually just a synthesizer, but with an associated character. This character appears in rendered music videos and even appears as a hologram in "live" shows. This is one extreme of VR/AR – the incorporation of the digital world into the real world. *Summer Wars* is a film discussing an online video game that is tied into Japanese infrastructure, exposing a vector for a malicious artificial intelligence to inflict real-world damage through the video game. *Dennō Coil* is an anime based on the premise that everyone has been equipped with AR glasses, modifying their view of the world and exposing them to digital surveillance. *Dennō Coil* represents a view where the digital reality is overlaid, masking the actual reality. Finally, on the other extreme of the spectrum from Hatsune Miku, *SAO* is an anime with the premise that a new VR gaming platform's launch game, Sword Art Online, traps players into the virtual world, and kill the players if their virtual avatar dies in the game, with the only hope of release to clear the game. Together, these 4 pop culture sources represent a full spectrum of mixed reality. This spectrum, along with the themes each pop culture icon represents, are illustrated in Table 1

Table 1: The spectrum of mixed reality in Japanese Pop Culture

	Hatsune Miku	*Summer Wars*	*Dennō Coil*	*Sword Art Online*
Mixed Reality Tech	Projection	AI	AR	VR
Artistic representation of mixed reality	Digital, tries to look real	Clearly digital	"old" AR is digital, while "new" VR is real	Indistinguishable from reality
Connectedness	Crowdsourced	World unites to defeat Love Machine	No significant commentary	Complex morality questions projected to VR
Negative/Positive?	Widespread acceptance	Negative	Negative	Negative, ends with positive note

As the only current "real world" phenomenon, Hatsune Miku represents the current state of technology. *Summer Wars* still has an AI that is not currently within reach, and the mixed reality present in *Dennō Coil* and *SAO* is not technologically feasible yet. Hatsune Miku raises questions such as whether a digital celebrity is real, and what a crowdsourced celebrity's personality is. Hatsune Miku is like a mask – her persona can be put on top of any performance, and any ideals or personalities can be projected onto her, ranging from a playful to seductive to deep and dark. Bo Zushi argues that "The singer serves as an empty vessel for the audience's fantasies," (Zushi, 2017) and notes that in the entertainment industry, an idol's image is carefully protected and manufactured, but that Hatsune Miku escapes these barriers. It is interesting to note that Hatsune Miku is Japanese, while human Japanese idols, especially female pop idols, are held to some of the most exacting standards possible, forced to maintain a "pure" image. Instead, Hatsune Miku is simply a screen for projection, entirely composed of user-generated content.

To focus in on this interaction, consider all of the ways in which users and fans interact with Miku. Every Miku song was written by a fan. Every Miku dance was choreographed by a normal user. Every lyric was written by someone "normal." Maybe an aspiring songwriter, or just someone who decided to try out the neat piece of software, but there are no production and publishing companies polishing every song published with Miku's name – Miku's fame and ubiquity is due entirely to user-generated content. Nearly all of the associated Miku content is also fan generated – fan-generated artwork, fan-generated stories. There are even fan-generated AR apps for Oculus Rift to enhance the lifelike nature of Miku. Lam argues succinctly "Instead of being a work of art, the Vocaloid singers are evidently products of reproduction meant for further reduplication. … As a product of reproduction, the copy possesses no aura of the original. As a product for reproduction … the cult value of the original is inevitably out of sight." Essentially, all of Miku's worth and value is derived from reproduction. Therefore, Miku represents the essence of the digital age – users interacting with content closer than ever before, and user-generated content exploding in popularity. As the world goes digital, content can be customized and bent to suit the needs and desires of even a single user. However, as the world goes digital, people also become connected through more channels than ever before, even collectively writing a story and a life for Miku that is more rich and complex than a real human.

Miku has transcended her origins as just a voice synthesizer, becoming a pop idol who is projected into real-world concerts. It is interesting to note that many of the efforts of Miku have been to emulate the real world. AR apps have been developed for the Oculus Rift which make use of fiducials to bring Miku to life as realistically as possible, making her move and react to the environment in a lifelike manner (Lichty, 2014). This is enabled by the use of fiducial markers, a mapping for the virtual world onto the real world. Furthermore, the original development of Hatsune Miku's Vocaloid software was intended to develop a "human-like singing voice", so the developers "digitized separable and transportable fragments of recorded voice and integrated them into a singer library." (Lam, 2016). In essence, Miku is made by sampling and recombining snippets of the real world. Lam further describes the developers as unsatisfied with a voice alone as a verisimilitude of life, leading to the creation of Miku's human persona, and ultimately, the true extent of Miku's popularity.

Moving on to the next example on the spectrum, *Summer Wars* concentrates on the possibly negative impacts of a fully-digital society. In *Summer Wars*, an artificial intelligence named Love Machine gains too much power in the virtual world of OZ, hacking into areas that it should not have access. Unfortunately, because Japan has become a fully-connected digital society, gaining power in OZ

allows Love Machine to affect real-world events, killing the main character's great-grandmother by disabling her heart monitor. Eventually, Love Machine gains enough power to steer a satellite into a collision course with a nuclear power plant, before eventually being defeated through the unification of all avatars in OZ. Though the prospects of an AI that can hack complex systems and make such malicious decisions is still a far-off concept, *Summer Wars* raises questions about our increasingly digitally connected world. It seems like every household appliance is getting connected to the internet, able to be controlled remotely, and products such as Amazon Alexa and Google Home are always listening, ready to spring to a user's bidding, but with potentially devastating results if they are ever hacked.

Milligan provides an in-depth analysis of the art styles behind *Summer Wars*, noting most interestingly the contrast in director Hosoda's depictions of the virtual world of OZ and the real-world city of Ueda where the rest of the film takes place (Milligan, 2010). This is in contrast to Hatsune Miku's efforts to be as lifelike as possible. *Dennō Coil* also takes an interesting approach to the art of its digital world versus the "real world". Roquet notes that *Dennō Coil* represents "old" technology with modern digital animation, but "new" technology along with the "real" objects are represented with traditional hand-drawn animation (Roquet, 2016). In ways, this can be seen as mirroring the ideal of mixed reality developers – they aim to make mixed reality unnoticeably different from reality, but current efforts are still distinctly digital and out-of-place. *Summer Wars*' depiction of OZ as distinctly different from the real world falls into the category of what is currently technologically feasible, which is the primary reason that I classify *Summer Wars* as less developed on the mixed reality spectrum than *Dennō Coil*.

Like *Summer Wars*, *Dennō Coil* highlights the negative impacts of mixed reality, including most tragically when a character was killed by a car when the AR glasses of the driver misrepresented the girl's position. *Dennō Coil*'s overall plot is incredibly dark, revolving around children disappearing into the digital void. The theme of children whisked away into the digital void seems to be a popular one, since this is also the central theme of *Sword Art Online*. The popularity of this theme is curious – one could argue that this represents the fear of the middle-aged generation towards digital technology, or in general a fear of various forms of mixed reality. Unfortunately, a full analysis of the specific theme of children being sucked into the digital void is beyond the scope of this paper. Within *SAO*, Sword Art Online is a digital world where players are trapped until the 100th boss level is cleared. Because SAO bosses are incredibly difficult to defeat, this requires significant teamwork to take down each new boss. Players organize into guilds, with guilds spanning a range of competitive abilities and moral grounds. One of the primary arcs of the story, for example, deals with a guild called "Laughing Coffin," which participates in player-killing. In a normal game, this might be frowned upon, but in SAO, this is literally murder, since players' bodies die in real life if their avatar dies in SAO. In this way, members of Laughing Coffin are hiding behind digital anonymity to commit murder.

This dystopian view of VR is balanced by the more nuanced view of VR presented in the final arc of the second season, Mother's Rosario, which focuses on a group of individuals with terminal illnesses using VR to live a "normal" life, free of the pain and prejudice associated with their respective diseases. After SAO is cleared and full-dive VR regains popularity with a variety of games, doctors look into using special versions of full-dive VR headsets for medical purposes. These modified full-dive headsets remove any sensation of pain for the individuals and allows them to undergo medical treatment that would normally be completely incapacitating, including being fully isolated in a cleanroom, for one individual that had contracted AIDS. The individuals undergoing treatment while being used as test subjects for this medical VR form a guild called the Sleeping Knights.

In Mother's Rosario, the members of the Sleeping Knights reach out to strong players in ALO, one of the VR worlds that has sprung up since SAO's destruction, and Asuna, one of the main characters in *SAO*, is chosen. The Sleeping Knights befriend Asuna and together clear a floor boss without the help of extra guilds. Throughout this interaction, the Sleeping Knights are able to conceal the fact that they are undergoing intense medical treatment, a true testament to the capabilities of the medical deep-dive system within the *SAO* world. This is not the only positive view of VR taken in *SAO* – two others are Kirito's efforts to allow Yui to interact with the real world, and Asuna's interactions with her mother. Yui is an Artificial Intelligence that Kirito and Asuna meet within SAO, who was programmed to act as a mental health monitor and aid, maintaining the mental health of players within SAO. Yui manifested as a young girl, who Kirito and Asuna adopted as their daughter, essentially. After escaping SAO, Kirito works on technology that lets Yui interact with the real world, including a web-connected camera and voice synthesizer for her.

In perhaps the most moving subplot of *SAO*, Asuna clashes with her mother over her use of VR after escaping SAO as well as whether she should switch schools to a more competitive school that none of Asuna's friends attend. Asuna's mother pushes her to limit or cease VR usage, pushing Asuna to focus on schoolwork to make up for the two years she lost when in SAO. However, Asuna uses VR to keep in contact with SAO friends, hanging out in VR since they are not all physically close or able to physically meet, especially with regard to Yui. Furthermore, they have more freedom in VR, the ability to fly, go on adventures, and similar. In short, VR has become Asuna's primary method of social interaction, but her mom views it as a detrimental influence. After many arguments, Asuna eventually convinces her mother to join her in the VR world so that she can show her mother the log house she owns in a forest. Asuna's mother is initially unimpressed, but upon seeing the view of the forest, breaks into tears, realizing that the scene is a familiar one – the forest and log cabin are extremely similar to Asuna's grandparents' house. Asuna's mother is overcome, finally realizing the potential of VR to connect with those that may be impossible to interact with physically. Upon this realization, Asuna's mother allows Asuna to continue using VR, and stay at school with her friends. This is one final example of how *SAO* views VR as a method to connect people.

In conclusion, we have looked at the full spectrum of mixed reality, from the digital world projected into the real world in Hatsune Miku to a full-dive virtual reality in *SAO*. We have also looked at 3 common themes of mixed reality in Japanese pop culture – the representation of reality, the connectedness of the digital world, and the cautionary tales. First, there is the representation of mixed reality. In the short term, it is typically depicted as falling short of reality (eg, Hatsune Miku, OZ in *Summer Wars*, and the older AR tech in *Dennō Coil*). However, in the long term it is represented as indistinguishable from reality, such as the new AR tech in *Dennō Coil* and the fully immersive world of *SAO*. Many pop culture references to mixed reality highlight the connectedness of digital worlds, such as the crowdsourced nature of Hatsune Miku, the final defeat of Love Machine in *Summer Wars*, and the complex interactions of *SAO*, especially the Sleeping Knights and, on a more negative note, Laughing Coffin. Finally, some of the pop culture sources studied tell a cautionary tale of mixed reality (*Summer Wars*, *Dennō Coil*, and *SAO* before the final arc of the anime), while some tell a more positive tale (Hatsune Miku is widely accepted, and *SAO*'s Mother's Rosario Arc ends on a far more positive view of VR).

The variety of nuanced views on mixed reality shown in Japanese pop culture is indicative of the complex nature of the subject. In general, these examples provide broad support for a few mixed reality

directions – first, to maintain sight of the real world. In none of these examples is mixed reality shown as entirely superior to the real world, and is only shown in a positive light when augmenting the real world. Second, these examples broadly support the benefits mixed reality can bring towards communication and connectedness. *Summer Wars*' main conflict is resolved when all accounts in the world come together to fight against Love Machine. In *SAO*, Asuna is only able to communicate effectively with her mother when in VR, and VR also enables her to hang out "in person" with remote friends. Furthermore, VR allows patients, who would not otherwise be able to live a normal life or communicate freely, to join their friends in VR. Finally, these examples also highlight the need for security in mixed reality. *Summer Wars'*, *Dennō Coil's*, and *SAO*'s central conflicts all revolve in some way around a flaw or insecurity in mixed reality. This is inherent in all computer systems, but the additional trust placed on mixed reality systems means that mixed reality systems require even more attention to security.

It is interesting to note the wide variety of views that Japanese pop culture sources take on mixed reality, as well as the variety of technologies showcased. It is clear that we are moving to a more digital, more connected world, and it seems likely that mixed reality will feature heavily in future technological advances. We need to begin a discourse on the benefits, drawbacks, and risks of mixed reality, and Japanese pop culture has gotten a jump start on this discussion, as well as pushing a few common viewpoints – that the real world must be augmented, not replaced, that communication must be a primary benefit, and that mixed reality requires incredibly good security. We must heed these lessons in the future when developing mixed reality systems.

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