"She's Like the World's Barbie Doll": How Semiotic Labor Reifies the Gendered Labor Assumptions of Hatsune Miku

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As the twenty-first century enters its third decade, the presence of virtual characters and artificial agents in everyday life increases. We define artificial agents as any computer program that produces an interactive entity designed to simulate a human being. The level of interactivity can produce a sense that the entity possesses agency, authenticity, and even an ability to impact people's lives. Physical robots, Twitterbots, and artificial assistants such as Siri, Alexa, and Cortana all represent examples of these emerging artificial agents. Currently, however, none of these artificial agents are true agents, as none possess complete autonomy over their functions and actions. Of course, the robots of science fiction, from Rosie in *The Jetsons* to EVE in *Wall-E*, will not soon enter the workforce. Yet they all represent a potential future, presently being examined by researchers in human-robot interaction studies to understand what happens when humans engage with true artificial agents.

Given the focus on simulating a human being, developers and users may gender artificial agents as feminine, especially if such artificial agents operate in feminized work spheres like health care, service, and domestic tasks. We already see such default gendering with Alexa, Siri, Cortana, and others such as GPS devices and apps. With these artificial assistants, developers and users frequently utilize auditory signals such as a "feminine" voice to code non-biological entities that lack the sexual characteristics often used to determine gender identity. Thus, through

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people's interactions with and their discussions about these artificial assistants, these "robots" exist within what we refer to as a networked gender, whereby individuals develop a gender identity via interactions with others. That is, from programmers to users, people work together to co-construct the artificial assistant's gender identity, imposing assumptions ascribed to biological entities onto a non-biological entity (see Costa; Schiller and McMahon; Woods). Artificial agents lack a concept of self in the traditional sense but are bestowed identities via people's semiotic labor, a communal activity that results in the creation of a self that thereby improves human-robot interactions. This paper analyzes the semiotic labor that circulates and creates these artificial agents' identities while also reifying traditional gender stereotypes.

Specifically, this analysis considers the Vocaloid Hatsune Miku, a computer program that allows users to create music for "her" to sing, making Miku essentially a programmable instrument. In the current analysis, we refer to Miku as "it" due to the lack of biological sex determination and gendered identity agency possible for the virtual posthuman performer. We only refer to Miku using gendered pronouns when others refer to the character as such. While not a traditional robot, Miku shares characteristics with other artificial agents: it exists as a computer program that allows users to achieve their goals. Additionally, the program's creator, Crypton Future Media, uses its image for marketing and entertainment purposes. Crypton and Miku's fans utilize its voice and appearance to produce their own entertainment, which can turn a profit off the character's labor. Along with the company and Miku's fans, researchers and journalists further work in a symbolic community to create and maintain the Vocaloid's identity. Thus, in conjunction with auditory codes common in artificial assistants, visual and power codes encoded into Miku by developers, users, journalists, and others further promote gender assumptions about the virtual performer. In other words, humans engage in a semiotic labor that reifies these gendered signals to co-construct Miku's identity.

Introducing Hatsune Miku

Vocaloid performers such as Hatsune Miku represent a subset of virtual bands, which have existed in one form or another since Alvin and the Chipmunks first burst onto the pop music scene in 1959, with Gorillaz serving as a commercially successful recent example (Conger). Virtual bands may be fronted by fictional, animated, or virtual characters or celebrities, but biological humans exist behind

these performers, providing the vocals and the instrumentation that comprise the bands' sound. Usually the presentation of the virtual character matches the gender of the biological performer, but given the anonymity afforded by the virtual performance, the biological musicians could engage in a form of identity tourism, whereby an individual appropriates and/or performs an identity involving a gender and/or race different than their own (Nakamura). Indeed, one virtual band, Studio Killers, has engaged in such gender-bending identity tourism. The most persistent rumor surrounding the band is that animated lead singer Cherry is performed by Teemu Brunila, the male front man for Finnish band The Crash (Richardson). Regardless of whether Brunila is indeed the human performer behind the virtual singer, many fans believe that a male singer provides Cherry's voice. The performer who voices Cherry uses multimedia tools to enable a more imaginative performance of identity; the character functions as another identity for the singer, one he presents to the world via these multimedia tools. Cherry's presentation thus recalls Lisa Nakamura's contention that online spaces allow users to "project a version of the self which is inherently theatrical" (16). Ultimately, Cherry represents a negotiated self that the performer presents to the world, one that allows him to engage in a form of roleplaying that serves to "underline the arbitrariness of gender and reveal its symbolic as opposed to its biological function" (Morse 27).

This notion of identity and performance becomes somewhat problematized when looking at Vocaloid performers, which remove the human element even further. While virtual bands rely on human performers to directly provide their voices for songs, Vocaloids require a handful of programmers to manipulate lines of code to bring them and their songs to "life." This subset of virtual bands is similarly fronted by virtual characters, but no human performers are directly responsible for the vocals or instrumentation (though, when touring and performing "live," biological musicians accompany the Vocaloids who appear via holograms). Humans control the Vocaloids via computer programs that contain a database of potential vocals and instrumentations, but the resulting performance represents an amalgamation of selected files assembled to produce a song. In a sense, these Vocaloids became new musical instruments for their human conductors, requiring far less human involvement or control over vocalists and instruments to produce a song than traditional musical compositions (see Bell).

Developed by Yamaha in 2000, a Vocaloid is a "singing voice synthesis" software application that allows "users to input melody and lyrics to synthesize singing" (Yamaha Corporation). Crypton Future Media utilized the Vocaloid

software in their speech synthesis applications. Then, using the MikuMikuDance software platform, a proprietary freeware animation program developed by Yu Higuchi that allows users to animate and create 3D movies, the company created a virtual spokesmodel to help sell their speech synthesis software. Thus, in 2007, Hatsune Miku, currently the most popular Vocaloid performer, was "born."

While Crypton copyrighted the software and characters, fans have produced most of the Vocaloids' songs. The main performers, including Miku, exist primarily as marketing devices intended to demonstrate what users can accomplish with the software. These posthuman performers serve as channels through which fans express themselves by sharing their original music online. In 2012, Crypton assigned a Piapro Character License: Creative Commons License to support global, non-commercial fan activities with their Vocaloids (Zaborowski). For the Vocaloids to be successful, both the corporate power of Crypton and the fans' labor must exist in a complex creative ecosystem (Leavitt et al.). Crypton retains the copyright for the Vocaloids, and they alone can profit off Miku. The fan labor helps them establish a market for licensing the character for profit (Leavitt et al.), such as featuring Miku in a 2011 Toyota Corolla ad campaign (Wicoff). By 2012, five years after Miku's introduction, the character generated more than $120 million US (roughly 10 billion yen) for Crypton (Hodgkins).

For a Vocaloid to perform, a human programmer animates its dance moves and inputs its voice "using fragments of voices recorded from actual singers, called the Singer Library" (Yamaha Corporation). Therefore, Vocaloids incorporate pieces and labors contributed by Crypton, the fans, actual vocalists, and MikuMikuDance. Vocaloids are "hybrid products" because they converge the traditionally disparate spheres of technology and art, physical and virtual, and producer and consumer (see Guga). Ian Condry uses the term "wiki-celebrity" (see Verini) to describe the Vocaloid, as audiences' interactions help form the perception and identity of the virtual individual. While Vocaloid performers may not have an identity programmed into them, they gain one through the communal activities of humans, who both impart a sense of self upon the Vocaloid performer and reevaluate their own conception of self in relation to the performer's co-constructed identity. Such semiotic labor, then, produces a networked gender for the Vocaloids in direct conversation with sociocultural gender assumptions.

Miku's Networked Gender

Miku exists not through its own labor, but through the labor of those around it. Per symbolic interactionalism (Denzin) and the networked self (Papacharissi), a person's identity develops through their communication with others, who provide the individual with the ability and opportunity to see themselves in different ways. Through the exchange and common interpretation of symbols, this network of individuals helps each agent develop a sense of self in relation to others. Thus, this network engages in semiotic labor, as agents co-construct identities in conjunction with other networked agents by sharing the meanings associated with communicated signs.

As a specific aspect of the networked self, the networked gender exists through the interactions of the individual's gender performance, how others respond to such performances, and how the individual perceives and anticipates such responses (Olson and Reinhard). Drawing on symbolic interactionism, individuals develop their sense of gender and themselves as a gendered entity through their communications with others. Through such symbolic exchange, an individual's social network engages in semiotic labor to co-construct the individual's gender identity, which can result in a networked gender that challenges or reifies sociocultural assumptions and norms regarding gender-appropriate behavior. Individuals could consciously engage in this process to explore and determine their gender identity, or they may unconsciously engage in this process.

Either way, people exhibit their agency in this process; currently, however, artificial agents do not have that agency of self-determining their gender identity. While a media representation could portray an AI demonstrating such agency, as in the case of the character BMO in the cult animated series *Adventure Time* (see Olson and Reinhard), such awareness of gender fluidity is not commonly seen in real-world AI. However, Miku has no agency except in such fictional representations; Miku primarily exists through the co-construction of its creators' profit-driven labor and its fans' labor. This type of labor is sometimes referred to as "lovebor" due to fans performing it out of love rather than an expectation of financial compensation (Stanfill). Miku does not participate in the semiotic labor, which instead occurs around and through it. To understand Miku, then, it is necessary to examine the semiotic labor of those creating and receiving, and co-constructing, the character.

However, because these artificial agents exist in the same sociocultural contexts as the people who create and use them, such AI are also subject to the same semiotic labor that results in a networked gender. Any AI creator may imbue it with gendered

characteristics that reflect sociocultural norms, such as giving the AI a feminine-coded voice, and the AI's release into the world would then be met with semiotic labor to reinforce or challenge this original determination. Even the lack of gendering by the AI's producer indicates a relationship to these sociocultural norms, given how central gender is to human identity. Analyzing an AI's networked gender can thereby provide information as to how people view gender.

Such theoretical assumptions informed our analysis of Hatsune Miku and how the Vocaloid's gender was co-constructed through the semiotic labor of its creator, fans, researchers, and journalists. Given that Miku's primary identity emerges through the collaboration between Crypton and fans, the character's gender should likewise be co-constructed. To analyze this networked gender, we consider the gendered pronouns and other symbolic language used to describe Miku by Crypton, its fans, journalists, and researchers. Analyzing these signs should provide insight into the assumptions people have about the Vocaloid's gender identity. The next section considers the discourses surrounding this artificial agent, examining how academics, news reporters, and fans have referred to Miku.

Gendering Hatsune Miku

First, Crypton genders Miku as female. The vocal samples stored in the database, known as a voice bank, were provided by anime voice actress Saki Fujita; Fujita, however, does not directly sing any of Miku's songs, as the computer program produces the final music. In other words, Fujita's labor created the database for the computer program, but not Miku's songs and performances. Miku is described as a 16-year-old "android diva in the near-future world where songs are lost" (Spacey). On their website, Crypton provides basic demographic and "biological" information for the performer: Miku stands 158 cm (just over 5 ft) and weighs 42 kg (about 92.5 lbs); its favorite music genres are J-Pop and Dance-Pop. Most importantly for this analysis, the website labels Miku as a young woman through the use of gendered pronouns like "she" and "her" (Crypton Future Media), which matches the assumptions based on Miku's common visual features (e.g., long hair in ponytails, skirt, stockings, slim waist, and slight breasts). Thus, the gendered identity ascribed to Miku by Crypton relies on feminine stereotypes associated with hair, body shape, voice, and dress.

Beyond these basic features, no information is provided about Miku's personality: those characteristics are largely left blank and thus open to

interpretation. Existing as a blank slate means Miku represents an "uncertain image" that exists "as a vessel for [fans] living out their own desires and fantasies" (Jørgensen et al. 3). According to Crypton, "She is also often called a global icon or 'hub,' because the culture around her encourages a worldwide creative community to produce and share Miku-related content." Because Crypton includes an illustration of Miku but omits "any information other than biographical data," fans can "apply their own interpretation to the character" (Le 3). Miku's fans are free to "project their own lives" (McLeod 505) onto the virtual performer through their representations of it and their presentations of their work through it. This uncertain image therefore results in a "socially networked phenomenon" (Jørgensen et al. 6) shaped by fan production and consumption; in other words, it is not enough that the programmers make her look/sound female, but her identity creation also involves fans accepting and reifying this presentation.

Fans thereby imbue Miku with an identity that would appeal to their own values. Indeed, Miku has become "'a hub of creative culture for collaborations' among artists and fans," who alter and add to her identity through activities including fan fiction, fan art, and cosplay (Mallenbaum). These fan-created identities are shared with other fans via social networking sites as well as official and unofficial fan sites such as *Mikufan.com*. This fan activity results in a networked self for the character, one composed of bits and pieces of identities generated via the fans' communal activities. Additionally, the circulation of identities reflects and shapes the fans' identities as well, demonstrating the concept of the networked self, writ across biological and artificial agents. As one astounded viewer put it after watching a video of Hatsune Miku performing in concert, "When you put a personality to it, like they're doing, then it becomes a real thing" (Fine and Fine). Fans and academics appear to agree that semiotic labor creates the character, or identity, of Miku.

Both groups also contribute to Miku's networked gender. Whether as aca-fans or objective critics, scholars have begun wrestling with how to describe and represent Miku. Most, however, do not appear to question Miku's gender identity (see Connor; Le; Leavitt et al.; Wicoff). Indeed, using feminine pronouns often occurs in relation to discussing Miku's realness. For example, Ken McLeod routinely refers to the Vocaloid as "her" when analyzing the quasi-spiritual relationship between the Vocaloid and its fans (507). Rafal Zaborowski sees the character's gender relating to its realness: "for her fans and producers Miku is a 'real' entity" (111) because "she sings about things that matter to [the fans]" (124).

Eve Klein compares the audience's playing along with the Vocaloid's fabrication to drag performances and further accounts for how Miku's gender and "humanness" exist through a co-construction between the audience and the semiotic labor involved in reading "the repetition of particular acts and gestures which are open to recontextualization" (41). In noting Miku's constructed identity and comparing Vocaloids to drag, Klein draws on Judith Butler's discussion of gender fluidity to argue how gender relates to realness as intertwined signifiers.

Other scholars address gender fluidity in their work, such as Francis Ka-Man Fu: "Given the relationship that Miku has established with her supporters, the psychological investment that supporters have made, and the human-like interaction between Miku and concert goers, it is my conviction that 'she' is a better fitting pronoun. Miku is definitely not 'a voice and nothing more'" (25). Roger Andre Søraa addresses this matter in relation to the realness issue: "This 'easy-gendering' debate might be because she lacks a physical body, and thus is seen as less 'real'" (43). Stina Marie Hasse Jørgensen, Sabrina Vitting-Seerup, and Katrine Wallevik all recognize that their gendering of Miku happens even though the Vocaloid "is a software program, and not someone who can identify with being a woman" (13). These reflections suggest more awareness of gender fluidity, but none spent significant time exploring this question. Of the published studies to date, Ka Yan Lam presents a feminist critique of Miku's gendered nature and how that identity relates to issues of authenticity and sexualization, doing so by putting quotes around the gendered pronouns.

As with the academic critiques and analyses, descriptions of Miku in news reports tend to align with the Crypton gendering. News publications routinely use gendered pronouns and feminine descriptors for Miku (see Hsu; Jenkins; Kelts; Mangu-Ward; Rao; Roose; Schwartz; Zushi). Additionally, a 2013 report by *Discovery Channel Canada* called Miku the "Queen of Pop who merges music and technology" (Daily Planet). Often, the story's angle focused on answering the question perceived to be foremost on the minds of the public: what is this virtual thing and why do people care about it? This "hook" is handled by juxtaposing the gendered nature against the non-humanness of Miku. Thus, Carly Mallenbaum wrote for the *USA Today* that "Hatsune Miku is a pop star, no doubt. She's just not a real person," and Lindsay Zoladz of the *New York Magazine* declared, "If you've heard of her, you've probably heard her described as a 'hologram'; maybe you've also heard people say she doesn't exist." At times this juxtaposition is used to also comment on Miku's fanbase, suggesting that Miku's fans are not bothered by the

"stark unreality" (Johnson) or that "not even her fans know, or care, how to taxonomize her" (Verini). Such messaging appears to draw on a perception of fans being easily duped into believing fictional entities are real people.

As for the English-speaking[1] fans regularly engaging with the character, their interactions appear to reflect a more complicated reception and understanding of the character's gender identity. According to Lukman Aroean and Philip Sugai, fans responded to a news story describing Miku as fake and argued instead for Miku's "real-ness" without questioning the character's gendered nature. Those fans did, however, refer to Miku as "Uta Hime" or "Princess of Song" and used feminine gendered pronouns, suggesting an acceptance of Crypton's positioning of Miku. Similarly, Espen Helgesen conducted an ethnography of children pretending to be Miku, and those children likewise focused more on the "fake versus real" binary than the gender binary in describing the Vocaloid. Furthermore, they too used feminine gendered pronouns to describe Miku. Zaborowski quotes fans referring to Miku as "she" when describing their perception of the character's songs, again emphasizing how the fans perceived the Vocaloid as real or virtual. Such analyses often discuss how the fans use Miku as a form of self-expression, to "become" Miku, suggesting a plurality of identifications with and uncertain identity for Miku, as discussed earlier.

Public fan descriptions of Miku tend to utilize the gendered pronouns as well. At *Mikufan.com*, the "About" page provides a background on the character, stating, "She continues to grow in unpredictable ways, but we'll do our best to keep up with her" (admin). A fan wiki for Miku presents the character's gender as "female" and repeatedly refers to Miku as "she," e.g., "She is considered the most popular and well known VOCALOID, and the first to become a pop idol." Interestingly, the fans' use of "she" both suggests Miku has human-like agency (e.g., "Later reports came that she had sold 60,000+ copies of her software.") while also acknowledging her artificial nature (e.g., "She was initially released in August 2007 for the *VOCALOID2* engine…") (Wikia "Hatsune Miku"). A similar duality is seen in Miku's Wikipedia entry, suggesting the character exists as an artifact of Crypton's creation while also being responsible for successful sales of the software and resulting songs — all the while referring to Miku as "she" although without the specific designation as "female."

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[1] We focused on English-speaking fans because a) English is our primary language and b) English contains specific gendered pronouns.

Fans discuss gender in online forums, but their focus is on the gendered nature of the Vocaloid's voice. In the fan forum Vocaverse Network, a search with the term "gender" returned only fans discussing how to manipulate the "gender factor" of various versions of the Vocaloid software and what happened to the songs that resulted from doing so. According to the Vocaloid Wikia, the gender factor allows users to control the voice to produce a "thicker masculine tone" or a "more feminine, even 'chipmunk-like', sound" (Wikia "Using the Parameter"). Thus, on Vocaverse, fans discuss how they can manipulate the gendered nature of the Vocaloid's singing voice, even managing to create a more masculinized sound in a feminized body. For example, Chia-P said, "Use some Gender shift to make Mikus [sic] voice SLIGHTLY deeper. Be careful not to overdo this effect, though" (emphasis in original). The direction in the first sentence aligns with other comments found on the forum; the second sentence, however, perhaps demonstrates a hesitancy to manipulate this gender factor too much, as doing so would stray too far from the perception of Miku's gender. This concern seems to match views collected by Zaborowski, who notes that Miku's voice "was an indispensable part of the experience" (123). Similarly, GreenFantasy64 shared a song on the Vocaverse forum made by a fan featuring Miku with a deeper voice:

> Love the instrumental, but I don't know about Miku's voice… One hand I think it works and sounds nice, but on the other I kind-of want more emotion from her…? I don't know […] like I would have preferred not too much Gender Factor on her voice (I'm probably wrong on that, so sorry if I am!).

Again, a fan was concerned that Miku's voice failed to match the character's ascribed gender identity.

Those fan discourses represent more direct focus on the means of using Miku to produce music, and not the character directly. When their attention is brought directly to the character's gender identity, nuance emerges. In the fifth episode of the 2016 *Mikumentary*, documentarian Tara Knight spoke with Miku fans who describe how other fans create sexualized portrayals of the character. One fan voices concern about such a portrayal, saying, "She's supposed to be cute […] she's supposed to be young," thus reflecting on the anime genre's tendency to sexualize girls but not considering the character's gender identity in relation to such objectification. At the same time, another fan finds inspiration in the gendered nature of Miku, which in turn encourages them to be truer to their own idealized self: "I wear what I want, and I do what I want. That's what it means to be female. I don't have to constantly be worrying about being a good woman or being a bad

woman." This reading allows for a more open perception of being gendered as a woman and expands the definition of "woman."

This openness, however, can be problematic. A 2018 *Washington Post* article quotes Viennese superfan Cien Miller, who praises Miku, saying: "She can be anything. She's like the world's Barbie doll" (Jenkins). Miller's comments reflect both the uncertain image of the character and the circumscribed nature of those potentialities given the character's gender. Comparing Miku to a Barbie doll comes with the assumptions and stereotypes coded into that figure, especially regarding the primacy of visual cues in determining gender identity and the power imbalances that come from such assumptions. Female performers often experience sexualization that male performers do not, representing a patriarchally enforced power difference that further represses women in the professional sphere (Dean 166). Both Barbie and Miku experience this sexualization without any ability to agenticly resist it: Barbie and Miku's labor operates for their "master's" pleasure.

Without Crypton providing more detailed identity information, Miku's identity remains open to others who can ascribe their own assumptions about gender onto it. When we uploaded to YouTube a video presentation of an earlier version of this paper (Pop Culture Lens), one fan responded with:

> we don't need somebody who [is] not a fan telling us what to think and how to act toward her. All her fans all know that she [is] not real […] it [is] not hard to tell which gender the Vocaloids are, you can usually tell just by looking at them. […] we Vocaloid fans know what gender the Vocaloids are and we don't need a reason to why we think that Vocaloid is a girl or boy. (Daisuke Niwa)

While this person challenged our analysis of the discourses, another fan responded with interest and hoped the analysis would be extended to "address how the male Vocaloids are often portrayed in the same feminine and male-gaze way that Miku is, because I find it fascinating that all Vocaloids […] are portrayed as feminine, regardless of their 'official' gender" (NattalaChao). These responses demonstrate the potential range that could occur when fans acknowledge the performative nature of gender, as well as the likelihood that fans, while working with Crypton and one another to create Miku's networked gender, appear to have given it little thought.

Miku as Gendered Laborer

The semiotic labor of the humans programming and using Miku appears to reify gender stereotypes as being under the control of others, especially in relation to female performers. This semiotic labor results in Miku's networked gender and demonstrates how future non-biological artificial agents may have their gender assumed and ascribed to them to improve human-robot interaction. Overall, these examples from the discourses demonstrate a desire to represent Miku and the performer's impact on fans as they work to legitimate Miku's presence and humanity by using gendered pronouns. Utilizing "it" is seen as too impersonal and diminishes a reason explaining people's affective entanglement with the character. The use of gendered pronouns, then, demonstrates an anthropomorphization that is common with digital, virtual, or artificial objects and agents (see Reeves and Nass). Assigning the Vocaloid a gendered persona is a "communicative strategy" to help those engaging in these discourses establish a common foundation on which symbols, and thus meaning, can be exchanged (Woods 336). Thus, it appears that public and fan discourses surrounding Miku reaffirm a basic gendered identity to improve the human-robot interaction Miku represents.

These discourses surrounding Miku, however, demonstrate the continued visual primacy and cisnormativity of determining gender through the codes used to describe the Vocaloid. Miku is not an empty sign as claimed, because people appear to accept the character's gender identity as determined by Crypton. The prevailing notions of gender are visible within the discourses, suggesting that Miku's physical appearance determines the character's gender identity. With Crypton labeling Miku with gendered pronouns that match the character's visual appearance, fans, academics, and the public have no real reason to challenge that assumption, even if they can add to other aspects of the character's identity. Without a challenge, this networked gender replicates the biological determinist argument for gender identity. Miku has been coded as a woman, and the discourses surrounding Miku reflect and reinforce these codes.

The networked gender exists through largely unconscious semiotic labor by those agents involved and identified earlier. It may be that the stereotypes concerning visual and vocal feminine codes are too ingrained in people's minds and their default assumptions too readily come to mind through activated gender schemas. Without anything in Miku's appearance to trigger challenges to these assumptions, fans and the public are more concerned with the binary question of whether the character can be considered "real." Assuming Miku possesses an inherent gendered identity helps answer this question: since Miku appears to be a

woman, she must be real, as women are real. People may apply existing social codes regarding gender to Miku because that is easier semiotic labor to perform (Lewis 509): using visual cues to assign gender identity can happen largely unconsciously, whereas challenging those stereotypes would require more semiotic labor, as other signs and codes would have to be considered. The commonality in the networked gender demonstrates the semiotic labor being less strenuous, perhaps to help offset the more strenuous semiotic labor of assigning "realness."

Overall, it seems that Miku's gendered nature helps people perceive the Vocaloid as real. Miku's gendered presence moderates people's need to suspend their disbelief over the realness of the artificial agent. Gendering Miku allows fans' identification with the virtual character through anthropomorphism, and the disinterest in problematizing the character's gender suggests a certain comfort level with anthropomorphizing artificial agents. This acceptance of Miku's gender may be undertaken to handle the binary of reality-virtuality; seeing the character as "she" may help "her" fans answer the question of why they have become so emotionally engaged with a software program. This conclusion has possible applications to everyday life as the presence of robots increases at work, at home, and in other areas. Gendering a robot could provide for improved comfort during human-robot interactions, for good or ill, as evidenced by the integration of Siri, Alexa, and others into our daily lives and workplaces (Fessler).

Thus, the unconscious reliance on and circulation of these gendered codes has implications beyond the Vocaloids. Since Miku has no agency over its appearance and performance, the character has no ability to speak back against how others treat it or conceptualize it. Biological performers, on the other hand, possess such agency over their gender identity and their performances,[2] including the basic ability to stop performing and leave the public spotlight. Thus, one criticism of Miku involves who exerts control over the feminine pop idol and thus control over its feminized form (see Dean). This criticism can be extended to other artificial agents put under a human's control: when the entity has no agency and no ability to consent, who gets to exert control, and how, over its labor?

With Miku, as with other virtual characters (and perhaps increasingly with biological performers, celebrities, and politicians), the Vocaloid's femininely gendered body has been created, recreated, and circulated for the consumption pleasure of others (Prior); she is, after all, the world's Barbie doll, reifying "the

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[2] For example: Billie Eilish, Brigette Lundy-Paine, and Asia Kate Dillon.

conventional role of women as playmates of their opposite sex" (Lam 1119). Accepting this connection between a feminized gender identity and enacting control over that gendered female body arises due to longstanding patriarchal attitudes and actions. This acceptance suggests issues for the subjugation of future artificial agents (see Guga; Lam; Sone). Failing to problematize Miku as feminine reflects a wider sociocultural acceptance of the objectification of the feminized body for entertainment purposes.

The consistent gendering of Miku as female reflects gendered labor of women and their lack of agency over their own labor, such as dancers, porn stars, maids, and other "subservient" workers. Miku's networked gender demonstrates a sociocultural preference to reflect prejudices about gender and labor, and for gender to operate as an organizing heuristic for understanding artificial agents. Gendered robots in popular culture have demonstrated this bifurcation in labor for decades; for example, Rosie in the 1960s cartoon *The Jetsons* reflected both "the then-common black female domestic worker, and a riff on the 'mammy' stereotype" (James 421). In analyzing the figuration of Amazon's Echo, Thao Phan draws parallels with Rosie by analyzing how "Alexa" reflects nostalgic conceptions of gendered and racialized domestic workers (6), thereby reifying power dynamics that have long impacted women and their labor. Heather Suzanne Woods argues this gendering of surveillance labor by smartspeakers operates to reduce anxieties about the AI persona people work with in their homes. Miku's networked gender suggests that the current practice of gendering AI like Alexa could continue as more artificial agents enter the workforce in professional, service, and domestic spheres. While such users can modify such AIs to produce more "masculine" sounding interfaces, the default is feminine, reifying sexist assumptions about women's position to others in labor contexts (see Costa; Faber; Schiller and McMahon; Woods; Fessler).

With more artificial agents entering the workforce, we must be mindful of semiotic labor to signify what is appropriate and inappropriate for gendered workers. Humans may continue to perpetuate gender stereotypes during their "reality labor." The subjective experience of reality — along with the sociocultural, historical-material, and political economic conditions and structures that constitute human civilization — is co-constructed through the symbolic interactionalism of people: how people create, perceive, and utilize popular culture representations developed into "imagined impressions" that inform how they make sense of the world (Phan 3). If people continue to utilize co-constructions of gender to perceive

artificial agents as real, then reality will continue to perpetuate gendered labor dynamics that can harm humans.

Conclusion

In our analysis of Hatsune Miku's networked gender, we see different types of labor working together to generate the character's networked gender, which only further reaffirms gender assumptions about women in the workforce. As this article demonstrates, the semiotic labor constituting Miku's networked gender demonstrates the continued visual primacy and cisnormativity of determining gender through the signals used to describe the Vocaloid. While it is possible to view Miku as an "empty sign," void of any identifying signals for people to layer their own desires unto, people appear to accept the character's gender identity based on "her" voice, appearance, and power relationships people have with the Vocaloid, all of which has been determined by Crypton. Indeed, the semiotic labor involved in Miku's networked gender potentially moderates people's need to suspend their disbelief over the realness of the artificial agent; seeing the character as female or feminine may help "her" fans answer the question of why they have become so emotionally engaged with a software program. Since the interpretation of "realness" requires more cognitive labor, people may rely on gendered heuristics to interpret the character's identity.

This conclusion has possible applications to everyday life as the presence of robots increases at work, home, and in other areas. Gendering a robot could provide for improved comfort during human-robot interactions. Two major issues concerning labor appear in the networked gender of Hatsune Miku. First, the networked gender reifies gendered work practices that disempower women and place Miku's labor under another's agency. Second, this process suggests such gendering of AIs will occur with other artificial agents to placate humans and improve human-robot interactions in work/labor contexts.

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