HUMAN-MACHINE COMMUNICATION

Human-Machine Communication
Volume 5, 2022
https://doi.org/10.30658/hmc.5.5

The Evolution of Gendered Software: Products, Scientific Reasoning, Criticism, and Tools

Victoria A. E. Kratel[1]

1 Institute of Media Studies, University of Tübingen, Germany

Abstract

Over the past 7 decades, gendered software has become globally established. In this theoretical distribution, I outline the evolution of gendered software. The journey of gendered software started with the raw idea fueled by Alan Turing's imitation game in the 1950s. And only shortly thereafter, in the 1960s and 1970s, the first gendered software products like Joseph Weizenbaum's ELIZA were developed. Thus, academia took its time to not only explore technological aspects, but to further investigate the matter of gender in the 1990s CASA-paradigm (Nass et al., 1994) and Media Equation (Reeves & Nass, 1996). As these theories reasoned the social impact of gendered software, voice assistants of the 2010s provided to be real-world examples stirring criticism. By posing the question of "boy or girl" through the decades, I take a deeper look at aspects such as raison d'être, realization, consequences, and future possibilities that ultimately challenge the applied gender binary. In doing so, it becomes evident that gendered software is situated in the bigger context of gender inequalities. Therefore, I propose to consider the listing of (1) product name, (2) voice, and (3) personality traits as decisive features forming to be powerful tools in the process of gendering software.

Keywords: gender bias, gender quality, gendered software, history of software, human-machine communication

CONTACT Victoria A. E. Kratel • Institute of Media Studies, University of Tübingen, Geschwister-Scholl-Platz, 72074 Tübingen, Germany • victoria.kratel@uni-tuebingen.de

ISSN 2638-602X (print)/ISSN 2638-6038 (online)
www.hmcjournal.com

Introduction

Boy or girl? Since the 1950s, this question has not only been on the minds of expectant parents, but also of software developers. As the software of technologies has increasingly become anthropomorphized, they do not only convey to be human, but also to belong to a certain gender. In order to shed light to the central question of "boy or girl" it is necessary to have a closer look at those features that induce the association of gender. A key challenge for this is that a software is not a biological system. Common indicators of biological sex, such as chromosomes, hormones, and genitalia (Jäncke, 2018), are therefore not applicable. Instead, in the context of gendered software, it is necessary to consider different kinds of sociocultural features that implicitly and explicitly shape the perception of gender. It is this very fact that highlights the absurdity of gendered software. If technological developments do not naturally come with a biological sex, why add a socially constructed gender? This question is gaining even more importance in the context of societal consequences. Making use of socially shaped comprehensions of what being female or male means in a world which is still permeated with gender inequalities cannot be understood to be without consequence. Hence, humankind reflects and reacts to the directions they want gendered software to take in the future.

The question of "boy or girl" regarding gendered technology is anything but trivial. It is deeply loaded with further questions and aspects such as raison d'être, realization, consequences, and future possibilities. With this theoretical piece, I intend to further illustrate the depth of these matters under the central question of "boy or girl" by outlining the evolution of gendered software. Since it is not feasible to capture all aspects of gender in the field of software, I do not focus on women as users of technology and only very slightly as developers. Thus, I am arguing less from a technofeminist position (Wajcman, 2004) but rather from a broader feminist perspective in HCI (Bardzell, 2010). Doing so, I will examine crucial software products as well as criticism and scientific contributions advocating for gender equality seeking to improve everyone's life. Here, I emphasize above all the inadequate representation of gender, especially femininity, through software. But before I proceed to present the structure of the following text, I want to focus on software as opposed to hardware and give context to the binary of "boy or girl."

On the matter of software, I consider the IEEE Standard Glossary of Software Engineering Terminology 1983 of "computer programs, procedures, rules, and possibly associated documentation and data pertaining to the operation of a computer system" (IEEE Standard Glossary of Software Engineering Terminology, 1983). As mentioned, while software and gender have many points of contact, I will focus specifically on how software is perceived as gendered. This investigation has repeatedly led me to software that operates via human language and thus forms a further narrowing in this essay. With that, I am acknowledging that its development regarding gendered features happened in a different scope than that of hardware. In the realm of design, the arrangement of technical components in a humanoid way can be traced back to a whole different toolset which has been around for centuries. An early example is Leonardo da Vinci's sketch of a robot from 1495, which presents a machine in the armor of a knight. Even though this design does not show any sexual characteristics, the association to the male gender can be made as the profession of knights in the 15th century was exclusively male (Rosheim, 2006). While the significance of societal images of

gender proves to be a parallel to software, gendered features of hardware exist in a different range of salience. In the discipline of robotics, this led to a differentiation between *gynoids*, female robots, and *androids*, male robots (Robertson, 2010). It is due to the focus on the design of a robot that this terminology is not universally applicable. Software might be able to feature similar aspects like avatars in video games (Bardzell, 2010), but they are commodities of the software and do not shape the perception of the software itself. Accordingly, the distinctiveness of the history and terminology of hardware must be considered. Though the functionality of technology is based on the interdependency of software and hardware, their development in the context of anthropomorphism and gender happened somewhat detached from each other. So, while both the examination of gendered hardware as well as the examination of gendered software are in need of a gender concept, they need to be considered isolated. This leads me to broach the issue of the gender binary. In the zeitgeist of gender and queer studies it is scientific consensus that the binary perception is outdated and does not do reality justice (Thorne et al., 2019). By posing the binary question of "boy or girl" toward the evolution of gendered software I am not seeking to find a definite answer that is limited to those two options. Rather I am looking at the different forms of resonance that this question has provoked over the last 7 decades. The binary is applied for the sole reason to provide a heuristic for the subject of gendered software in which its shortcomings and criticism help to reinforce arguments made along the way.

Having set the tone, I will trace back the evolution of gendered software to the 1950s. It was this era in which the idea of software with capabilities similar to humans was publicized and placed in a context of gender through the works of Alan Turing (Gonçalves, 2021). Regardless of software not yet existing, discussions on ethics and the construction of gender were ignited. With the question of "boy or girl" being anchored in the public consciousness, 2 decades later the 1960s and 1970s have seemingly answered: It is a girl! It was the time in which gendered software found an uptake in home life and businesses. They came with female names like *ELIZA* or were condescendingly called *Bitchin' Betty*, giving away that they were perceived as female (Dhavala, 2014; Weizenbaum, 1966). After presenting crucial products of the 1960s and 1970s, I proceed to give insight on scientific reasoning of gendered software. Examining the anthropomorphism of technology, scientists of the 1990s created the *CASA-paradigm* assigning computers the role as social actors (Nass et al., 1994). Derived from that, the *media equation* was formulated stating that findings of social sciences can also be applied to media. As a result, Byron Reeves and Clifford Nass found that female gendered technology, especially that with voice outputs, is subjected to gender discrimination (Reeves & Nass, 1996). This insight forms the basis of the criticism of female gendered voice assistants which have maintained their global popularity since the early 2010s. As the notion of "It's a girl" remains reinforced, so do gender stereotypes (Fortunati et al., 2022; West et al., 2019). Developers have increasingly become aware of these issues and entered several paths to not only reduce harm caused by gendered software but to create positive effects as counteractions (Buxton, 2017; Carpenter, 2019).

By outlining the evolution of gendered software, the tools used to gender software products became visible. Based on this, I was able to carve out a listing of three reoccurring features of gendered software. Namely, product name, voice, and personality traits. They have an immense significance in their social impact as either fighting gender inequalities or reinforcing them, playing into the bigger picture of how society reacts toward "boy or girl."

Turing's Enigmatic Stance on Gender in the 1950s

Picking up the introductory question of "boy or girl" toward expectant parents, Alan Turing is often referred to as the father of computer science (Bernhardt, 2016; Guo, 2015). His ideas from the 1950s paved the way for today's concepts of algorithms and artificial intelligence as he formed the idea of "a machine that can learn from experience" (Copeland, 2004, p. 375). Special attention is given to his thought experiment on human computer interaction which he referred to as the *imitation game* famously posing the question "Can machines think?" (Turing, 1950, p. 433). Interestingly, Turing did not set up one, but a variety of tests that made history as *the Turing Test*, one of them being deeply rooted in the context of gender (Gonçalves, 2021). In the original article from 1950, Turing describes a party game that involves three parties. Player A is male and player B is female while the gender of player C is unspecified. Player C takes the role of the interrogator and must determine the gender of player A and player B with whom they can only interact through written communication. Whereas the female player B has to assist the unspecified player C, the male player A ought to trick player C (Turing, 1950). Hence, the scenario can be described as "man-imitates-woman" (Gonçalves, 2021, p. 109). Turing then proceeds to make a crucial intervention by exchanging the male player A with a computer. Doing so, he questions the ability of the computer to trick player C into perceiving it to be a human adequately performing their part in the game (Turing, 1950). But what does that mean for the gender context of the game? The role of player A, formerly taken by a male human being, is now taken by a computer. Therefore, this scenario could be understood as "machine-imitates-man" (Gonçalves, 2021, p. 179) if it were not for the wording Turing used. When exchanging the role of player A, he states that the part of the formerly player B is now "taken by a man" (Turing, 1950, p. 442). Does that mean that the computer is pretending to be a female player? It is widely assumed that this confusion is solely due to masculine generics and that Turing's ideas were more about machine-imitates-human by creating an overall species test than about gender (Gonçalves, 2021). Thus, Turing might have come close to the question of "boy or girl" but he never answered it.

As the matter of gender has always been a hot topic and rarely avoids conflict, it is unsurprising that scientists did not leave Turing's thought experiment and its gender context at that. In his doctoral dissertation Bernardo Gonçalves (2021) highlights the Turing-Jefferson controversy. Turing's opponent, Geoffrey Jefferson, Professor for Neurosurgery in England, publicly took issue with the thought experiment based on his own publication, *The Mind of Mechanical Man,* from 1949. While the title initially leaves room to assume that Jefferson is in favor of male gendered software, he claims that the increasing equation between human and machine due to technological innovations are neither ethically justifiable by the means of religion and social conduct nor reasonable. Since humans have sex hormones, Jefferson argues, their behavior is unique and cannot be compared to mechanic systems (Jefferson, 1949). There are two fundamental aspects that can be derived from Jefferson's statement that remain relevant as of today. First, he questions the raison d'être for anthropomorphic machines. Jefferson is completely opposed to creating machines after the human model which also implies the negation of gendered technology. According to his religious and political background of the 1950s, Jefferson wanted to limit the scope of technological development in order to maintain the status quo (Jefferson, 1949). With this,

he emphasizes the societal impact of technology as he touches on the recurring question of how far technology is allowed to go. Second, Jefferson shares his understanding on how gender is constituted by pointing toward sex hormones. He describes that machines do not come with biological features indicating a certain gender and implies that the general assignment of gender toward an object is somewhat grotesque (Jefferson, 1949). Given the historical context in which the significance of socially shaped behavior and self-identity has not been recognized yet, his statements can be described as biological-deterministic. Today it is widely acknowledged that in addition to the biological sex, humans have a social gender (McDermott & Hatemi, 2011). It is this very piece of knowledge that forms the origin of the discourse on gendered technology: Machines cannot be assigned to a certain sex, but to a gender. While it is clear that technology is "uncoupled from organic reproduction" (Haraway, 2006, p. 118) and does not have sex determining chromosomes, the occurrence of gender is not ruled out. The question of "boy or girl" is still on.

In addition to Jefferson, Gonçalves (2021) points out other critics of Turing's stance on gender who were less bothered by the portrayal of gender but more of the ambiguity. Accordingly, the Turing Test was referred to as a "sexual guessing game" by biographer Andrew Hodges (2012 [1983], p. 415) or dismissed as the construction of a "mechanical transvestite" (Hayes & Ford, 1995, p. 973). These phrases are intended to point out the shortcomings of Turing's ambiguity on gender. But in fact, they come short themselves as neither of them recognize the immense foundation for further discourses on gendered software that was built.

The 1950s can be metaphorically seen as the birth hour of all software. Besides Turing's publications, the *Dartmouth conference* in 1956 is also credited with seminal importance for computing. There, the term artificial intelligence was coined (Moor, 2006), but the question of gender was not addressed. It was for Turing's sake that the matter was put on the plate. And even though the central question of "boy or girl" was not answered by Turing himself, he granted an immense potential to it. His ideas and subsequent criticism show that gender has been intertwined with software developments and spawned controversies from the very beginning, even in times in which they have been mere imaginations. As the central question was not rejected, the search for an answer just began.

Moore and Moore Progress in the 1960s and 1970s

In 1965 American engineer Gordon Moore stated that the number of transistors on a microchip will double every 2 years (Moore, 2006 [1965]). What made history as *Moore's law* is nothing less than the prediction that software capabilities are intensely increasing (Mollick, 2006). And while Moore made public that the ideas of the 1950s were about to come true, Joseph Weizenbaum was already, at least to some extent, realizing them. From 1964 to 1966 he developed the natural language processing computer program *ELIZA* for the tech company IBM (Weizenbaum, 1966).

Acting in the manner of a psychotherapist, ELIZA was designed to hold a conversation through written language. The users would type on a keyboard and the program would answer on the computer screen (Weizenbaum, 1966). Since the software relied on pattern matching, the delivered answers were rather superficial as there were no implemented tools that were able to contextualize. With that, ELIZA was not only one of the first programs to

undergo a variation of the Turing test, but to fail it (Shum et al., 2018). Having answered the question of whether ELIZA can think like a human, what about being a "boy or girl" like a human? The program is generally associated with the female gender due to being labeled with a common female name. Specifically, Weizenbaum named the program after *Eliza Doolittle*, a female character from George Bernard Shaw's play *Pygmalion*, and modeled his software after her personality trait to appear fairly civilized (Weizenbaum, 1966). This indicates that the product name and personality traits can be considered as decisive features when it comes to determining if it is "boy or girl."

As software literally took off, the 1970s hinted toward another distinctive feature: voice. Voice warning systems became a security standard in aviation and later in other means of transport. The systems are designed to verbally warn their operators in the event of danger (Arrabito, 2009). Usually using a recording of a female voice, the warning systems became humanized and got condescending nicknames like *Bitchin' Betty* or *Nagging Nora* (Bachman, 2016). Warning systems operating through male voices are referred to as *Barking Bob* (Rogoway, 2016). What can be seen from these labels is that voice is a decisive factor for assigning gender through gendered nicknames. Thus, the question of "boy or girl" has gained uptake. The quest was to find out whether a male or a female voice is suited best for the respective context of use. To this date, research results on this remain contradictory (West et al., 2019). Early research state that female voices are more suitable, others state that male voices have certain advantages as pilots are predominantly male (Dhavala, 2014). Continuing to look at the gender of the systems operator, others declare that the voice of the opposite gender is favored (Vukovic et al., 2010; West et al., 2019). Hence, it is understandable that voice warning systems come with different options and the question of "boy or girl" is left to be answered by the users. While the naming of objects, including technologies, is an important mechanism of sensemaking, the unceasing urge to label lifesaving devices with condescending names is striking. Specifically, the gender-specific offensiveness of the female nicknames leaves room for critical thoughts.

The technological developments of the 1960s and 1970s did not answer the central question definitively but showed an inclination toward female technology. Product names, nicknames, voice recordings, and character traits are derived from real human women. Rounding up the 2 decades, the dominance of female gendered software offers a new perspective on TIME Magazine's decision to cancel the announcement of the Man of the Year in 1983. Instead, in a gender-neutral way they declared the computer as "Machine of the Year" (Time Machine of the Year, 2019 [1983]).

Looking for Reasoning in the 1990s

As software technology in general has become increasingly established in everyday life, researchers started to investigate its science. Especially media and communication studies in the US of the 1990s formed the research field of human-computer interaction (Edwards et al., 2019). With that, gendered software and their social impact did not remain unnoticed. One of the major publications granting scientific context to the discussion on gendered software was by Clifford Nass, Jonathan Steuer, and Ellen Siminoff from 1994. Following the acronym of their proposed *CASA-paradigm* they stated that "Computers Are Social Actors" (Nass et al., 1994, p. 72). The authors based this statement on five research experiments in

which they proved that findings of social sciences can also be applied to the interaction between people and computers (Nass et al., 1994). Building on the same approach as the CASA-paradigm, Byron Reeves and Clifford Nass published *The Media Equation* in 1996. Besides computers, they also considered television and new media. At the forefront of their book is the equation "media equal real life" (Reeves & Nass, 1996, p. 5). According to this, people treat computers, television, and new media like real people or places. These interactions can be described as "fundamentally social and natural" (Nass et al., 1994, p. 5). Thus, all people act according to the media equation. Age, culture, and media literacy are of no importance nor does an awareness that computers, televisions, and news media are not real people or places have any influence. Every form of media use, including passive forms, is based on the media equation. Therefore, people expect media to be subject to the same set of rules as social interactions (Nass et al., 1994).

Both the CASA-paradigm and the media equation prove the exert influence of human-like technology. By doing so, they scientifically legitimize further considerations of the social impact of technologies like in this very theoretical contribution. The importance of the CASA-paradigm and the Media Equation to the matter of gendered features goes even further: Not only does gendered software fall within the subject area of these theories, but gendered characteristics are specifically highlighted as both aforementioned publications conducted experiments on gender-based stereotyping of technologies. It was found that female gendered technologies have a low standing regarding the evaluation of their competence (Nass et al., 1994; Reeves & Nass, 1996). One could assume that this unequal assessment might be caused by the novelty and the associated limited area of use of the female gendered software like ELIZA shown in the former section on the 1960s and 1970s. With that, the assessment could be quite innocently reasoned by the functionality of technology and not by a discriminatory perception of gender. But considering the experimental designs that also included male gendered features, this argument is invalid. Rather, the unequal perception of female and male features of technology are inherently linked to the same patriarchal and capitalist societal structures that real girls and women are subjected to. An example of this, which like the CASA paradigm and the media equation dates to the 1990s, is provided by BMW. German, mainly male, drivers had refused to accept instructions from a navigation device with a female voice. As a result, the car manufacturer decided to recall the cars (Nass & Brave, 2005). And even though gender equality is increasing, a study by Ernst and Herm-Stapelberg from 2020 shows that technology with female features is still assessed to be less competent than technology with male features.

While these insights do not answer the question of "boy or girl" directly, they touch on it by shedding light on what happens when the question is already answered. For this reason, it is of interest on how the question was answered beforehand. As the examples from the 1970s already gave away, one of the distinctive gender cues was the implementation of a voice output. Reeves and Nass also put an emphasis on voice recordings that are embedded in software. They attribute this significance to the human perception of gender through the distinctiveness of male and female voices as they state that "voice is one of the most powerful indicators of gender, absent the actual person" (Reeves & Nass, 1996, p. 163). Within seconds, users can recognize which gender they ascribe to the voice which makes it a salient cue regarding the perception of gender. The decision made completely interplays with the binary of "boy or girl," since the human perception of voices seems to only distinguish

between male and female. Although gradated scales of perceived masculinity and femininity exist, Reeves and Nass (1996) argue that there is no possibility to perceive voices as gender neutral. Taking this piece of knowledge, the answer to the question of "boy or girl" toward software with voice features should be quick to find. However, current research (in this volume) is questioning this presumption. In addition, voice is an important, albeit not the only, decisive feature when it comes to the determination of gender.

The theorists of the 1990s took on the important role of scientifically grounding the discussions on gendered software. Herewith, they were providing a scientific basis for pointing out gender inequalities and highlighted the importance of voice technologies; almost as if they had sensed what was about to come.

Critical Voices of the 2010s

The 2000s quite rarely used the potential of gendered features. One of the only examples is provided with *Eugene Goostman*, a chatbot imitating a 13-year-old Ukrainian boy. Being one of the few male gendered software technologies attributed to perform masculinity (Fancher, 2016), the focus was more on making use of the traits of juvenile unknowingness of a boy to pass the Turing test than to feature any other male characteristics (Warwick & Shah, 2016). Contrary to that, the 2010s rang in a massive revival of gendered software. Launching *Siri* in 2011, Apple kicked off the global spread of voice assistant software completing different everyday tasks for their users (Perez Garcia et al., 2018). What is special about these technologies is that their interface is operated through spoken language. The user asks and, based on natural language processing and an algorithm selecting a corresponding voice recording, the technology answers (Natale, 2020). Using Siri as an example, two gender determining features of software that were also observable in the examples of the 1960s and 1970s reoccur. Firstly, while the name Siri can be interpreted as an abbreviation for *Speech Interpretation and Recognition Interface*, the "father" (The Week Staff, 2015) of the technology, Norwegian developer Dag Kittlaus, intended otherwise. In Kittlaus's native language, the name stands for "beautiful woman who leads you to victory" (The Week Staff, 2015) and is a common Scandinavian first name for women. This makes Siri prone to be perceived as female. Secondly, the default voice used for the voice output in most languages in which Apple products are marketed is also female (West et al., 2019).

As observable in the voice warning systems and reasoned by Reeves and Nass (1996), voice is an important cue to assign a gender. Regardless of male voice alternatives becoming increasingly available, competing products like *Alexa* by Amazon and *Cortana* from Microsoft also have a female product name and come with a female voice by default at the beginning (West et al., 2019). Additionally, another feature underlining voice assistants being perceived as female is recurring. Since the sale of voice assistants can make astounding profits, nothing is left to chance, and everything is done to manufacture a satisfying product. For this reason, cultural contexts and more recent developments are also taken into account. While male BMW drivers in the 1990s rejected female voices from navigation systems, German consumers have now accepted female voice assistants. In a small selection of countries, however, male voices are still favored (Nass & Brave, 2005). Thus, creative teams intentionally determine personality traits that their products are supposed to convey.

And while these creative teams are not throwing gender reveal parties, the undertone of the embedded dialogues gives away that it is, yet again, a girl (West et al., 2019).

The holistic feminization of voice software is fundamentally criticized for a variety of reasons. At the baseline critics argue that voice assistants take on "algorithmically-amplified feminized persona" (Woods, 2018) and therefore amplify outdated stereotypes of women. They are seeing parallels to the image of a young, submissive woman with the scope of duties similar to a secretary (Ahn & Costigan, 2019, Fortunati et al., 2022; Guzman, 2017). This becomes evident in the embedded reactions to verbal harassment that technologies have been subjected to since the 1970s. While the voice warning systems of the 1970s are not meant to interact but to warn, voice assistants of the 2010s have the capability to fight back. As this potential was left without use, a subsequent article by journalist Leah Fessler of the online magazine Quartz caused a stir in 2017. Fessler tested Siri and Alexa's responses to verbal sexual harassment and sexist insults, most of which turned out to be affirmative or neutral. Female gendered voice software is thus criticized for fueling rape culture and providing a platform for sexual harassment (Fessler, 2017).

Another degrading aspect associated with voice assistants and their volitionless behavior is that they mainly operate in the domestic sphere. This supposedly allows the comparison to the role of a Victorian servant who is hovering in the background "ready to do her master's bidding swiftly yet meticulously" (Shulevitz, 2018). The criticism on the sphere of action is heavily reinforced as the few existing male gendered technologies take on "high-powered tasks" (Sheriff, 2018). Examples include the AI-robot *CIMON*, used for tasks on the International Space Station, and *IBM*'s *Watson* application that assists business decisions (Sheriff, 2018; Steele, 2018; Williams & Braddock, 2019). Overall, this described inadequacy of female gendered voice software is claimed to be harming real girls and women by intensifying gender inequalities. And it seems to be a vicious circle. Posing the question of "boy or girl" toward expectant parents, we encountered multiple fathers: Alan Turing, Joseph Weizenbaum, and Dag Kittlaus. But what about the mothers? The underrepresentation of women in STEM professions is causing development teams to be mainly constituted of men. Recognizing this, technofeminists state that through this imbalance, male developers' experiences and images of women are unreflectively integrated into technologies. It is mostly men who design entire backstories for voice assistants (West et al., 2019). Social anthropologist Kathleen Richardson, whose work is focused on the adjacent topic of (sex) robots (Richardson 2016, 2018), made a particularly pertinent remark to the popular press in this regard:

> I think that probably reflects what some men think about women—that they're not fully human beings. (Kathleen Richardson according to Adrienne LaFrance, 2016)

The developments of the 2010s reveal how female gendered software is degraded. Although software with a female voice had already been subjected to an unequal assessment compared to a male voice in the decades prior, this assessment happened externally through the users. Nowadays, the harmful assessments of female images are directly embedded in the software. Connecting past and present, the question of how far technology is allowed to go

remains relevant. Therefore, future paths are reconsidering their options and the legitimacy when it comes to "boy or girl."

Pathways to the Future

The vocal criticism of the 2010s has caused change. After the 2017 outrage on the insufficient reactions of female gendered voice software toward verbal harassment, market-leading companies adapted their technologies. However, critics state that these changes are not adequate enough as the responses given by the software prioritize not displeasing customers (West et al., 2019). Still, the current situation shows that market-leading companies are at least engaging in the discussion and, to some extent, show a willingness to change. While there might be a long way to go, the possibility to go at all is considered. But in what direction? Engaging in the ongoing discussion, Heather Zorn, who is part of the Alexa development team at Amazon, points toward female empowerment. Opposing the mass of criticism, she identifies changes in female gendered software. In an interview with *Refinery29*, Zorn stated that she and her team see it as their duty to present Alexa in a positive way, especially to girls and women. For example, Alexa openly professes to be a supporter of feminism (Buxton, 2017). Hence, female gendered software could use their societal impact to promote gender equality.

Contrary to that, critics are pointing toward another direction. On the question "boy or girl" they are demanding to leave it be. They maintain that gendered features of software besides the ones inherently linked to functionality are not legitimate. Gendered software is allowed to go as far as it has in order to work, but no further. Therefore, gender-specific attributes should be kept as low as possible and if they are embedded, then a clear demarcation toward human beings must be made.

An example of how this request can be satisfied is the voice assistant *Q*, especially designed "to end gender bias in AI assistants" using a "Genderless Voice" (Copenhagen Pride et al., n.d.). Though the clear distinction between male and female in the human perception of voices remains, the developers made use of gradations selecting tone frequencies that are closest to being androgynous. For that matter voices of people who identify as gender non-binary were recorded (Carpenter, 2019). Doing so, the creation process of Q shows that diversifying the development team enhances the range of software products and the gender binary as in "boy or girl" is insufficient. The tech profession will prospectively become more diverse. And it is already happening: Recent trends demonstrate that albeit software engineers are still being predominately male, there is an ongoing effort to increase the number of women and queer people in tech professions (West et al., 2019).

Taking steps, little they may be, software developers have already entered pathways of female empowerment, genderless technologies, and a diverse workforce toward the future. And while the narrow scope of the question of "boy or girl" is not as applicable in this context, it highlights the ongoing explorations and relevance of gender in its multitude of facets.

Discussion

The outlined evolution of gendered software granted insight on how gendered software products spawned broad discussions. Ethics, specific products, scientific reasoning, and future demands have all come under the umbrella of the central question and additional spheres of gender. And in doing so, something interesting happened quite casually: The features of how gender is assigned to software were revealed. Hereinafter, I will propose a listing of three features that I encountered separately in the overall rabbit hole of gendered software and already loosely recognizing their similar character like West et al. (2019). While I do not claim this listing to be definite, I am providing a starting point sorting the decisive features by their increasing complexity:

(1) Product Name

In most cultures, naming a newborn is sex-specific. The practice of naming can therefore be seen as an act of *doing gender* (Pilcher, 2017). This also applies to the official and unofficial naming of software and other technologies when gendered first names are used to label them. It is reasonable to give a product a name, but there is no technological argument for choosing a gendered name as it does not influence the functionality of a software.

(2) Voice

As Reeves and Nass (1996) described in The Media Equation and revisited multiple times through the highlighted software technologies, the gender binary is inherent to the human perception of voice. Consequently, software systems with a built-in voice output have a built-in gender. Contrary to the product name, the gender assignment is caused by the functionality of the software.

(3) Personality Traits

Spoken words entail marks of gender (Chasin, 1995; Luca, 2015; Suchman, 2006). As the CASA-paradigm and The Media Equation from the 1990s state, findings like this can also be applied to human-computer-interaction (Nass et al., 1994; Reeves & Nass, 1996). Therefore, software that makes use of human language is inherently capable of conveying certain personality traits which is also proven by ELIZA and the voice assistants of the 2010s. This is significant for the context of gender, as personality traits are influenced by cultural expectations of gender (Gerber, 2009). The intentional act of assigning personality traits to software holds the power to determine gender. However, the matter is not as black and white as it may seem but left to nuance. While there is broad consensus on what personality traits are understood as female or male, there is still room for individual deviations. What one person understands to be a female personality trait, could be understood as male by someone else. In addition, there are gradations to the intention of assigning gendered personality traits. Weizenbaum created parallels between ELIZA and character traits of a fictional character that also happened to be female. At the forefront he prioritized personality traits not gender. In contrast, market-leading companies of voice assistants are intentionally creating gendered personas such as Alexa, Cortana, and Siri. The gendered feature of a personality trait can thus be partially attributed to the functionality as personality traits will inevitably be revealed within interactions, but there is no technological reason to make further use of it.

Looking at these three features of gendered software and connecting them to criticism, they hold an immense power as the decisive tools. As shown in the example of *Q*, the realization of these features can be adjusted so that they may reinforce the gender binary or make technologies anthropomorphic but seemingly genderless. Still, the preference to create female gendered software is astounding. Accordingly, the decision-makers must be considered. While I could reason how product names, voices, and personality traits are linked to gender assignment, I could not find a valid answer on why girl is favored over boy or options beyond the binary. Nevertheless, the outlined evolution led me to make two assumptions. First, software is made to serve their users. Due to the human history of gender inequalities women took on the role to serve society like described by Shulevitz's analogy of the Victorian server (Shulevitz, 2018). Hence, gendered software is a replication of this circumstance. Second, even though tides are turning, the software profession is male dominated as it has been since its formation (West et al., 2019). It might be reasonable for heterosexual men to create companions according to their preference of women. And while both assumptions are left to be proven, the described patriarchal and capitalist structures they are based on are more than evident in the described evolution of gendered software.

Voice warning systems from the 1970s are mocked to this date, research findings of the 1990s show that female gendered software is ascribed less competency than male gendered software and the global spread of voice assistant systems is found fault with as they reinforce outdated stereotypes. All these points are not ingrained in technology but reflecting the stand of the female gender in society. Therefore, as many authors did before (Benjamin, 2020; Noble, 2021; Wajcman, 2015), I am opposing technology determinism. I am not locating the source of the problems in software and technology in general, but in the bigger context of gender inequality. The problem of gendered technology is not in the imitation of human capabilities, but in how gender is treated in society. It is grotesque that the majority of gendered software is made out to be female while in general boys are valued over girls or any options out of the binary. I therefore attribute immense importance to the future pathways described in the section above. As long as the empowerment of women is sincerely actualized, and development teams become more diverse, social change is brought forward. However, these positive developments should be taken with a grain of salt. Even empowering representations of femininity in software are ultimately commodifications. Whenever economic profit plays a role, these adjustments can hardly be linked to pure intentions only. For this reason, I am particularly excited about what the future will bring in terms of software out of the binary. As long as the acquisition of gender traits leads to disadvantages for real people, any attempt to represent software as human-like but almost genderless form would be the less harmful choice. In addition to that, actions which are not directly linked to gendered software but promote gender equality can also be ascribed an immense impact. With me talking this talk, it is on us as humans to collaboratively walk the walk.

Conclusion

In this article, I have outlined the evolution of gendered software. While technologies in general cannot be assigned to a biological sex, the social construct of gender offers the decisive loophole. Using the question of "boy or girl," I was able to map the recurring motifs

of raison d'être, realization, consequences, and future directions that accompanied the gendered software products of the last 7 decades.

Touching on the question of how far technology is allowed to go, George Jefferson's (1949) statements from the 1950s and criticism on female gendered voice assistants of the 2010s dealt with the raison d'être. Using different arguments, both claim that gendered software technology is a threat to society. But while the legitimacy of the gendered technology in the context of ethics remains to be debated, software engineers did not wait for a verdict. Instead, they realized their ideas and brought mostly female gendered products to the market. That led me to shed light on the matter of how gender is conveyed through a software product. Clues were given by the listed software products in this article, the CASA-paradigm and the media equation from the 1990s as well as a publication of West et al. (2019) of criticism on female gendered voice assistants. Ultimately, I was able to carve out three distinctive gendered features of technology: product name, voice, and personality traits. With that, I am providing an overview of the decisive features for the assignment of gender in software products. I do not claim this listing to be exhaustive nor that I have considered the potential of each feature in its full depth. Rather, I propose to take the proclamation of these three as an invitation for future research. It is a starting point to gather empirical data on each feature and to look at how they are constituted. In particular, the feature of personality traits leaves room for further insights on how they are selected, which tools are used to convey them (e.g., humor, vocabulary) and how the perception is socially shaped.

The described features are gaining immense relevance through the power that they exert. Especially the fact that female gendered software products made gender inequalities visible and were able to reinforce them, shows that they are tools that should be used with caution. And while I argue that society must change as a whole to put an end to inequalities in gendered software, recent developments prove that progress is already made. Development teams become slowly but steadily more diverse and carefully consider their tools given. The future paths simultaneously taken by them are leading toward female empowerment and options out of the binary.

This leads me to finalize my stance on using the binary question of "boy or girl" illustrating the evolution of gendered software. Never meant to be met with a blanket answer, it was a suited instrument to vividly highlight the different discourses of gendered software evolution. Its narrow nature has put an emphasis on the significance of its contrast, namely gender as a concept to be understood as a spectrum. Ergo, I end by discarding the witty phrase of "boy or girl" once and for all as it has done its due.

Author Biography

Victoria A. E. Kratel is a researcher and PhD candidate at the Institute of Media Studies at the University of Tübingen, Germany. Under the broader lens of intersectional feminism, her research interests lie in human-machine communication as well as digital disconnection.

https://orcid.org/0000-0003-3296-6558

References

Ahn, S., & Costigan, A. (2019). *How AI reinforces gender stereotypes (Trend brief)*. Catalyst. https://web.archive.org/web/20200618102855/https://www.catalyst.org/research/ai-gender-stereotypes/

Arrabito, G. R. (2009). Effects of talker sex and voice style of verbal cockpit warnings on performance. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *51*(1), 3–20. https://doi.org/10.1177/0018720808333411

Bachman, J. (2016). The world's top fighter pilots fear this woman's voice. *Bloomberg*. https://web.archive.org/web/20160606101811/https://www.bloomberg.com/features/2016-voice-of-the-fa-18-super-hornet/

Bardzell, S. (2010). *Feminist HCI: Taking stock and outlining an agenda for design.* Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Atlanta, Georgia, USA. https://doi.org/10.1145/1753326.1753521

Benjamin, R. (2020). *Race after technology abolitionist tools for the new Jim code* (Reprinted ed.). Polity.

Bernhardt, C. (2016). *Turing's vision: The birth of computer science*. The MIT Press.

Buxton, M. (2017). Writing For Alexa becomes more complicated in the #MeToo era. *Refinery29*. https://www.refinery29.com/en-us/2017/12/184496/amazo-alexa-personality-me-too-era

Carpenter, J. (2019). Why project Q is more than the world's first nonbinary voice for technology. *Interactions*, *26*(6), 56–59. https://doi.org/10.1145/3358912

Chasin, A. (1995). Class and its close relations: Identities among women, servants, and machines. In J. Halberstram & I. Livingston (Eds.), *Posthuman bodies* (pp. 73–96). Indiana University Press.

Copeland, J. B. (2004). Lecture on the automatic computing engine (1947). In J. B. Copeland (Ed.), *The essential Turing seminal writings in computing, logic, philosophy, artificial intelligence, and artificial life plus the secrets of enigma* (pp. 362–394). Oxford University Press.

Copenhagen Pride, V., Equal AI, Koalition Interactive & thirtysoundsgood. (n.d.). *What is Q?* https://web.archive.org/web/20190323070233/https://www.genderlessvoice.com/about/

Dhavala, L. (2014, November 20–22). *Use of synthetic voice to improve communication between air traffic controllers and pilots.* International Aviation Management Conference, Dubai, UAE.

Edwards, C., Edwards, A., Kim, J., Spence, P., de Graaf, M., Nah, S., & Rosenthal-von der Pütten, A. M. (2019). *Human-machine communication: What does/could communication science contribute to HRI?* https://doi.org/10.1109/HRI.2019.8673138

Ernst, C.-P., & Herm-Stapelberg, N. (2020). *Gender stereotyping's influence on the perceived competence of Siri and co*. https://doi.org/10.24251/HICSS.2020.544

Fancher, P. (2016). Composing artificial intelligence: Performing Whiteness and masculinity. *Present Tense, 6*(1). https://www.presenttensejournal.org/volume-6/composing-artificial-intelligence/

Fessler, L. (2017). *We tested bots like Siri and Alexa to see who would stand up to sexual harassment*. Quartz. https://web.archive.org/web/20170224075311/https://qz.com/911681/we-tested-apples-siri-amazon-echos-alexa-microsofts-cortana-and-googles-google-home-to-see-which-personal-assistant-bots-stand-up-for-themselves-in-the-face-of-sexual-harassment/

Fortunati, L., Edwards, A., Edwards, C., Manganelli, A. M., & de Luca, F. (2022). Is Alexa female, male, or neutral? A cross-national and cross-gender comparison of perceptions of Alexa's gender and status as a communicator. *Computers in Human Behavior*, 137, 107426. https://doi.org/10.1016/j.chb.2022.107426

Gerber, G. L. (2009). Status and the gender stereotyped personality traits: Toward an integration. *Sex Roles*, *61*(5–6), 297–316. https://doi.org/10.1007/s11199-008-9529-9

Gonçalves, B. (2021). Machines will think: Structure and interpretation of Alan Turing's imitation game. Doctoral dissertation, Faculty of Philosophy, Language and Literature, and Human Sciences, University of São Paulo, São Paulo. https://doi.org/10.11606/T.8.2021.tde-10062021-173217

Guo, T. (2015). Spirituality as reconceptualisation of the self: Alan Turing and his pioneering ideas on artificial intelligence. *Culture and Religion*, *16*(3), 269–290. https://doi.org/10.1080/14755610.2015.1083457

Guzman, A. L. (2017). Making AI safe for humans: A conversation with Siri. In R. W. Gehl & M. Bakardjieva (Eds.), *Socialbots and their friends: Digital media and the automation of sociality*, 69–82. Routledge.

Haraway, D. (2006). A cyborg manifesto: Science, technology, and socialist-feminism in the late 20th century. In J. Weiss, J. Nolan, J. Hunsinger, & P. Trifonas (Eds.), *The international handbook of virtual learning environments* (pp. 117–158). Springer Netherlands. https://doi.org/10.1007/978-1-4020-3803-7_4

Hayes, P., & Ford, K. (1995). *Turing test considered harmful*. In Proceedings of the 14th international joint conference on artificial intelligence (Vol. 1, pp. 972–977) (IJCAI'95). Morgan Kaufmann Publishers Inc.

Hodges, A. (2012 [1983]). *Alan Turing: The enigma the centenary edition*. Princeton University Press. https://doi.org/10.1515/9781400844975

IEEE Standard Glossary of Software Engineering Terminology. (1983). *ANSI/ IEEE Std 729-1983*, 1–40. https://doi.org/10.1109/IEEESTD.1983.7435207

Jäncke, L. (2018). Sex/gender differences in cognition, neurophysiology, and neuroanatomy. *F1000research*, 7, 805. https://doi.org/10.12688/f1000research.13917.1

Jefferson, G. (1949). The mind of mechanical man. *BMJ*, *1*(4616), 1105–1110. https://doi.org/10.1136/bmj.1.4616.1105

LaFrance, A. (2016). Why do so many digital assistants have feminine names? *The Atlantic*. https://web.archive.org/web/20160404080903/https://www.theatlantic.com/technology/archive/2016/03/why-do-so-many-digital-assistants-have-feminine-names/475884/

Luca, M. (2015). Emotion simulation for robots. In M. L. Tudorel Dima (Ed.), *Cognitive sciences—An interdisciplinary approach*, 267–275. PROUNIVERSITARIA Editure.

McDermott, R., & Hatemi, P. (2011). Distinguishing sex and gender. *PS: Political Science & Politics*, *44*, 89–92. https://doi.org/10.1017/S1049096510001939

Mollick, E. (2006). Establishing Moore's Law. *IEEE Annals of the History of Computing*, *28*(3), 62–75. https://doi.org/10.1109/MAHC.2006.45

Moor, J. (2006). The Dartmouth College artificial intelligence conference: The next fifty years. *AI Magazine*, *27,* 87–91.

Moore, G. E. (2006 [1965]). Cramming more components onto integrated circuits. Reprinted from *Electronics, 38*(8), April 19, 1965 (pp. 114 ff). *IEEE Solid-State Circuits Society Newsletter*, *11*(3), 3335. https://doi.org/10.1109/N-SSC.2006.4785860

Nass, C., & Brave, S. (2005). Wired for speech: How voice activates and advances the human-computer relationship. *MIT Press.*

Nass, C., Steuer, J., & Siminoff, E. (1994). *Computer are social actors*. In Conference Companion on Human Factors in Computing Systems (CHI '94). Association for Computing Machinery, New York, NY, USA, 72–78. https://doi.org/10.1145/259963.260288

Natale, S. (2020). To believe in Siri: A critical analysis of AI voice assistants. *Communicative Figurations | ZeMKI Working Papers, 32,* 1–17. https://web.archive.org/web/20200906172340/https://www.uni-bremen.de/fileadmin/user_upload/fachbereiche/fb9/zemki/media/photos/publikationen/working-papers/2020/CoFi_EWP_No-32_Simone-Natale.pdf

Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism.* New York University Press.

Perez Garcia, M., Saffon Lopez, S., & Donis, H. (2018). *Everybody is talking about voice activated virtual assistants, but how are people really adopting and using them? Lessons from a multi-country study*. In Proceedings of the 32nd International BCS Human Computer Interaction Conference (HCI), Belfast, UK, 1–5. https://doi.org/10.14236/ewic/HCI2018.96

Pilcher, J. (2017). Names and "doing gender": How forenames and surnames contribute to gender identities, difference, and inequalities. *Sex Roles, 77*(11–12), 812–822. https://doi.org/10.1007/s11199-017-0805-4

Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. Bibliovault OAI Repository, the University of Chicago Press.

Richardson, K. (2016). Sex robot matters: Slavery, the prostituted, and the rights of machines. *IEEE Technology and Society Magazine, 35*(2), 46–53. https://doi.org/10.1109/MTS.2016.2554421

Richardson, K. (2018). *Challenging sociality: An anthropology of robots, autism, and attachment.* Palgrave Macmillan. https://doi.org/10.1007/978-3-319-74754-5

Robertson, J. (2010). Gendering humanoid robots: Robo-sexism in Japan. *Body & Society*, *16*(2), 1–36. https://doi.org/10.1177/1357034x10364767

Rogoway, T. (2016). The distinct voice of the F/A-18 Hornet's 'Bitchin' Betty' warning system is retiring. *Jalopnik.* https://web.archive.org/web/20221010200234/https://jalopnik.com/the-distinct-voice-of-the-f-a-18-hornets-bitchin-betty-1764527531

Rosheim, M. E. (2006). Leonardo's lost robots. Springer Berlin/ Heidelberg.

Sheriff, L. (2018). *Meet Pegg, a gender-neutral robot assistant.* The World. https://web.archive.org/web/20220126171442/https://theworld.org/stories/2018-03-28/meet-pegg-gender-neutral-robot-assistant

Shulevitz, J. (2018). Alexa, should we trust you? *The Atlantic*. https://web.archive.org/web/20181102120327/https://www.theatlantic.com/magazine/archive/2018/11/alexa-how-will-you-change-us/570844/

Shum, H.-Y., He, X., & Li, D. (2018). From Eliza to XiaoIce: Challenges and opportunities with social chatbots. *arXiv pre-print server*. https://doi.org/10.1631/FITEE.1700826

Steele, C. (2018). The real reason voice assistants are female (and why it matters). *PCMag*. https://web.archive.org/web/20211201095456/https://uk.pcmag.com/smart-home/92697/the-real-reason-voice-assistants-are-female-and-why-it-matters

Suchman, L. (2006). *Human-machine reconfigurations: Plans and situated actions* (2nd ed., Learning in Doing: Social, Cognitive and Computational Perspectives). Cambridge University Press. https://doi.org/10.1017/CBO9780511808418

Thorne, N., Yip, A. K.-T., Bouman, W. P., Marshall, E., & Arcelus, J. (2019). The terminology of identities between, outside and beyond the gender binary–A systematic review. *International Journal of Transgenderism*, *20*(2–3), 138–154. https://doi.org/10.1080/15532739.2019.1640654

Time machine of the year. The computer moves in. (2019 [1983]). *Time Magazine*. http://content.time.com/time/covers/0,16641,19830103,00.html

Turing, A. M. (1950). Computing machinery and intelligence. *Mind*, *LIX*(236), 433–460. https://doi.org/10.1093/mind/LIX.236.433

Vukovic, J., Jones, B. C., Debruine, L., Feinberg, D. R., Smith, F. G., Little, A. C., Welling, L. L. M., & Main, J. (2010). Women's own voice pitch predicts their preferences for masculinity in men's voices. *Behavioral Ecology*, *21*(4), 767–772. https://doi.org/10.1093/beheco/arq051

Wajcman, J. (2004). *TechnoFeminism*. Polity.

Wajcman, J. (2015). *Pressed for time the acceleration of life in digital capitalism*. Univ. of Chicago Press.

Warwick, K., & Shah, H. (2016). Can machines think? A report on Turing test experiments at the Royal Society. *Journal of Experimental & Theoretical Artificial Intelligence*, *28*(6), 989–1007. https://doi.org/10.1080/0952813x.2015.1055826

The Week Staff. (2015). How Apple's Siri got her name. *The Week*. https://web.archive.org/web/20151125232503/https://theweek.com/articles/476851/how-apples-siri-got-name

Weizenbaum, J. (1966). ELIZA–A computer program for the study of natural language communication between man and machine. *Communications of the ACM*, *9*(1), 36–45. https://doi.org/10.1145/365153.365168

West, M., Kraut, R., & Chew, H. E. (2019). *I'd blush if I could. Closing gender divides in digital skills through education*. EQUALS, UNESCO. https://web.archive.org/web/20191219022753/https://en.unesco.org/Id-blush-if-I-could

Williams, M., & Braddock, M. (2019). AI case studies: Potential for human health, space exploration and colonisation and a proposed superimposition of the Kubler-Ross change curve on the hype cycle. *Studia Humana*, *8*, 3–18. https://doi.org/10.2478/sh-2019-0001

Woods, H. S. (2018). Asking more of Siri and Alexa: Feminine persona in service of surveillance capitalism. *Critical Studies in Media Communication*, *35*(4), 334–349. https://doi.org/10.1080/15295036.2018.1488082

HUMAN-MACHINE
COMMUNICATION