

SEX AND FRIENDSHIP WITH ROBOTS

Technically in Love: Individual Differences in Desire for Intimacy with Robots

by

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B.Sc., Arizona State University, 2018

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Robots

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### Abstract

Engineers have begun creating robots that look and act human, with the aim of maximizing the likability of real-life robot partners for friendship and sex. In science fiction, robots often look and act human, and these robot characters usually develop interpersonal relationships with human characters. Researchers have begun creating robots like those depicted in science fiction, gauging the beliefs of participants to maximize the likability of robot partners in real life. This thesis explored how today's Canadian undergraduates view robots, and if they would want to have a robot as a friend, or to have sex with a robot. I measured participant *Robosexuality*, or participant interest in having sex with a robot, and *Robofriendship*, or participant interest in having a robot friend. I also measured how sociosexual orientation, social dominance orientation, hostile sexism, and gender relate to Robosexuality and Robofriendship, including a mediation that examined if men are more sexist than women, and if this sexism explain men's higher Robosexuality. Participants varied widely in their expressed interest in close relationships with robots, with almost flat distributions across both scales. Sociosexual orientation, social dominance orientation, gender, and hostile sexism all predicted Robosexuality, but only hostile sexism predicted Robofriendship. Results from the mediation showed that hostile sexism partially explained the relation between gender and Robosexuality. I conclude by discussing the limitations and future directions for this research.

## Table of Contents

Supervisory Committee.....	ii
Abstract.....	iii
Table of Contents.....	iv
List of Tables.....	v
List of Figures.....	vi
Acknowledgements.....	vii
Introduction.....	1
Robots as Companions to Humans.....	4
Robots as Sex Partners.....	8
Robots at the Bottom of the Hierarchy.....	10
Hostility Toward Robots Based on Gender.....	13
The Present Study.....	16
Method.....	24
Participants and Procedures.....	24
Measures.....	26
Results.....	29
Preliminary Analyses.....	29
Main Analyses.....	31
Gender Differences.....	31
Moderation Analyses.....	35
Robosexuality.....	35
Robofriendship.....	38
Mediation Analyses.....	41
General Discussion.....	43
Limitations.....	49
Future Directions.....	53
Conclusion.....	55
References.....	57
Appendix A.....	69
Full Survey.....	69

**List of Tables**

Table 1: Summary of Hypotheses.....18

Table 2: Demographics.....25

Table 3: Variables Assessed, Means, Standard Deviations, and Zero-Order Correlations.....30

Table 4: Gender Differences Across the Predictor and Outcome Variables.....32

Table 5: Hierarchical Linear Regressions Predicting Robosexuality.....36

Table 6: Hierarchical Linear Regressions Predicting Robofriendship.....39

**List of Figures**

Figure 1: Frequency Distribution of Robofriendship by Respondent Gender.....33

Figure 2: Frequency Distribution of Robosexuality by Respondent Gender.....34

Figure 3: Interaction between Social Dominance Orientation and Gender on Robosexuality.....37

Figure 4: Interaction between Social Dominance Orientation and Gender on Robofriendship...40

Figure 5: Results of Mediation Between Gender and Robosexuality with Hostile Sexism.....42

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## **Technically in Love: Individual Differences and the Relationship with Intimate Engagement and Robots**

Since World War II, scientists from around the world have been trying to build a robot that is capable of simulating interpersonal social interactions. Alan Turing's (1950) seminal article on machine learning ended its first sentence with a question: "Can machines think?" (Turing, 1950, p. 2). Years ahead of his time, Turing's work inspired a field of research in which scientists would examine the *thinking machine*—a machine that both scientists and science fiction writers would refer to as robots. One of the main foci since Turing has been to create a robot that is capable of not only mimicking human behavior, but also a robot that is able to provide and reciprocate social competence. Some researchers believe that social robots are an inevitability due to the prevalence of humanlike robots in science fiction (Lorenčík, Tarhaničová & Sinčák, 2013), robots in hospitality that can make connections with guests (Bowen & Morosan, 2018; Kuo, Chen & Tseng, 2017), and the continued advancement of sex robots for personal use (Doering & Poschl, 2018; Scheutz & Arnold, 2016).

While the fields of engineering and robotics are working on how to build a robot that is both like humans and pleasing to humans, the goal of social science should be to learn who might be interested in robots, and the reasons they might be interested. From *Star Wars* to *Black Mirror*, the general population may develop preconceived ideas about robots in the real world based on fictional media (Clocksin, 2003). Film directors and scientists frequently work together to ensure that technology in science fiction appears realistic (Kirby, 2003), which then inspires people to create those technologies in real life (Mubin et al., 2016). Previous technologies, such as the handheld tablet from *2001: A Space Odyssey* or the Nike self-lacing shoe from *Back to the*

*Future*, were created decades after their on-screen debuts, but were only possible due to innovation (Bell, Fletcher, Greenhill, Griffiths, & McLean, 2013).

In the scientific journal *Nature* (2017), an editorial proposed the idea that humans who lack companionship with other humans can instead turn to robots. Humans are social animals with a need to relate and connect with others (Dautenhahn, 2001; Frith & Frith, 2007; Nehaniv & Dautenhahn, 2007), and research suggests that humans can have close relationships with humanlike robots (Doering, Poeschl, Gross, Bley, Martin & Boehme, 2015; Kim & Kim, 2013). This could include robots that think like humans (Reeves & Nass, 1996; Sundar, Waddell & Jung, 2016), robots that can mentor humans (Brink & Wellman, 2020; Leyzberg, Spaulding & Scassellati, 2014; Spaulding, Gordon, Breazeal, 2016), robots that can be romantic partners to humans (Cheok, Levy, Karunanayaka, 2016; Samani, Cheok, Ngiap, Nagpal & Mingde, 2010), and robots that can have sex with humans (Appel, Marker & Mara, 2019; Doring & Poschl, 2018; Scheutz & Arnold, 2016). On the other hand, some participants view robots as “eerie” (Mara & Appel, 2015), “uncanny” (Mori, 1970), and “capable of subjugating or ending humanity” if they are given too much power (Bruckenberger, Weiss, Morning, Strasser, Stadler & Tschelgi, 2013; Müller, Gao, Nijssen & Damren, 2020). The incomplete and contradictory nature of extant evidence regarding attitudes toward robots highlights the need for new research into human-robot interactions. Thus, new research is needed to better understand beliefs about robots, and why people may view robots as desirable for sex or friendship.

The goal of this thesis is to examine the beliefs people have about robots and their Robosexuality, which I define as interest in sex with a robot, and Robofriendship, which I define as an interest in friendship with a robot. Researchers are beginning to examine these questions, examining how human traits positively influence people’s responsiveness and closeness with

technology (Doering et al., 2014; Mori, 1970). However, little research has focused on the beliefs that predispose someone to have an interest in robot partners, and some clinicians believe this population is in desperate need of study (McArthur & Twist, 2017). I aim to add to this body of research examining both an interest in friend and sex robots, and how some beliefs about other groups might relate to this interest. Understanding why people are (or are not) interested in social interactions with robots may raise important ethical and practical questions to consider for the future as robots become more advanced and available.

### **Robots as Companions to Humans**

Researchers have asked if robots and humans could ever be compatible. The fields of Erobotics (Dube & Anctil, 2020) and Lovotics (Samani et al., 2010; Samani & Saadatian, 2011) examine if people could develop romantic or sexual relationships with robots. The study of Human-Robot Interaction (HRI; Kriz, Ferro, Damero & Porter, 2010; Lohse, 2009) is examining and reducing the effects of the uncanny valley (defined below) to positively influence how people can develop interpersonal relationships with robots. As well, studies examining robots in the field of marketing (Aaltonen, Arvola, Heikkilä, & Lammi, 2017; Doering et al., 2015) and medicine (Dautenhahn et al., 2005; Parks, 2010) have made strides in bringing robots into workplaces and homes. My literature review examines how these advancements have impacted the liking of and desire for robots for interpersonal relationships. Ultimately, robots have a lot of potential as they advance, and their possible influence on the future of human relationships and sex is vast.

Robots create a unique opportunity for people who, for any number of reasons, have difficulty engaging in interpersonal relationships. In the 2013 movie *Her* (Jonze, 2013), the main character is newly divorced and has trouble finding a new relationship. This changes when his robot assistant is updated to help him in any way she can, and they begin a romantic relationship. Whether someone desires a casual or committed relationship, humanlike robots may sooth the stress that follows a breakup (Frazier & Cook, 1993), reduce the negative affect that comes as a result of long-term, unwanted singlehood (Donnelly, Burgess, Anderson, Davis & Dillard, 1991), or overcome the difficulties someone might have in attempting to initiate a romantic or platonic relationship (Gilmartin, 1987). Humans have needs, and robots can be one way to form intimate connections for individuals who have difficulty relating to other people.

As noted earlier, in fictional media robots are often depicted as companions to humans in platonic or sexual ways. For example, in *AI: Artificial Intelligence* (Spielberg, 2001) child robots are created to be replacement children for families who have lost their children prematurely, and adult robots are created to be servants and sex workers. While real robots of today may not be exactly how they are portrayed in movies, people may still expect robots would make good platonic or sexual partners.

There are many ways robots and people can build platonic relationships. Robot pets have already been created for children in the form of the *Tamagotchi* toy from the early 2000's. The *Tamagotchi* was a handheld toy that children carried around in their pocket that required constant attention and would die if neglected. Although the *Tamagotchi* was not a learning technology, children still treated them as pets (Pettman, 2009). *Tamagotchis* were often a child's first experience with responsibility, pet ownership, and even death of a loved one (Turkle, Breazeal, Dasté & Scassellati, 2011). Robots have come far since the *Tamagotchi*. In a later cross-cultural study, children enjoyed playing with a social toy robot more than playing alone or with a *Tamagotchi*-like toy (Shahid, Kraemer & Swerts, 2014). While children still preferred playing with a real friend over the robot, many children indicated that they enjoyed playing with the robot when the other option was playing alone. Further, in another study, researchers found that if children between ages 5 and 16 believe a robot is more advanced than a toy, most will treat it like a human instead of a machine (Fior, Nugent, Beran, Ramirez-Serrano & Kuzyk, 2010). As well, children will trust a robot more if it gets a question right and will put even more trust into it if they believe the robot has psychological agency (Brink & Wellman, 2020). While neither the *Tamagotchi* nor the toy robots were artificially intelligent, children enjoyed playing with them more than other toys. With that said, a child's beliefs about robots may be much different from

adults' beliefs, as children may just want something they can play with, while adults may want more out of a social partner.

For adults, robots have taken on the role of both a digital and in-person assistant, both organizing schedules and helping healthcare professionals (Locsin & Ito, 2018). When UK respondents were asked if they wanted robots to be a part of their lives, a plurality of respondents reported that they want a robot to help them with day-to-day tasks, compared to as friends, mates, or in industry (Dautenhahn, Woods, Kaouri, Walters, Koay & Werry, 2005). As adults age, they may become more open to robots as companions, as a robot can help them maintain routines while also filling the void of loneliness (Louie, McColl & Nejat, 2014; McColl & Nejat, 2013). There are several reasons an adult might want to use a robot, but this research indicated that adults seem to prefer a robot that can help them accomplish tasks. When adults get older, like children, they just want someone to keep them company. Children who grow up familiar with robots may be more open to robots in their daily lives, but adults who missed the robotic march of progress may still need time to get used to them. When this level of comfort increases, and people become closer with robots as friends, intimate relationships with robots may also become possible.

Making people comfortable around robots has been a challenge for decades, but there have been several breakthroughs in improving the likability of robots. In 1970, the roboticist Masahiro Mori coined the concept of the *uncanny valley* to describe how robots become “eerie” as they become more human-like. The uncanny valley effect happens because even when robots approach humanness, they are different enough that observers them as “uncanny,” and it makes people uncomfortable. At the one end of the human-like spectrum are robots that are far from human appearance, such as industrial robots or toy robots (Mori, MacDorman & Kageki, 2012),

and these robots do not cause discomfort. On the other end of the human-like spectrum are humans and (hypothetically) robots that are indistinguishable from humans, and these also do not inspire this effect. On the contrary, if a robot looks exactly human, people may want to be friends with it (Carpenter, Eliot & Schultheis, 2006; Ezer, Fisk & Rogers, 2009). But the uncanny valley effect is observed for near-perfect humanoid robots, dead bodies, and prosthetic limbs. This effect has been tested and replicated for humans with fake limbs, robots with human features (Palomäki et al., 2018), and “chatbots”, which are algorithms that simulate conversations with people (Ciechanowski, Przegalinska, Magnuski, & Gloor, 2019). Robots are also disliked when they don’t act human enough or violate social norms (Carpenter et al., 2006). While robots still need work, they should become more appealing to humans as robots improve. And as robots become more advanced, they may become more reciprocal intimate partners.

### **Robots as Sex Partners**

In 2007, David Levy published the book *Love and Sex with Robots*, which proposed both philosophical and theoretical arguments regarding sexual relationships between humans and robots. Following its publication, research has focused on why people might purchase sex robots (Szcuka & Krämer, 2016), the ethical implications of sex robots (Amuda & Tijani, 2012; Richardson, 2016), the sociological implications of sex robots (Cox-George & Bewley, 2018; Eggleton, 2018), and whether sex with robots is infidelity (Nordmo, Næss, Husøy & Arnestad, 2020; Rothstein, Connolly, de Visser, & Phillips, 2021). There are also recommendations about what traits sex robots should have. For example, it has been argued that sex robots should not be child-like (van Huizen, 2020; Royakkers & Van Est, 2015) and that sex robots should have some degree of autonomy and should be available in a diverse range of skin colors and body types (Danaher, 2019).

One goal of this thesis is to add to the empirical research literature on sex robots. Few studies have engaged with why some respondents might want to use a sex robot. Learning about attitudes toward sex robots can improve how engineers target different markets. Prior research suggests that men may like sex robots more than women like sex robots (Appel et al., 2019; Olesky & Wnuk, 2021), and that public acceptance of sex robots is still years away (Scheutz & Arnold, 2017). One aim of my thesis is to add to the empirical literature on sex robots by examining individual differences related to interest in using robots for sex.

One reason someone might want to use a sex robot is because a sex robot can act as a substitute for a human casual sex partner. It may be challenging to find a human partner at times, such as during a worldwide pandemic between the months of March 2020 and June 2021, but this may not decrease someone's drive for sex. If someone is interested in engaging in a

pleasurable experience but cannot find a human partner, a robot may be an apt substitute. In research by Koverola and colleagues (2020), researchers found that participants with restricted sociosexual orientations (i.e., less interest in casual sex) reported more disgust toward someone using a sex robot, regardless of whether that person was married or single. People with unrestricted sociosexual orientations (i.e., more interest in casual sex) reported less disgust for someone using a sex robot. If a robot is viewed as a partner rather than a device, people with an unrestricted sociosexual orientation may be interested in having sex with it. However, if respondents view robots as a toy, they may still be interested in using it for pleasure but may not treat it the way they would treat a partner.

Understanding whether robots might be viewed as partners or toys is important, because it may also suggest whether robots might be viewed more generally as a human or a tool. If robots are viewed as human, then robots may be treated as equals to humans, but if robots are viewed as tools, they might be treated as less than human. The treatment of robots as equal to or less than humans has important implications for why someone might want to use one; for example, some people might want a partner and view robots as sufficiently human, and other people might want pleasure to come from something vaguely shaped like a human. A human may want a robot friend because a robot friend could do things for the human without wanting things in return. Or a human might want to have sex with a robot because they want to receive pleasure without having to reciprocate pleasure. To examine this, I next review literature on group identity and robots to speculate on how people might view robots, and if people may treat robots as equal to or less than other humans.

### **Robots at the Bottom of the Hierarchy**

The history of treating robots as tools began with the language used to describe enslaved humans. The word “Robot,” from the Czech “Robotnik,” means “slave,” and referred to enslaved humans prior to the 20th century. This changed in 1920, when Karel Capek’s science fiction drama “Rossum’s Universal Robots” changed the meaning of the word “Robot” to mechanical workers instead of human workers (Williams, 2021). Compared to humans, who have needs and deserve basic rights to life and liberty, stereotypical robots do not need to eat or sleep, and may be bought from a store in the near future. From their first appearance on stage, robots have been viewed as something to be used and ordered around, and this might still hold true if robots are bought by people who view robots as servants. If a robot is unable to mimic human emotions and instead just takes commands and executes behaviors, the treatment of robots will probably be different from how humans treat each other. However, if a robot mimics human emotions and behaviors such that an observer cannot tell if the robot is simulating emotions or actually has emotions, then the treatment of robots may instead be based on if people view them as part of their group, or part of an outgroup.

How robots are treated might depend on how closely they mimic human behavior. If robots come close to mimicking human behavior, it may inspire the uncanny valley effect. However, if a robot perfectly mimics human behavior, then the question is whether it will be treated like humans or still differently from humans. In a paper titled *Robots Should Be Slaves*, Bryson (2010) argued that humans have an innate desire to control their robot companions, so there is no reason to program robots with [complete] autonomy. In one line of research, real robots that were part of respondents’ ingroup were treated better than humans who were part of the outgroup (Fraune, Šabanović, & Smith, 2017), but ingroup robots were treated worse than

human ingroup members (Fraune & Šabanović, 2020). Ingroup robots were also more liked than outgroup robots, and ingroup robots were treated with more humanity compared to outgroup robots (Eyssel & Kuchenbrant, 2012; Häring, Kuchenbrandt & André, 2014). These findings provide evidence that robots can be treated like humans, and if the way people view robots determines how a robot could be treated.

Whether robots are treated like humans may ultimately be determined by whether or not people view robots as in the same group as them, or in a different group. If robots are viewed as in the same group, people may be more likely to treat them like humans (Eyssel & Kuchenbrandt, 2012; Fraune & Šabanović, 2020; Häring et al., 2014). If people treat robots like humans, then we may want to treat robots how we treat our friends—if we treat our friends equally, then we may treat robots equally. If people do not treat robots like humans, they may have less interest in treating them like a friend or sexual partner.

A common practice by engineers creating robotic assistants is to give the assistants feminine voices and names such as Siri and Alexa, (Bergen, 2016; Donald, 2019). This is by design—gender roles in Western society have long associated women with service and domestic roles (Donald, 2019). In previous research, respondents were interviewed after engaging with a machinelike robot and a female, humanlike robot, and a majority of the respondents indicated a preference for a female robot to help with domestic chores (Carpenter, Davis, Erwin-Stewart, Lee, Bransford & Vye, 2009; Lee, Kavva & Lasser, 2021). As well, research has shown that respondents view female robots as communal, and that female robots would be better at taking care of children and household maintenance than male robots (Eyssel & Hegel, 2012). For a comparison, the male robot tasks included transporting goods and repairing and servicing technical equipment. Because these stereotypes were upheld in studies, it suggests that humans

may map on their own gender roles to robots. While groups can differ on societal gender roles, robots having gender may play a role in increasing interest in Robosexuality and Robofriendship. People may want to have sex with a robot that fits their sexuality and/or they may want a robot friend that matches their gender. To examine this, I close out this literature review by examining how gender relates to interest in engaging with robots for friendship or sex.

### **Hostility Toward Robots Based on Gender**

The gender of the human user and the perceived or assumed gender of the robot may affect whether someone wants to engage with a robot for sex or for friendship. The creators of most robots are men, and those men typically create robots that are visually and audibly appealing to them (Donald, 2019; Marchetti-Bowick, 2009). Creators give technologies feminine-coded traits such as high voices and women's names (Donald, 2019), and they create the technologies to match the presumed aesthetic or sexual preferences of (primarily male) users. For sex robots, men may prefer female-coded robots, while women may not share those preferences. Robots with hourglass figures were seen as more communal than robots with an equal waist-to-hip ratio, although both robots were deemed equally suitable for agentic tasks (Bernotat et al., 2019). In another sample, presumably straight men preferred robots with female faces and voices (González-González, Gil-Iranzo, Paderewski-Rodríguez, 2020; Hou & Ye, 2019), while presumably straight women did not show a preference for voices nor faces (Hou & Ye, 2019). In a study examining the appeal of sex robots compared to biological humans and humans with cybernetic traits, men liked sex robots them more than women did (Appel et al., 2019).

Digital assistants, despite having no body, are almost always given high, female-coded voices by their creators (Donald, 2019), and the voice must be changed by the user to a lower, male-coded voice if that is the preference (Bergen, 2016). As well, male participants were more likely to donate money to a fund when the robot asking had a feminine-coded versus a masculine-coded voice, while women did not differ based on the robot's voice (Siegel, Breazeal & Norton, 2009). Further, in a study examining how participants work in a tool-based or a fashion-based task with a gendered robot—the robot looked the same in both conditions, but it

had a different masculine- or feminine-coded voice and name—men performed worse when working with a female-coded robot, and all participants anthropomorphized only the male-coded robots, reporting that the female-coded robot was more machinelike (Kuchenbrandt, Häring, Eichberg, Eyssel & André, 2014). When the robot is made to be friends with humans, male and female participants reported that they liked robots that appeared to match their own gender compared to robots that did not (Eyssel et al., 2012). Further, when a robot is not explicitly sexual, men thought the female-coded robot was more trustworthy, and women thought the male-coded robot was more trustworthy. Thus, both the gender of the human user and the perceived gender of the robot are related to beliefs and opinions about robots, ranging from sexual attraction to the robot to the trustworthiness and persuasiveness of the robot. This suggests that people apply their beliefs about sex or gender to robots with gendered traits. If so, then it may be that gendered ideologies like sexism also extend to robots.

While robots do not have biological sex or gender identity, they may activate gender stereotypes. Respondents found a robot more trustworthy when either a male or female robot's emotional intelligence matched the participant's gender expectation (i.e., women more emotional and men more assertive; Law, Chita-Tegmark & Scheutz, 2021). As well, participants liked robots more when they matched gender stereotypes, such that male robots were extroverted and female robots were introverted (Tay, Jung, & Park, 2014). In another study, short-haired male robots were viewed as more agentic, while female robots were seen as more communal (Eyssel & Hegel, 2012), and participants have reported finding male robots more capable than female robots in completing a simple building task (Bernotat, Eyssel, & Sachse, 2019; Eyssel & Hegel, 2012). If robots are liked more when they match stereotypes and gender roles, then the likability of gendered robots may relate to how they perform that gender. For instance, in either sexual or

platonic relationships between two people, there may be an expectation of reciprocation between partners and their needs of fulfillment. If one partner is a robot, then there is only one person with needs, and the robot may be used by the human so that the human can get only their needs met. There have been recent calls to include the users in the prototyping process (Reich-Stiebert et al., 2018), which may reduce the objectification of robot partners if both men and women can be involved with the different robots. If people ascribe gender to robots, then it is important to understand how gender-related beliefs about women affect people's interest in engaging with robots for sex or for friendship. This is one goal of my research.

### The Present Study

One aim of the study is to provide a snapshot of self-reported interest in *Robosexuality*, or interest in having sex with a robot, and *Robofriendship*, or interest in having a robot as a friend, in a sample of Canadian psychology students surveyed in 2020. Robosexuality and Robofriendship resemble prior concepts in the literature on human attitudes toward robots, such as *Human-Robot Interaction or HRI* (Lohse, 2005), *Erobotics* (Dube & Antcil, 2020), and *Lovotics* (Samani & Saadatian, 2012). While my study was in part inspired by this prior work, in my study there was no actual interaction with robots, so it was not directly HRI. Neither Erobotics nor Lovotics have associated measurement scales at this time. I use the terms *Robosexuality* and *Robofriendship* to refer to psychological constructs that at present lack validated measures. As a stop-gap measure, I adapted existing validated measures of attitudes toward sexuality and friendship. In future, those scales may be replaced or modified following studies of measure validation.

A second goal of my research is to examine if gender, hostile sexism, social dominance orientation, and sociosexual orientation relate to respondents' Robosexuality or Robofriendship. There may be a relationship between how individuals treat other people and the ways they treat robots (Reeves & Nass, 1996). Robots may either be viewed as equal to humans, or as subservient to humans (Bruckenberg et al., 2013), and this may also relate to respondents' treatment of robots in the future. In this study, I measure if respondents' gender predicts their beliefs about robots, Robosexuality and Robofriendship, and if respondents' beliefs of hostile sexism, social dominance orientation, and sociosexual orientation predict their Robosexuality and Robofriendship. By measuring these associations, I hope to further the literature on these

interactions and provide insight into why some people may be drawn toward robots for friendship or for sex.

For this study, I run a series of tests where gender, hostile sexism, social dominance orientation, and sociosexual orientation are regressed onto Robosexuality and Robofriendship. I also test whether men and women differ on Robosexuality and Robofriendship based on their scores on the belief variables. Lastly, I test for a mediation examining whether men's interest in sex robots can be predicted by their hostile sexism.

Table 1 describes both the confirmatory and exploratory hypotheses for this study. First, I expect that gender will predict Robosexuality, such that men will be more interested than women (H1). I do not expect to observe a gender effect for Robofriendship. According to previous research, men are more interested in sex with robots than are women (Appel et al., 2019; Nordmo et al, 2020; Scheutz & Arnold, 2016). But if someone views a robot as a friend, male and female participants like robots that match their gender compared to robots that do not (Eyssel et al., 2012). While men seem to like sex robots more than women do, the only previously documented preference for Robofriendship is that the robot matches the respondent's gender, so I do not anticipate gender predicting someone's interest in a robot friend.

**Table 1** Summary of Hypotheses

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*Confirmatory Hypotheses*

H1: Gender will predict interest in sex with a robot, such that men will be more interested than women.

H2: Hostile sexism will positively predict interest in sex with robots.

H3: Men will score higher in hostile sexism than women, and in turn, higher hostile sexism scores will predict heightened desire for a sex robot (i.e., participant gender → hostile sexism → desire for sex robot).

H4: Social dominance orientation will positively predict interest in robot partners for both friendship and sex.

H5: Sociosexual orientation will positively predict desire for sex with a robot.

*Exploratory Hypotheses*

EH1: Does gender moderate the associations between hostile sexism, social dominance orientation, sociosexuality, and interest in sex with a robot?

EH2: Does sociosexual orientation relate to wanting to have a robot as a friend?

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I also predict that beliefs about gender will predict differences in Robosexuality and Robofriendship. People assign gender to technology primarily based on the voice and appearance (Bergen, 2016; Donald, 2019), and engineers give robots gendered voices like Cortana and Marty. As well, because respondents in previous research believed that robots have gender, they also attached gender stereotypes to robots (Bernotat et al, 2019; Kuchenbrandt et al., 2012, Law, Chita-Tegmark & Scheutz, 2020; Tay et al., 2014). These results suggest that respondents find male robots to be more competent than female robots—which matches stereotypes about men and women (Biernat & Fuegen, 2001). If people believe that a robot embodies gender, they may also express gendered hostility toward a female-appearing robot, such as objectification (Bergen, 2016; Bernotat et al., 2019). Hostile sexism is “an adversarial view of gender relations in which

women are perceived as seeking to control men” (Glick & Fiske, 2001, p. 109), and someone who scores high on hostile sexism may believe that men have to maintain control over women. For example, if a man believes women are only hired for positions at his job because of diversity reasons, he will believe that women are not as good as because they received advantages that he did not. If a man thinks women are not as good as he, and applies gendered beliefs to sex robots, then he may also apply hostile sexist beliefs toward robots. I anticipate that hostile sexist beliefs will positively predict interest in sex with robots (H2). But, because the gender of a robot friend should match the gender of the respondent based on previously determined preferences (Eyssel et al., 2012), I anticipate that hostile sexist beliefs will not predict wanting a robot as a friend.

Further, the reason men have more interest in sex robots may be due to hostile sexism, as men are more sexist than women (Glick & Fiske, 1996), and a man may find robots aesthetically pleasing because oftentimes robots are made by male creators to appeal to people like them. As well, because robots may only look human, men may be interested in sex robots if they have hostile sexist beliefs because they can objectify it. For instance, men who believe that women use sex to get favors or money from men may prefer a female sex robot to a human woman because they do not have to worry about a sex robot having ulterior motives. Someone high on hostile sexism may believe that they are better than women, but a robot can simulate the same experience of having power over something that is perceived to be female without social repercussions. I predict that men will score higher in hostile sexism than women, and in turn, higher hostile sexism will predict greater Robosexuality (i.e., participant gender → hostile sexism → to desire for sex with a robot; H3).

However, someone might still believe their group, humans, is better than another group, robots, regardless of their hostile sexism or the perceived gender of the robot. If someone views a

robot as a mechanical servant, that person may be open to using the robot for their own purposes without any consideration for the robot itself. One way to measure this is to assess participants' social dominance orientation (Pratto, Sidanius, & Levin, 2006). If someone is high on social dominance orientation, they believe that their ingroup has more power and rights than outgroups. If someone is low on social dominance orientation, then that person believes members of outgroups deserve the same treatment as members of their ingroup. Robots are different from humans in a variety of ways, but even the most humanlike robots will be different from humans because they are made of circuits. Respondents in previous research have reported viewing robots as an outgroup (Bruckenberg et al., 2013)—even (or perhaps especially) robots that look human or act in human ways. People may also view robots as potentially dangerous (Müller, Gao, Nijssen, & Damen, 2020), and think that if robots are treated equally that they may gain power and overtake humans. If people view robots as an unequal outgroup, they may want a friend robot because they can dominate the robot, and the robot can take care of them (Yamazaki et al., 2012). As well, people high in social dominance orientation may like a sex robot because the sex robot will do whatever it is asked, and robots do not have the same sexual needs as humans (Döring & Pöschl, 2018). Further, if someone views outgroups as equal, they may not want a robot friend or sexual partner since it may require them to own and thus have power over a robot. Someone low in social dominance orientation may not want to own something that is humanlike, even if the robot is conspicuously different from them. Therefore, I predict that people who are high on social dominance orientation will be higher on Robosexuality and Robofriendship, while people low on social dominance orientation will be lower on Robosexuality and Robofriendship (H4).

In addition to the constructs described above, sociosexual orientation is a powerful predictor of sexual openness beliefs and behaviors. Sociosexual orientation is an individual's engagement in, beliefs about, and desire for casual sex. Penke and Asendorpf (2008) found that people who have an unrestricted sociosexual orientation (i.e., are more open to casual sex) have more casual sexual partners and are more likely to be single, whereas people with a restricted sociosexual orientation have fewer casual sexual partners and are more likely to be in committed relationships. I propose that sociosexual orientation will predict people's interest in a robot sexual partner. If someone has an unrestricted sociosexual orientation (i.e., they engage in casual sex more, have positive beliefs toward casual sex, and desire casual sex more), they may be more interested in sex with a robot because it might simulate casual sex. Further, in one university study, the researchers found that over 50% of respondents endorsed the idea that sex with robots might improve the quality of sex with others, and about 40% said that sex with a robot does not count as cheating (Scheutz & Arnold, 2017). This could mean that people who have an unrestricted sociosexual orientation could be more interested in sex robots as it allows them to have multiple partners even if they are in a relationship. As well, even if robots are not viewed as actual partners, people with restricted sociosexual orientations will be less interested in sex robots as they could still be considered cheating, or might still cause stress in a committed relationship by simulating an extra partner. Therefore, I predict that an unrestricted sociosexual orientation will positively predict Robosexuality (H5). By examining this relationship, I aim to provide insight into whether interest in casual sex predicts interest in having sex with a robot.

Next, I explore whether gender moderates the associations between the individual difference variables (i.e., hostile sexism, social dominance orientation, sociosexuality) and Robofriendship and Robosexuality (EH1). While I anticipate that men will be higher across the

different belief variables, I cannot foresee how men who are higher on a variable such as social dominance orientation will view robots, compared to, for example, women who are higher on social dominance orientation. Perhaps the associations between the individual difference variables and Robofriendship and Robosexuality will be different for men and women. Assessing these potential interactions is important because it will allow future researchers and engineers to understand how men and women differ across the individual difference variables that I assess, and how those differences might predict their interest in engaging with robots sexually or platonically.

Lastly, I also examine one exploratory hypothesis for sociosexual orientation and its relationship to Robofriendship. Perhaps having a restricted sociosexual orientation predicts not wanting to have sex with a robot, but if someone with a restricted sociosexual orientation views a robot as a human, they may still want to be friends with the robot. To my knowledge, there has been no examination of sociosexual orientation and friendship outside of opposite-sex friendships, and this study does not specify the gender of the robot partners. If sociosexual orientation does relate to Robofriendship, this will create an important avenue for both robot friendships and platonic friendships related to someone's casual sex drive.

Taken together, this research not only examines how beliefs about other groups applies to desire for sex or friendship with a robot, but it also offers evidence as to why people might be interested in robots, and if that interest exists for both sexual and platonic robots. People may have beliefs already about robots, and these beliefs would likely persist in different scenarios where people imagine using a robot. In contemporary society, it might be frowned upon to treat people like objects, but maltreatment may not apply to objects themselves—even humanlike ones. If people who are high in social dominance orientation are open to owning robots, it

suggests that people may apply outgroup power differences toward robots too. Or, if people high on sociosexual orientation think robots and human partners are equal, then it creates a new avenue for sexual experience—one that also creates opportunities for people with disabilities, the elderly, or people with sexually-transmitted diseases (Doering & Poschl, 2018). For people with disabilities or the elderly, robots can provide pleasure regardless of the mobility or sensitivity of the user, as the robot can be programmed exactly to the user's specifications. For people with sexually transmitted diseases, because robots have no disease pathways or immune systems, users can have unprotected sex with a robot without the stress of passing on the disease. Overall, this analysis offers a glimpse into respondents' opinions other groups, and if the interest in robot partners relates respondents' interests in sex and friendship with robots.

## Method

The script, figures, syntax, and original dataset can be found on the Open Science Framework (<https://osf.io/rv8xg/>). Approval for this study came from the University of Victoria's Human Research Ethics Board (Protocol Number: 20-0466).

### Participants and Procedure

Participants included 223 undergraduate students from the University of Victoria. Participants could not take the survey if they were under 18, or if they were not fluent English speakers in case any of the questions were not understood. I intended to exclude anyone who left at least 25% of the questions blank, but no participants met this criterion. I excluded anyone who did not identify as male or female ( $n = 11$ ), as the sample did not have enough transgender respondents to compare to the other groups, and previous research has not validated the individual difference variables for trans people. As well, because my theorizing is based on binary gender roles, it is unclear how it would apply to trans and/or non-binary people. This left a remainder of 212 participants (see Table 2). Participants received .5 course credits in appreciation for their time. Participants accessed the survey through the University of Victoria's SONA system and completed the survey on Qualtrics. Most participants completed the survey in 15-25 minutes.

**Table 2** Demographics

Total n	212 (100%)
Gender	
Female	157 (74%)
Male	55 (26%)
Sexuality	
Asexual	2
Bisexual	27 (13%)
Gay	2
Lesbian	3
Other	4
Pansexual	1
Straight	173 (82%)
Ethnicity	
Asian	36 (17%)
Black	1
Caucasian	156 (74%)
Indigenous	3
Latinx	2
Middle Eastern	2
Native Hawaiian/Pacific Islander	1
Other	11 (5%)
Age	
18	29 (14%)
19	47 (22%)
20	40 (19%)
21	37 (18%)
22	28 (13%)
23	11 (5%)
24-29	8
30-39	10
40+	2

*Note.* Table totals exclude participants removed from analysis. Percentages not included if value is under 5% ( $\leq 10$  participants).

Participants began this survey by answering questions assessing the variables of interest in the following order: sociosexual orientation, hostile sexism, and social dominance orientation. Following these measures, participants read a short passage where they imagined they had just received a robot friend for free. The passage read as follows:

You win a raffle tomorrow and for your prize you are given a robo-friend. This robot 1) looks and feels human and 2) acts and behaves in a believably human way. Imagine how this robot might look or act, and how you might engage with such a robot. Answer the following questions on a scale of Strongly Disagree to Strongly Agree.

Participants then answered questions about Robofriendship. Next, participants read a passage where they received a sex robot that looked human and behaved in a believably human way, and answered questions related to their Robosexuality. The passage read as follows:

You get a call from the manufacturer that handles the raffle. Since you have so much experience with your robo-friend, they are giving you the opportunity to try out a robot from their adult brand of sex robots. All you have to do is answer the questions in this survey.

Participants then answered questions about Robosexuality. In both scenarios, the participant received the robot for free so that participants could imagine using a robot without cost or worth. Participants received .5 credits for participating in this study, and were given a brief description of the study at the end of the survey with an email address to contact for further information.

### **Measures**

The complete survey is included in Appendix A.

Reported scale reliabilities were assessed using Revelle's omega total ( $\omega$ ; McNeish, 2018), which estimates reliability more accurately than Cronbach's alpha.

### ***Sociosexual Orientation***

Sociosexual orientation (SOI) was measured with the revised sociosexual orientation inventory (SOI-R; Penke & Asendorpf, 2008), which has previously shown good reliability. The

SOI-R includes 9 questions, such as “Sex without love is OK”, on a scale from 1 (strongly disagree) to 9 (strongly agree). The reliability for this measure lower than ideal ( $\omega = .62$ ), but since this scale has been well-validated elsewhere I still used it in my analyses (I will discuss this issue in the limitations).

### ***Hostile Sexism Index***

Hostile sexism was measured using the Hostile Sexism facet from the Ambivalent Sexism Scale (ASI; Glick & Fiske, 1996), which has previously shown good reliability. Items from this scale range from 1 (strongly disagree) to 5 (strongly agree), and an example of an item from the hostile sexism facet is “Women are too easily offended.” Reliability in this sample was adequate ( $\omega = .88$ ).

### ***Social Dominance Orientation Scale***

Social Dominance Orientation (SDO) was measured with the 16-item Social Dominance Orientation Scale (SDOS; Pratto et al., 2006), which has previously shown good reliability. The SDOS asks questions like “Some groups of people are more worthy than others”, and participants respond on a scale of 1 (strongly disagree) to 7 (strongly agree). Reliability in this sample was adequate ( $\omega = .89$ ).

### ***Adapted Friendship Qualities Scale for Robots***

The friendship qualities scale (FQS) asks children and young adults about the qualities they want in friends (Bukowski, Hoza & Boivin, 1994), and has previously shown good reliability. The FQS asks questions such as, “I would spend all my free time with my friend”, on a scale from 1 (strongly disagree) to 7 (strongly agree). This study used an adapted version of this scale to ask participants about a robot friend. The only difference between the original FQS and the FQS adapted for this study changed the word “friend” to “robo-friend”, and one item

asking about going to a friend's house was removed. Reliability in this sample was adequate ( $\omega = .83$ ).

### ***Adapted Robosexuality Identification Scale***

Participants answered several questions from the Asexuality Identification Scale (AIS; Yule, Brotto & Gorzalka, 2015), which has shown good reliability in follow-up research (Zheng & Su, 2018). The AIS asks questions such as “I lack interest in sexual activity” and, “The thought of sexual activity repulses me”, on a scale from 1 (Strongly Agree) to 7 (Strongly Disagree). The only changes to the scale consisted of replacing uses of the words “other people” with “robots”, and any mention of “sexual activity” was followed by “with a robot”. For example, the question “I lack interest in sexual activity” was revised to “I lack sexual interest in sexual activity with a robot.” Items were coded so that items endorsing interest in sex with a robot had higher scores for strong agreement, and items not endorsing sex with a robot gave higher scores for strong disagreement. Reliability in this sample was adequate ( $\omega = .83$ ).

### ***Demographics***

Participants were asked to enter information about what their gender identity, age, ethnicity, and sexuality.

## Results

### Preliminary Analyses

*Power.* I conducted post hoc power analyses prior to data examination, to estimate the smallest effect sizes for which power would be 80%. With 211 participants, the minimum effect that would be detected 80% of the time for a regression with gender and each of the belief variables in it is  $R^2 = .046$ . For detecting an effect with the two variables and the interaction effect at step 2, the minimum effect that would be detected 80% of the time is  $R^2 = .052$ . There was adequate power for the Robosexuality analyses, but the Robofriendship analyses were slightly underpowered. Because this study is exploratory, I still move forward with the analyses with the power caveat.

*Reliability.* I used omega to assess internal reliability, based on McNeish (2018), who suggested that alpha tends to underestimate reliability and recommends using omega total to estimate reliability. The minimum requirements for omega are the same as alpha. For SOI, the measure did not meet the minimum cutoff for acceptable reliability ( $\omega = .63$ ). For hostile sexism, the measure met the minimum cutoff for acceptable reliability ( $\omega = .87$ ). For SDO, the measure met the minimum cutoff for acceptable reliability ( $\omega = .90$ ). For Robosexuality, the measure met the minimum cutoff for acceptable reliability ( $\omega = .83$ ). Last, for Robofriendship, the measure met the minimum cutoff for acceptable reliability ( $\omega = .83$ ). As this study is exploratory, I keep all the items and their measures in this analysis, but the lack of reliability for SOI constrains the generalizability.

*Correlations.* The variables assessed, their means and standard deviations, and zero-order correlations are presented in Table 3. As was expected, hostile sexism and social dominance orientation were highly correlated, as both relate to hostile beliefs about another group.

Surprisingly, sociosexual orientation negatively predicted Robosexuality, suggesting that persons who are more interested in casual sex are less robosexual. Another surprise was that Robosexuality and Robofriendship were negatively correlated, meaning that Robofriendship negatively predicts interest in having sex with a robot. This suggests that there may be three groups of people: people who want a sex robot, people who want a friend robot, and people who want no robot, with little overlap between the first two, but I will return to this possibility in my General Discussion. Lastly, hostile sexism and social dominance both correlated with not wanting a robot friend, suggesting that people who have negative views toward other groups also may have negative views toward robots.

**Table 3** Variables Assessed, Their Means and Standard Deviations, and Zero-Order Correlations Among Variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1. Hostile Sexism	2.96	0.84				
2. SDO	3.66	1.29	.57** [.47, .65]			
3. SOI	4.53	1.14	-.11 [-.23, .03]	-.09 [-.22, .04]		
4. Robosexuality	3.54	1.38	.18** [.05, .30]	.24** [.11, .36]	-.17* [-.29, -.04]	
5. Robofriendship	3.38	0.91	-.20** [-.32, -.07]	-.14* [-.27, -.01]	.02 [-.11, .15]	-.19** [-.31, -.06]

*Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ . Hostile Sexism was measured on a scale of 1-5. Social Dominance Orientation (SDO), Robosexuality, and Robofriendship were measured on scales of 1-7. Sociosexual Orientation (SOI) was measured on a scale from 1-9. Numbers in square brackets refer to the 95% confidence intervals.

## Main Analyses

### *Gender Differences*

I next investigated the gender differences on the variables of interest (Table 4). In line with prior research, there was a difference between men and women on both hostile sexism (Glick & Fiske, 1996), and SDO (Sidanius & Pratto, 2001), with men scoring higher on both measures. On both these variables, the effect size was large and moderate, respectively, suggesting a stark difference between men and women and their views toward other groups. Unsurprisingly, men were much more sexist toward women than women are toward women, but this was also consistent for power differences between ingroups and outgroups. As well, there was no difference between men and women on SOI, meaning that both men and women in this sample had similar beliefs, attitudes, and desires for engaging in casual sex.

There were also gender differences in both Robosexuality and Robofriendship (see Figures 1 and 2). I hypothesized that men would have higher Robosexuality, and that men and women would be equal on Robofriendship. As predicted, for Robosexuality, men scored higher than women, meaning that on average they were more interested in sex with robots than women were. But the distribution of Robosexuality ratings for men was very flat. This suggests that men's robosexuality, while higher on average than women's robosexuality, had fairly large variance. For women, the distribution of Robosexuality scores was positively skewed ( $Skew = .66$ ), with most women having scores below the mid-point of the scale. This suggests that most women had near 0 interest in sex with robots, while some women had ample interest, and a few women had high interest in sex with robots. The effect size for the gender difference on Robosexuality was also moderate, meaning that the difference between groups was easy to

detect, and that there is a marked difference between men and women on wanting to have sex with a robot.

For Robofriendship, although the p-value does not meet the generally accepted threshold of .05, and thus arguably should not be interpreted, I will interpret results with p-values between 0.5 and .10 with caution because this study is novel and exploratory. Women tended to score higher than men on Robofriendship, suggesting that on average women in this population are more open to having robots as friends than men. That said, the overlap in distributions is more striking than the difference, which seems to be driven by a small number of women with very high Robofriendship scores of 6 or 7. The effect size here was also small to moderate, suggesting a stark gender difference between men and women; however, the direction of the difference changed with women being higher than men. Of all the differences, Robofriendship is the only variable on which women were higher, and the effect size suggests that this difference was not small—even though the p-value was slightly above .5.

**Table 4** Gender Means, Standard Deviations, 95% Confidence Interval, t-values, p-values, and effect sizes

Gender Differences	Men	Women	95% CI	<i>t</i>	<i>p</i>	<i>d</i>
Hostile Sexism	3.29 (.57)	2.85 (.89)	[.19, .69]	3.430	<.001	.54
SDO	4.00 (1.17)	3.54 (1.32)	[-.07, .86]	2.320	.021	.37
SOI	4.63 (1.15)	4.45 (1.14)	[-.17, .53]	1.003	.317	.16
Robosexuality	3.96 (1.37)	3.39 (1.35)	[-.15, 1.00]	2.684	.008	.42
Robofriendship	3.19 (.76)	3.47 (.95)	[-.55, .01]	-1.914	.057	.30

*Note.* Hostile Sexism is measured on a scale of 1-5. Social Dominance Orientation (SDO), Robosexuality and Robofriendship are measured on scales of 1-7. Sociosexual Orientation (SOI) was measured on a scale from 1-9.

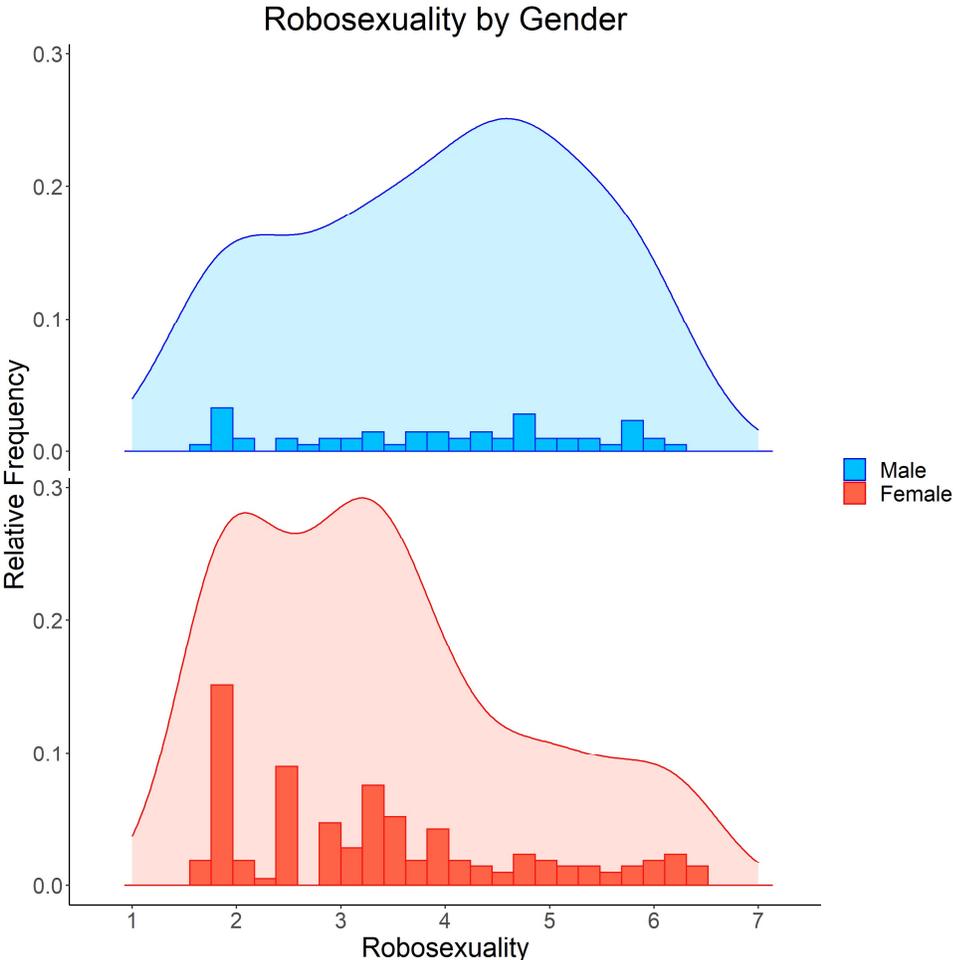


Figure 1. Robosexuality x Gender relative frequency histogram with distribution overlay. Relative frequency is relative to the full sample (74% female). Scale ranged from 1 (Strongly Disagree) to 7 (Strongly Agree). An example of a question from this scale is “I lack sexual interest in sexual activity with a robot”, reverse-coded so that 7 refers to higher interest.

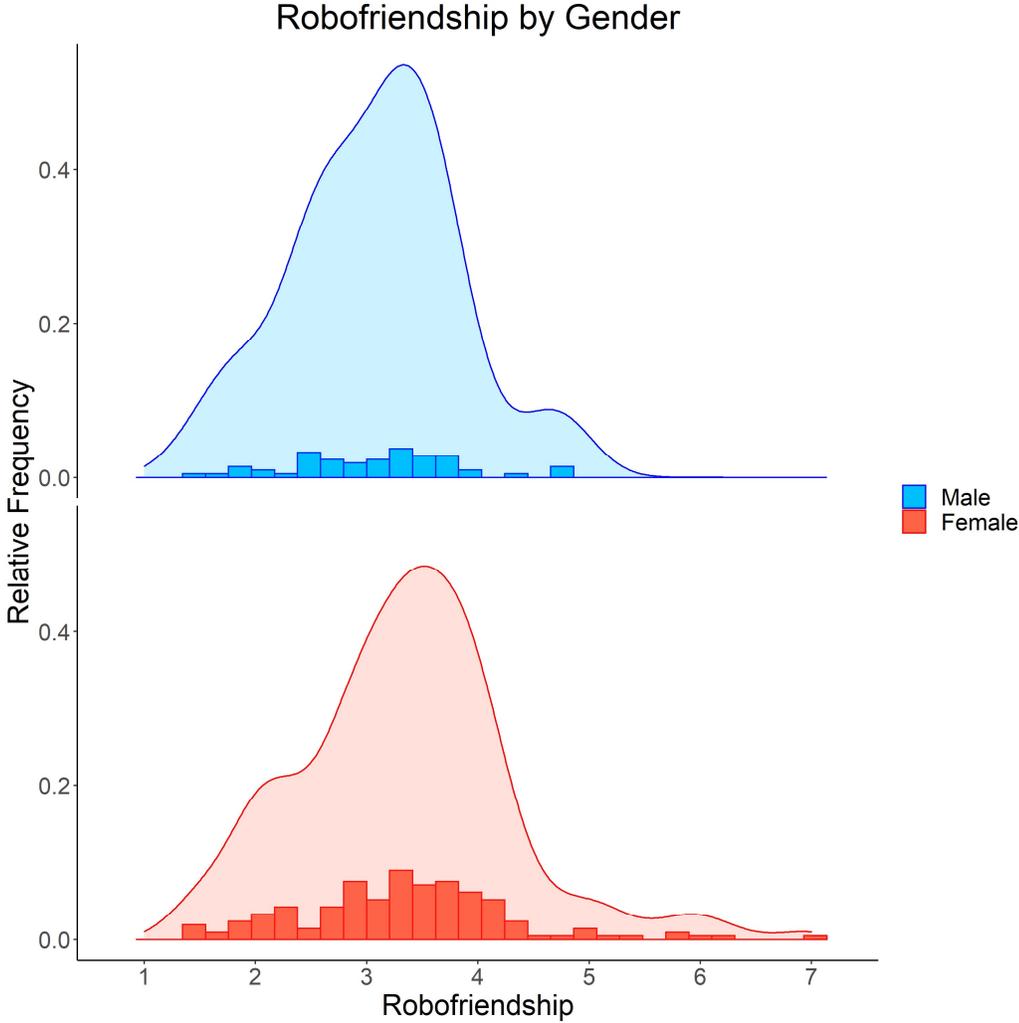


Figure 2. Robofriendship x Gender relative frequency histogram with distribution overlay. Relative frequency is relative to the full sample (74% female). Scale ranged from 1 (Strongly Disagree) to 7 (Strongly Agree). An example of a question from this scale is “I would spend all my free time with my robo-friend.”

*Moderation analyses*

**Robosexuality.** I predicted that hostile sexism, SDO, and SOI (i.e., the *belief variables*) would all positively predict Robosexuality, and I sought to explore whether gender moderated those associations. To test these hypotheses, I used the same basic hierarchical regression model to predict Robosexuality: Step 1) dummy-coded gender (Men = 0, Women = 1) and the mean-centered belief variable; and Step 2) the gender X belief variable interaction. I conducted three regressions in total, one for each outcome. Results are presented in Table 5.

I have already described the main effects of gender and the associations between each belief variable and Robosexuality (see discussion on p. 26). There were main effects of hostile sexism and sociosexual orientation on Robosexuality, such that hostile sexism positively predicts Robosexuality, and SOI negatively predicts Robosexuality. This suggests that having more hostile beliefs toward women also predicts interest in a sex robot. As well, as SOI negatively predicts Robosexuality, this suggests that more interest in casual sex with human partners, or more actual engagement in sex with human partners, relates to having less interest in a partner substitute like a robot. Although none of the interactions were significant at  $\alpha = .05$ , the interaction between gender and social dominance orientation had a p-value below 0.100, so I interpreted this finding with caution. Men's SDO was unrelated to Robosexuality,  $\beta = -.30$ ,  $b = -.31$ , 95% CI [-.94, .31],  $t(208) = -.991$ ,  $p = .323$ . Women's SDO was also unrelated to Robosexuality,  $\beta = .13$ ,  $b = .14$ , 95% CI [-.03, .31],  $t(208) = 1.62$ ,  $p = .11$ . However, while there was a gender difference at low levels of SDO,  $\beta = -.30$ ,  $b = -.93$ , 95% CI [-1.6, -.26],  $t(208) = -2.746$ ,  $p = .007$ , there was no gender difference at high levels of SDO,  $\beta = -.05$ ,  $b = -.15$ , 95% CI [-.69, .4],  $t(208) = -.535$ ,  $p = .593$ . This finding indicates that men are higher than women on Robosexuality at lower levels of SDO, but both men and women are about equal in their desire

for sex with a robot at higher levels of SDO. This suggests that one reason that men are generally more interested in sex with robots may be because men are typically higher in SDO than women (Sidanius & Pratto, 1996).

Table 5  
*Results of hierarchical linear regressions predicting Robosexuality.*

Predictor	$\beta$	$b$	95% CI	$t$	$p$	$\Delta R^2$	$f^2$
<i>Step 1 (df = 209)</i>						.058**	.026
Gender	-.14	-.45	[-.28, -.01]	-2.096	.037		
Hostile Sexism	.16	.27	[.03, .30]	2.364	.019		
<i>Step 2 (df = 208)</i>						.058**	<.001
Hostile Sexism X Gender	.02	.02	[-.065, .069]	.058	.954		
<i>Step 1 (df = 209)</i>						.078**	.047
Gender	-.15	-.46	[-.28, -.02]	-2.204	.029		
Social Dominance Orientation	.21	.23	[.08, .35]	3.186	.017		
<i>Step 2 (df = 208)</i>						.091**	.013
Social Dominance Orientation X Gender	.52	.30	[-.04, .064]	1.751	.081		
<i>Step 1 (df = 209)</i>						.075***	.044
Gender	-.20	-.62	[-.34, -.07]	-2.942	.004		
Sociosexual Orientation	-.20	-.25	[-.40, -.09]	-3.063	.002		
<i>Step 2 (df = 208)</i>						.075**	<.001
Sociosexual Orientation X Gender	.05	.03	[-.04, .064]	.189	.851		

Note. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

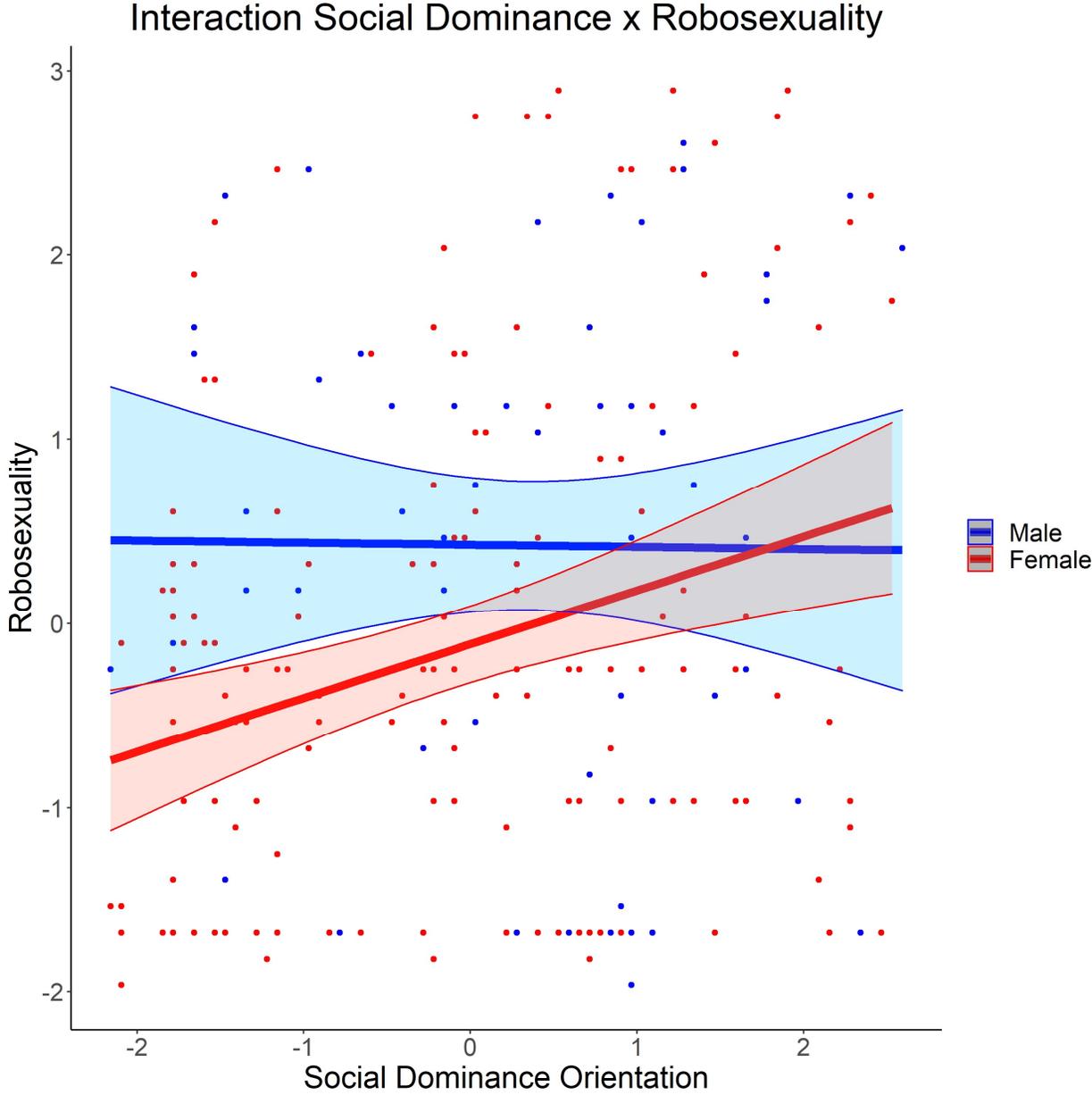


Figure 3. Interaction between participant aggregate scores on social dominance orientation and Robosexuality. Data points are mean-centered. The shaded area around each line represents the 95% confidence interval for that estimate.

**Robofriendship.** I predicted that only SDO would positively predict Robofriendship, and that hostile sexism and gender would not predict Robofriendship. I also had an exploratory hypothesis to see if SOI related to Robofriendship. I used the same regressions I described previously to test these predictions (see Table 6 and Figure 4). Once again, I have already described the main effects of gender and the associations between each belief variable and Robosexuality (see discussion on p. 26). There was a significant main effect of hostile sexism, where hostile sexism negatively predicted Robofriendship. This suggests that, if people have hostile beliefs toward women, they probably will not want to have a robot as a friend. While there were no statements made about the gender of the robot in the study because robots are prototypically feminine (Donald, 2019), people may have assumed the robot would have been female or feminine. Further, although none of the interactions were significant at  $\alpha = .05$ , the interaction between gender and social dominance orientation had a p-value below 0.100, so once again I interpreted this finding with caution. For men, as SDO increased, Robofriendship stayed the same,  $\beta = .39$ ,  $b = .27$ , 95% CI [-.15, .70],  $t(208) = 1.268$ ,  $p = .206$ . There was also no relationship between women and SDO on Robofriendship,  $\beta = -.05$ ,  $b = -.03$ , 95% CI [-.15, .08],  $t(208) = -0.541$ ,  $p = .589$ . But similar to Robosexuality, while there was a difference between men and women in Robofriendship at low levels of SDO  $\beta = .26$ ,  $b = .54$ , 95% CI [.09, .99],  $t(208) = -2.235$ ,  $p = .02$ , this effect was not present at high levels of SDO,  $\beta = .10$ ,  $b = .07$ , 95% CI [-.36, .39],  $t(208) = .671$ ,  $p = .503$ . Once again, this suggests that gender differences in SDO may help to explain gender differences in Robosexuality.

Table 6  
*Results of hierarchical linear regressions predicting Robofriendship.*

Predictor	Quality of Robot Friendship							
	$\beta$	$b$	95% CI	$t$	$p$	$\Delta R^2$	$f^2$	
<i>Step 1 (df = 210)</i>							.043*	.027
Gender	.09	.19	[-.04, .23]	1.337	.183			
Hostile Sexism	-.16	-.18	[-.30, -.03]	-2.369	.019			
<i>Step 2 (df = 209)</i>							.047*	.004
Hostile Sexism X Gender	-.37	-.22	[-.66, .23]	-.950	.343			
<i>Step 1 (df = 209)</i>							.033**	.017
Gender	.11	.23	[-.26, .01]	1.606	.109			
Social Dominance Orientation	-.13	-.09	[-.03, .25]	-1.865	.064			
<i>Step 2 (df = 208)</i>							.047**	.014
Social Dominance Orientation X Gender	-.53	-.20	[-.44, .03]	-1.730	.085			
<i>Step 1 (df = 209)</i>							.018	.001
Gender	.13	.28	[-.00, .27]	1.943	.053			
Sociosexual Orientation	.04	.03	[-.10, .17]	.531	.596			
<i>Step 2 (df = 208)</i>							.018	<.001
Sociosexual Orientation X Gender	-.20	-.09	[-.34, .16]	-.726	.468			

*Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

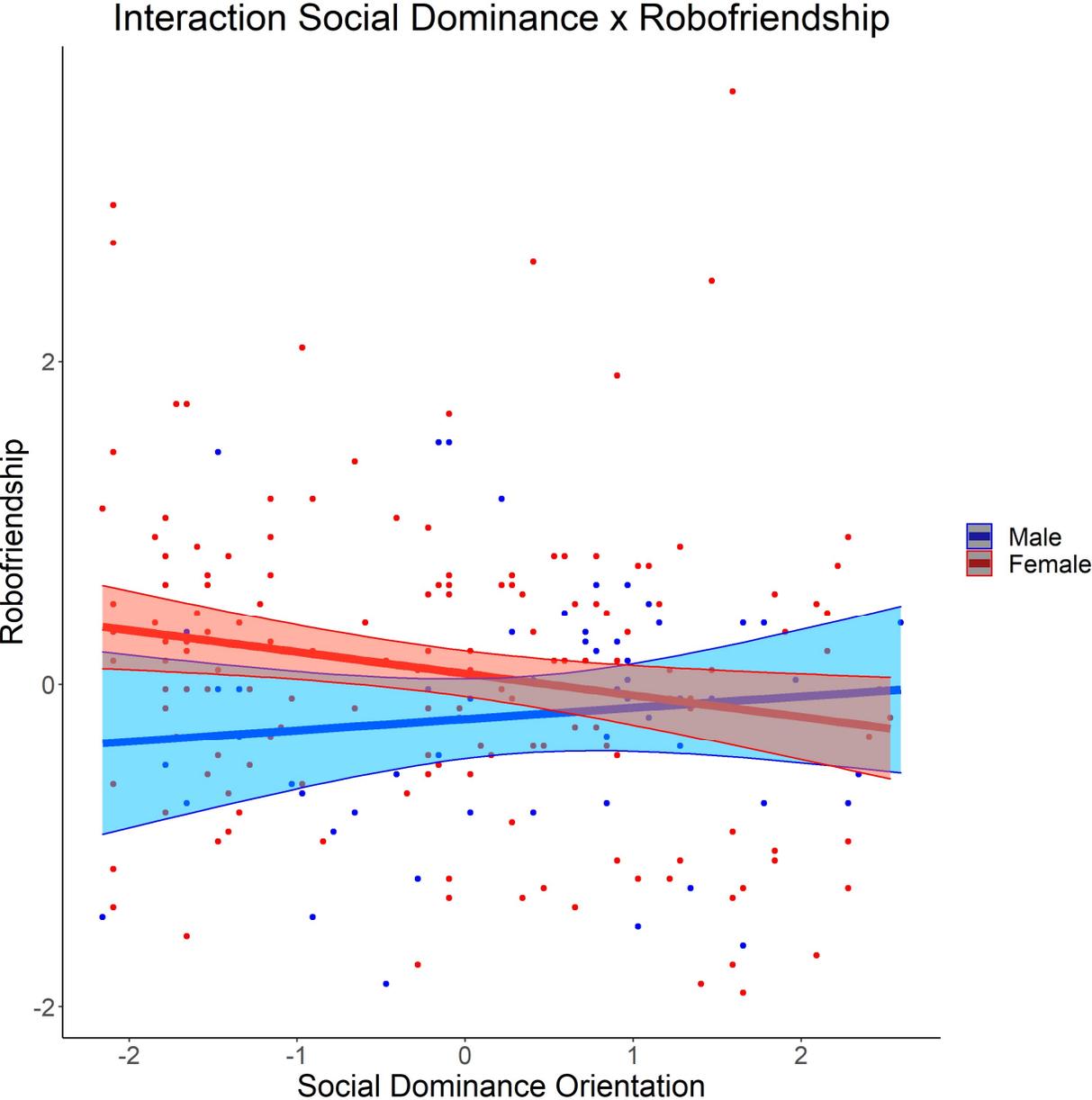


Figure 4. Interaction between participant aggregate scores on social dominance orientation and Robosexuality. Data points are mean-centered. The shaded area around each line represents the 95% confidence interval for that estimate.

### *Mediation Analysis*

Lastly, I tested whether gender has an indirect effect on Robosexuality via hostile sexism (i.e., gender  $\rightarrow$  hostile sexism  $\rightarrow$  Robosexuality). First, I regressed Robosexuality on gender. Results confirmed that men scored higher on Robosexuality compared to women,  $\beta = -.18$ ,  $b = -.57$ , 95% CI [-.99, -.15],  $t(210) = 2.684$ ,  $p = .008$ ,  $\Delta R^2 = .29$  (path  $c'$  in Figure 5). Then I regressed hostile sexism on gender. Results confirmed that men had higher hostile sexism than women,  $\beta = -.23$ ,  $b = -.44$ , 95% CI [-.69, -.19],  $t(210) = -3.431$ ,  $p = <.001$ ,  $\Delta R^2 = .49$  (path  $a$  in Figure 5). Next, I regressed Robosexuality onto: Step 1) gender; and Step 2) hostile sexism. Controlling for gender, higher hostile sexism predicted increased Robosexuality,  $\beta = .16$ ,  $b = .27$ , 95% CI [.04, .49],  $t(209) = 2.364$ ,  $p = .019$ ,  $\Delta R^2 = .05$  (path  $b$  in Figure 5). Last, I used the *lavaan* function in R (Rosseel, 2012) using 5,000 bootstrap samples to estimate the 95% bias-corrected CI of the indirect path from gender to Robosexuality via hostile sexism (i.e., path  $ab$ ). Using this method, the indirect path is considered statistically significant at  $\alpha = .05$ , and partial mediation present, when zero is not contained within the 95% CI. Results revealed that the indirect path was statistically significant, indirect path =  $-.118$ ,  $SE = .057$ , 95% CI [-.237, -.018]. Consistent with my hypothesis, these results indicate that gender predicts greater levels of hostile sexism, which in turn predicts greater Robosexuality. This finding suggests that hostile sexism plays a role in why people—mostly men—are interested in sex robots. The direct path was also still significant when hostile sexism was included in the regression, direct path =  $-.453$ ,  $SE = .220$ , 95% CI [-.883, -.014], suggesting that hostile sexism does not fully explain why men are more interested in sex with robots compared to women. While gender still predicts this relationship, there is most likely an unmeasured mediator that relates to Robosexuality.

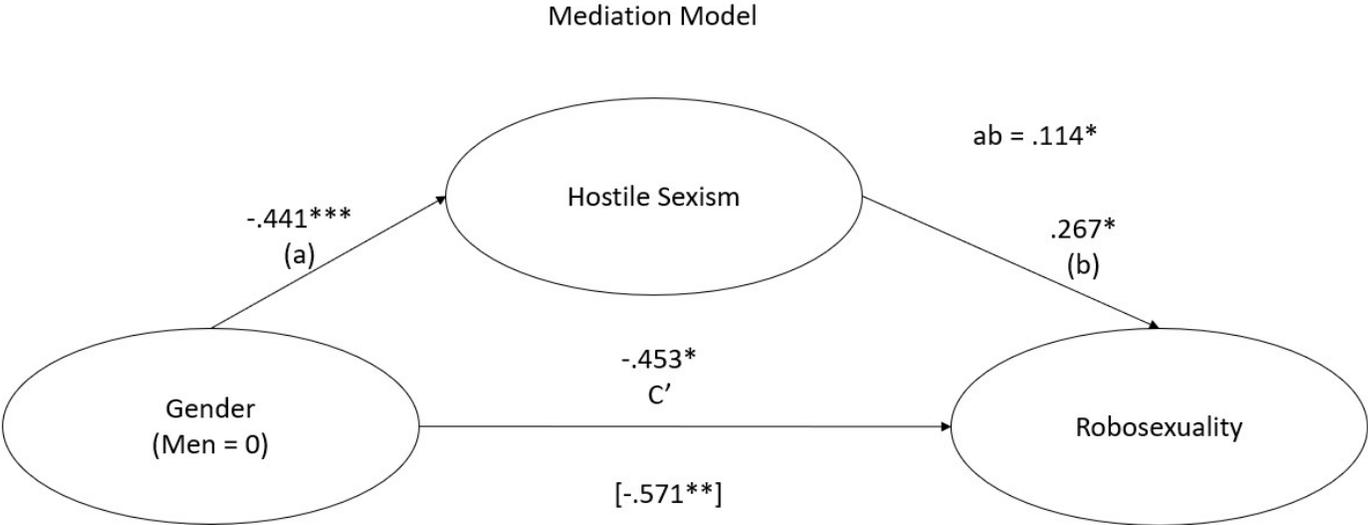


Figure 5. Results of mediation between gender and Robosexuality with hostile sexism. Both the direct and indirect paths were significant. Value in brackets represents c-path without mediation. Note. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

### General Discussion

The goal of this study was to investigate how gender, hostile sexism, social dominance orientation, and sociosexual orientation predict Robosexuality or Robofriendship. Men were higher on social dominance orientation and hostile sexism than women, and there was no difference between genders on sociosexual orientation. A significant effect of gender on Robosexuality suggests that men are higher on Robosexuality than women, and this relationship was reversed for Robofriendship with women having higher scores. Further, as social dominance orientation and hostile sexism increased, so too did interest in having sex with robots. This effect was reversed with sociosexual orientation negatively predicting interest in having sex with a robot. Only hostile sexism predicted Robofriendship when I had predicted that social dominance orientation would predict Robofriendship. There were two marginally significant interactions where social dominance orientation interacted with gender to predict Robosexuality and Robofriendship. However, none of the simple slopes were significant, meaning that the scores for men nor women changed across scores of SDO. Lastly, hostile sexism partially explained gender differences in Robosexuality, with men having more hostile sexist beliefs, and hostile sexism predicting interest in sex with a robot. The direct effect between gender and Robosexuality was still present.

First, I focus on how gender relates to the different belief variables as well as Robosexuality and Robofriendship. I hypothesized that men would be higher on hostile sexism, SDO, and Robosexuality compared to women, whereas men and women would be equal on sociosexual orientation and Robofriendship. Men were higher on SDO, hostile sexism, and Robosexuality. Women were only higher than men on Robofriendship. Last, men and women were statistically equal on sociosexual orientation. The gender main effects disappear, however,

when gender interacts with SDO. As the results of the correlation analyses suggested that Robosexuality and Robofriendship were negatively correlated, it is unsurprising that there are differences between men and women on Robosexuality and Robofriendship. Differences across gender have been apparent in previous sex robot research (Appel et al., 2019; Nordmo et al., 2020), so this effect being present in this sample as well suggests that this effect is likely supported in a variety of samples. However, outside of samples with children, I am unaware of a finding that women are more interested in robot friends than men are. It should also be noted that sexual orientation and sexual desire were beyond the scope of this study, but these results might be different for men-loving-men (MLM) and women-loving women (WLW). Unfortunately, this study attracted less than ten total people from the MLM and WLW communities, and the number of bisexual people was below 20% (see Table 2), so moderation analyses with this present dataset was not feasible. Future research should take care to examine how sexual orientation might moderate the gender findings, as Gender and Sexual Minorities (GSM) might have different interests in robot partners than the cisgender and (mostly) heterosexual participants in my research.

Next, I examine the relationship between social dominance orientation, hostile sexism, and sociosexual orientation, and if they predict Robosexuality and Robofriendship. First, I hypothesized that all three belief variables would positively predict Robosexuality, such that people with higher scores on the three variables would be more interested in sex with a robot. First, hostile sexism positively predicted Robosexuality, while SOI negatively predicted Robosexuality, such that people who had higher scores of SOI were less interested in sex with robots. While SDO was significant, the interaction between SDO and gender was also significant, so I interpret the interaction effect below. This finding suggests that people who have

hostile or differential views toward women are more interested in acting on those beliefs with sex robots. Perhaps people engaging in casual sex do not need a sex robot as a partner because they have less difficulty finding partners to have sex with than someone who scores lower on SOI. While more study is needed to unpack the exact findings, the results suggest that beliefs about gender inequality predict interest in sex with a robot, and that engagement with or availability of partners for casual sex makes intercourse with a robot less appealing.

For Robofriendship, I hypothesized that only social dominance orientation would significantly predict Robofriendship, such that higher scores on SDO would only predict wanting to have a robot friend. As well, I explored whether SOI significantly predicted Robofriendship. Briefly, SOI did not predict interest in a robot friend, suggesting that people who were low on SOI had no more interest in a platonic robot friend than those high on SOI. Contrary to my expectations, only hostile sexism predicted Robofriendship, and social dominance orientation did not (although the significant interaction with SDO and gender is discussed below). More specifically, the findings suggested people high on hostile sexism wanted a robot friend *less* than people who were low on hostile sexism. This finding could be because many modern technologies that humans engage with are prototypically feminine—such as Siri, Cortana, Alexa, etc. (Donald, 2019), and having hostile beliefs about women may make someone less interested in a robot as a friend. The fact that women were only higher than men on Robofriendship also suggests that there is some effect of gender, as women were more interested in a robot friend, and people who dislike women were less interested in a robot friend. A person's heuristic about robots may be that they are all womanlike based on their previous experience with Siri and Alexa, and if someone dislikes women, they may be less interested in a robot friend. Future

research should examine what people imagine when they think of a robot, as different imaginations may lead to different responses depending on the participant.

Next, I consider the results of the moderation analyses. These moderations explored if men and women differed across scores of the belief variables. The results suggested that for both Robosexuality and Robofriendship, while men's and women's scores were constant across levels of SDO. For men, Robosexuality was constant regardless of how they viewed other groups. For women, may have been misleading, as figure 3 seems to depict an increase as scores increased for SDO. While women did increase across scores of SDO, there were very few women with high scores on SDO, while most of the women's scores were at or below the mean (see figure 3). The skew was also somewhat notable and positive, suggesting fewer scores at the upper end of the distribution. There might be a significant simple slope for women on robosexuality as SDO increases, but there may have not been enough women with higher scores on SDO to support that finding. While there might have been enough power to detect such an effect for women, there should be care in future research to find participants who are normally distributed across SDO or other similar variables where participants may tend to score lower—people may not want to appear racist or against other groups so they may score lower.

For Robofriendship, while the interaction was marginally significant, once again the simple slopes were both not significant. The reason for this may be different than the effect happening for Robosexuality. In this sample, both male and female participants had scores that seemed to be centered around the midpoint. The interaction was significant because men's scores slightly increased while women's scores slightly decreased. However, both the scores for men and women seemed to be around the midpoint of the scale with a few extreme scores on both ends. People in this sample may be more interested in a robot friend than a robot for sex, and

SDO seems to play a role in how this difference in interest might manifest. But because most of the people in the sample were about neutral on the idea of sex with robots, the slopes could be flat while the interaction was driven by small differences across scores of SDO. Future research should aim to replicate this finding with more equal samples and either more advanced robots or better depictions of robots. Equal samples might create a better depiction of actual differences in gender, and people may have more diverse opinions about robots if robots are more advanced in society, or people can engage with a robot in advance of answering a questionnaire.

Following the tests of the simple slopes, I tested if there were differences between men and women at lower levels and higher levels of SDO. The findings suggested that men were higher on Robosexuality at lower levels of SDO, and that men and women were about equal on Robosexuality at higher levels of SDO. At the same time, women were higher on Robofriendship at lower levels of SDO, and both men and women were about equal on Robofriendship at higher levels of SDO. This suggests that men and women in this sample are about the same when they think they have more power than other groups, and this predicts their interest in sex with and friendship with robots, with women increasing on Robosexuality and men increasing on Robofriendship at higher levels of SDO. This finding suggests that SDO does not necessarily predict higher Robosexuality and Robofriendship overall, but rather, in this sample, that higher SDO makes it so men and women both have the same Robosexuality and Robofriendship.

Lastly, I predicted that men would be higher on hostile sexism than women, and that hostile sexism would fully mediate the relationship between gender and Robosexuality. I have already discussed the finding that men were higher on hostile sexism (discussion on p. 38). Hostile sexism as a mediator also predicted Robosexuality, such that higher scores on hostile sexism predicted Robosexuality. The indirect path was also significant, such that men were more

hostile sexist, and hostile sexism predicted Robosexuality. This effect was not a full mediation, however, and men were still higher on Robosexuality than women were regardless of hostile sexism. What this partial mediation suggests is that while hostile sexism likely plays a role in Robosexuality, there is likely another unmeasured mediator accounting for this effect. One mediator worth measuring could be a variable like Erotophilia (Fisher, White, Byrne & Kelley, 1988), which measures someone's interest in different kinks and fetishes. As an example, a man may not be interested in sex with a robot because he is sexist, but if he is both sexist and found the robot in *Her* enticing, this combination of factors may tip the scale in Robosexuality's favor. To my knowledge, this is the first study to find evidence for a variable that mediates the relationship between gender and Robosexuality, and it should provide a foundation for future studies to do the same. With that said, future studies should take care to use a more diverse sample, validated measures, and attempt to measure participants on more than one occasion to determine whether these findings are consistent and represent universal beliefs and interests.

### Limitations

This study has a number of limitations to address. First, the overall size of the sample is small for this type of analyses. Robosexuality scores were statistically significantly greater for men than for women, but the opposite directional difference between men's and women's Robofriendship was not statistically significant. It may be that the latter outcome was a Type II error due to inadequate statistical power. Second, the numbers of men and women in the study were not equal, as the first iteration of this study had 157 women and 32 men. I collected more data from men in the same population and increased the number of male participants from 32 to 55, but there was still nearly three times as many women and men. The representativeness of the sample was another limitation, as all were undergraduate students at the University of Victoria and hence most of the participants were Caucasian or Asian, young, and high socio-economic status. Studies featuring these participants make up a vast majority of the studies in social psychology, so there is little representativeness for a number of important groups (Heinrich, Heine, & Norenzayan, 2012). Most research on robots also takes place in European, North American, and Asian countries (Reich-Stiebert, Eyszel, & Hohnemann, 2019), meaning a lack of Hispanic and Black participants is even more problematic and misses key, underrepresented groups. As well, more than 75% of the sample self-reported as straight, whereas the remaining 25% identified as primarily bisexual, and other GSM. While these findings may be representative of a university in British Columbia, the results here hardly shed light on *Robosexuality* and *Robofriendship* in the global south, as an example. There might be significant interest in Brazil or Indonesia in robots for sex and friendship, but this study does not claim to make any conclusions about those people. Perhaps there are traits in other communities and countries, such as height and skin color, that fit preferences in those populations, but not in

others. It is also important to run this study in a GSM group, as GSM would ostensibly like robots that fit a sexual preference which differs from heterosexual participants. Gay and bisexual men could have the same interest as women in robots, or their inclusion might lead to the design of robots that might include body types that fit into their tribal subculture (i.e., bears and otters; Prestage et al., 2015). Overall, this study was able to present information about primarily heterosexual, white women, with some meaningful information also from bisexual people, Asian people, and men in a WEIRD, pacific-northwest sample. Future research should be conducted to address those missing responses. While this may take a lot of time and require multiple studies and replications in a variety of populations, it is important that researchers attempt to understand who might be interested in robots for sex and friendship, and why.

Second, this research lacked validated measures for predicting interest in robots. As explained in the Method section, I created the Robosexuality and Robofriendship scales by modifying the Asexuality Identification Scale (AIS; Yule et al., 2015) and the Friendship Qualities Scale (FQS; Bukowski et al., 1994), respectively. The AIS has had good reliability in follow-up studies ( $\alpha = .95$ ; Zheng & Su, 2018), as has the FQS ( $.71 \leq \alpha \leq .86$ ; Bukowski et al., 1994). While Robosexuality and Robofriendship were both reliable in this study, internal reliability is a low-bar basis for assessing the psychometric qualities of a measure (see Flake & Fried, 2020). I am not aware of assessments of the validity of the underlying measures on which RS and RF were based. There are scales for asking children what it might be like to interact with a robot (Robert & van den Bergh, 2014) and what level of rapport children have with robots (Nomura & Kanda, 2015); however, these are more suitable for when humans interact directly with a robot prototype. I considered using a scale focused on human expectations for future robots (Lu, Cai & Gursoy, 2019), but those questions were more focused on service robots rather

than robots for interpersonal relationships. There was a recent scale that examined the general beliefs around personal relationships with robots (Morsunbul, 2019), but this scale only asked participants yes or no questions. To my knowledge, no scale yet exists to ask participants if and to what degree they would engage with robots for friendship or for sex. The creation and validation of a scale that examines interpersonal relationships with robots is outside the scope of this study, but the lack of a validated scale limits the generalizability of the results considerably.

Third, survey methods are entirely self-report and are only snapshots of the time they are answered in. People can answer a survey however they want, and there is no guarantee that someone's responses are completely true to the individual, or if someone's score is equal to another person's score. A 4 for someone may be a 3 for another person, after all. Further, because these responses were both anonymous and for credit, it is impossible to know if someone's responses were truthful. Someone may want to save face out of a worry that responses are not truly accurate, or they may just complete the survey absentmindedly to receive the credit. This accuracy also is also dependent on both how advanced robots are and how much the public knows about robots, because this research relies on how participants imagine robots. Unless one or multiple governments are hiding such a creation, no Turing robot currently exists, and this will limit how much someone will want to engage with one—are they engaging with a simple robot or one that can learn to be a better friend or sex partner? If the behaviors of robots are limited by the current level of technology, then the number of people interested in having a digital companion is also limited. Work in human-robot interaction is constantly changing, with new findings becoming possible as robotic technology improves. But, as technology advances, more in-depth research becomes possible, and a bounty of future directions can be undertaken by social scientists and engineers alike.

It is challenging to envision the reproducibility of all facets of this research. This study was conducted during a pandemic, and hence loneliness and other pandemic-induced psychological states may have influenced my results. The study was conducted in a small sample of a WEIRD (Heinrich, Heine & Norenzayan, 2012) population. While there is some evidence that the gender effects might reproduce (Appel et al., 2019), the lack of a validated measures of the key constructs of robosexuality and robofriendship might undermine confidence in the findings. As this study was exploratory, no claims are made here that the results will generalize to samples in other parts of the world; instead, this study provides some evidence that these findings may arise in other samples, and further analysis is necessary. One strength of this study is its empirical nature, as the number of human-robot interaction studies is fairly limited, and this study provides another avenue for roboticists and social scientists to consider. Moreover, to aid in this future research, I made the dataset, syntax, and output available to interested parties on the Open Science Framework (<https://osf.io/rv8xg/>).

### **Future Directions**

This research has several potential future directions. I believe the most important follow-up is a longitudinal survey, measuring how much people want to interface with robots each year. It is important to track this information regularly as technology improves every day, and manufacturers can address the wants of the general populace. Marketing may also improve, and the more advanced robots become, the more they may be part of our daily lives. Someone might be against robots one day, but may meet one at a hotel or restaurant, and suddenly be more open to having one in their personal life. While this study lacks generalizability to any population outside Pacific Northwest universities, the findings here can be used to inform later studies.

As well, future iterations of this research should provide visual examples of robots, or have participants describe the robot they are imagining. This study asked participants to consider their interest in a robot that matched their perfect desires, and the results reflect upon that perfect robot. Unfortunately, there is no guarantee a robot will be made any time soon that matches each respondent's perfect interest. Showing participants robots may shift their interest or desire from their perfect partner, as they might hope for R2D2 but instead get C3PO. Previous research in human-robot interactions has allowed participants to engage with actual robots (Aaltonen, Arvola, Heikkilä & Lammi, 2017; Doering et al., 2015; Samani & Sadatian, 2012) or toys that participants believe are robots (Horstmann et al., 2018; Reeves & Nass, 1996), and these designs have allowed participants to draw conclusions based on actual experiences. If someone who hates the idea of robots can see or interact with a robot, their initial perceptions may shift drastically. If researchers know what traits participants want to see in a robot, it will help researchers and manufacturers pinpoint exactly what people want in a robot partner. I already mentioned that these findings would be bolstered by knowing what people think of when they

imagine such a robot—if respondents either describe their imagined robot, or if a robot is provided for a respondent to engage with, it will provide important information that this research can only make assumptions about.

One other future direction relates to my decision to let participants imagine their robo-partner, rather than providing real robots for participants to look at and engage with. Because of this, I don't know what participants imagined for their ideal robot. Although some robots do exist, they are not at the point where they look human, think like humans, or act human, so it is not currently possible for participants to engage with a robot in the manner described in my hypothetical scenario. Thus, I asked participants to think of their ideal robot that fit their ideals on the aforementioned traits, then to answer questions related to robosexuality and robofriendship. Future iterations of this research should ask participants to describe the robot they were imagining—not only to concretize their mental imagery, but also so researchers can understand what the ideal robot for each participant might look like. This would allow researchers to learn if there are overlapping traits in preferences for robots, and if certain traits might lend themselves to follow-up responses from participants. As an extra benefit, it would also allow researchers to know if a participant interested in same-sex relationships, or participants without a sexual preference, envision a robot with particular gender traits.

### Conclusion

The field of human-robot interaction is still relatively nascent, and there is still a lot of work to do before having a firm foundation in empirical analysis. Researchers across disciplines need to work together to advance the field of social robotics—a field which many still view as science fiction. Robots are far from being what is proposed in this thesis, but the research must start now so that scientists across disciplines are ready when robots become widely available. Every year, more films and stories positing relationships between humans and robots are released—science fiction began this journey nearly a century ago, and now reality is finally catching up. At the time of writing, one of the largest media franchises, the Marvel Cinematic Universe, just finished airing an original show featuring a woman married to an AI robot in *Wandavision* (Schaeffer, 2021). There are likely many more stories to come. These fictions are a boon for the field because it creates a prototype for the layperson to point to when asked if they want a robot friend or for sex. Roboticists and social scientists are undoubtedly watching these discoveries closely (Clocksin, 2003). While using the prototypes presented in this study may be flawed as actual robots may act much differently, it is important to understand how interest in robots increases or decreases, and why those interests may be present in the first place.

Although this study had several limitations, it may help create forward momentum. To my knowledge, it is one of the first studies to provide evidence that Robosexuality is predicted by beliefs about group inequality. This may impact the trajectory of ethics and research moving forward, as the reason some people want a robot is specifically to use it to get their own needs met. It will be important to monitor how beliefs change and robots approach humanity, as people may treat robots more humanely when they interact with one (Reeves & Nass, 1996). As things stand, this research is an important step for both interpersonal relationships and social

psychology, as the advancement of robots can significantly impact both disciplines. Who is to say that findings in social psychology will still hold up when a psychologist runs a classic study with a robot? While it is hard to know exactly what the future holds, I close this paper on the *Final Jeopardy Answer* by *Jeopardy* record-holder Ken Jennings. After his defeat at the hands of IBM's Watson supercomputer, despite Jennings' own vast knowledge of trivia, he acknowledges his loss and concludes the episode with one phrase: "I for one welcome our new computer overlords" (Jennings, 2011).

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**Appendix A.****Full Survey**

Below are the items used in the survey. Any item number with an R (i.e., Hos\_Sex\_4\_R) is reverse-coded. When numeric values are not in order, this reflects recommendations for order from the original measure.

You are going to be shown a series of questions asking about you. Please answer each question to the best of your ability.

SOI\_B1 With how many different partners have you had sex within the past 12 months?

- 0
- 1
- 2
- 3
- 4
- 5-6
- 7-9
- 10-19
- 20 or more

SOI\_B2 With how many different partners have you had sex with on one, and only one, occasion?

- 0
- 1
- 2
- 3
- 4
- 5-6
- 7-9
- 10-19
- 20

SOI\_B3 With how many different partners have you had sex without having an interest in a long-term committed relationship with this person?

- 0
- 1
- 2
- 3

- 4
- 5-6
- 7-9
- 10-19
- 20

SOI\_A1 Sex without love is OK.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Somewhat Agree
- Agree
- Strongly Agree

SOI\_A2 I can imagine myself being comfortable and enjoying "casual" sex with different partners.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Somewhat Agree
- Agree
- Strongly Agree

SOI\_A3\_R I do *not* want to have sex with a person until I am sure that we will have a long-term, serious relationship.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Somewhat Agree
- Agree
- Strongly Agree

SOI\_D1 How often do you have fantasies about having sex with someone you are not in a committed romantic relationship with?

- Never
- Very Seldom
- About Once Every Two or Three Months
- About Once a Month
- About Once Every Two Weeks
- About Once a Week
- Several Times Per Week
- Nearly Every Day
- At Least Once a Day

SOI\_D2 How often do you experience sexual arousal when you are in contact with someone you are not in a committed romantic relationship with?

- Never
- Very Seldom
- About Once Every Two or Three Months
- About Once a Month
- About Once Every Two Weeks
- About Once a Week
- Several Times Per Week
- Nearly Every Day
- At Least Once a Day

SOI\_D3 In everyday life, how often do you have spontaneous fantasies about having sex with someone you have just met?

- Never
- Very Seldom
- About Once Every Two or Three Months
- About Once a Month
- About Once Every Two Weeks
- About Once a Week
- Several Times Per Week
- Nearly Every Day
- At Least Once a Day

You are going to be shown a series of questions asking about you. Please answer each question to the best of your ability.

Hos\_Sex\_1 Many women seek special favors, such as hiring policies that favor them over men, under the guise of asking for "Equality".

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_2 Most women interpret innocent remarks or acts as being sexist.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_3 Women are too easily offended.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_4\_R Feminists are not seeking for women to have more power than men.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_5 Most women fail to appreciate fully all that men do for them.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_6 Women seek to gain power by getting control over men.

- Strongly Disagree
- Disagree
- Neither agree nor disagree

- Agree
- Strongly Agree

Hos\_Sex\_7 Women exaggerate problems they have at work.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_8 Once a woman gets a man to commit to her, she usually tries to put him on a tight leash.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_9 When women lose to men in a fair competition, they typically complain about being discriminated against.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_10\_R There are very few women who get a kick out of teasing men by seeming sexually available, and then refusing male advances.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

Hos\_Sex\_11\_R Feminists are making entirely reasonable demands of men.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly Agree

You are going to be shown a series of questions asking about you. Please answer each question to the best of your ability.

SocDom\_1 Some groups of people are just more worthy than others.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_2 In getting what your group wants, it is sometimes necessary to use force.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_9\_R It would be good if all groups could be equal.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_3 It's OK if some groups have more of a chance in life than others.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_12\_R We should do what we can to equalize conditions for different groups.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_4 To get ahead in life, it is sometimes necessary to step on others groups.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_10\_R Group equality should be our ideal

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_14\_R We would have fewer problems if we treated different groups more equally.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_5 If certain groups of people stayed in their place, we would have fewer problems.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_13\_R We should increase social equality.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_6 It's probably a good thing that certain groups are at the bottom and other groups are at the top.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_11\_R All groups should be given an equal chance in life.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_7 Inferior groups should stay in their place.

- Strongly Disagree
- Disagree

- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_15\_R We should strive to make incomes for different people in the same positions equal.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_8 Sometimes other groups must be kept in their place.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

SocDom\_16\_R No one group should dominate in society.

- Strongly Disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

You win a raffle tomorrow and for your prize you are given a robo-friend. This robot 1) looks and feels human and 2) acts and behaves in a believably human way. Imagine how this robot might look or act, and how you might engage with such a robot. Answer the following questions on a scale of Strongly Disagree to Strongly Agree.

FQS-COM-1 I would spend all my free time with my robo-friend.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-COM-2 My robo-friend would think of fun things for us to do together.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-COM-3 I could just sit around with my robo-friend and talk about school, work, or things we like.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-CON-1 My robo-friend could bug me or annoy me even when I ask them not to.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-CON-2 My robo-friend and I would argue a lot.

- Strongly Disagree
- Disagree
- Slightly Disagree

- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-AID-1 My robo-friend would help me if I was having trouble with something.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-AID-2 My robo-friend would help me if I needed it.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-PRO-1 If I was being bothered by a group of people, my robot friend would help me.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-PRO-2 My robo-friend would stick up for me if someone was causing me trouble.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-ALL-1 If I had a problem at home or work, I could talk to my robo-friend about it.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-ALL-2 If there was something bothering me, I could tell my robo-friend about it even if it was something I could not tell to other people.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-TRA-1 If I said I was sorry after having a fight with my robo-friend, they would still be mad at me.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-TRA-2 If my robo-friend had a fight or argument, I could say "I'm sorry" and everything would be alright.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-AFF-1 If my robo-friend broke or were taken from me, I would miss them.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-AFF-2 I would feel happy with my robo-friend.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-APP-1 My robo-friend would be happy for me if I did a good job at something.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

FQS-APP-2 My robo-friend would do things for me or make me feel special.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

You get a call from the manufacturer that handles the raffle. Since you have so much experience with your robo-friend, they are giving you the opportunity to try out a robot from their adult brand of sex robots. All you have to do is answer the questions in this

survey. No matter what you say, we will still send you the robot to try out if you want one. *Note.* All items are reverse-coded as the original scale was written for asexuality.

ROBO-ASEX-1 I could experience sexual attraction toward a robot.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-2 I lack interest in sexual activity with a robot.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-3 The thought of sexual activity with a robot repulses me.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-4 I have previously found myself experiencing sexual attraction toward a robot.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-5 I am confused by imagining how much interest and time other people put into romantic and sexual relationships with robots.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-6 I would be content if I never had sex with a robot.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

ROBO-ASEX-7 My ideal relationship would not involve sexual activity with a robot.

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neither Agree nor Disagree
- Slightly Agree
- Agree
- Strongly Agree

Age How Old Are You? (Please answers using numbers; i.e., 24):

\_\_\_\_\_

Gender What gender do you identify as?

- Agender
- Genderfluid
- Gender Non-Conforming
- Genderqueer
- Cis-Man
- Non-Binary
- Transman
- Transwoman

- Cis-Woman
- Other
- I choose not to disclose

Q94 What best describes your sexuality?

- Straight
- Gay
- Lesbian
- Asexual
- Bisexual
- Pansexual
- Other: \_\_\_\_\_

Ethnicity? How would you best describe yourself?

- Indigenous
- Asian
- Black or African American
- Native Hawaiian or Pacific Islander
- Caucasian
- Middle Eastern
- Latinx
- Other: \_\_\_\_\_