Lena Klassen
1005477128
INF311H1
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Critical Analysis of my CYOA Story "Babybots and Botbabies"

Revolutionary reproductive technologies have typically been met with resistance, but eventually, as the technologies become normalized and accepted, they have resulted in changes in multiple domains – including regulations and policies, and reproductive decision making.[1] This is why I chose to write a choose your own adventure story based on a fictional prototype of a new reproductive technology: a Mechanical Embryo Incubator and Pregnancy Simulator (MEIPS), referred to as the babybot. It is difficult to sufficiently explore the many hypothetical implications of a future technology in a brief storyline and give appropriate attention to each matter. Even so, I quickly realized while writing my story that even short anecdotes and scenarios can give rise to fascinating questions by touching on complex and thought-provoking issues. I mainly explore the impact of the babybot in three areas, which I address in three storylines: cyberwarfare, legalities and propaganda, and reproductive decision making. These storylines explore how a revolutionary reproductive technology like the babybot could drastically change how women make reproductive decisions; could require many legal considerations, especially with regard to citizenship rights; and could have a significant impact on the cyberwarfare realm.

[1] John K Amory, "A History of The Birth Control Movement in America," review of *A History of The Birth Control Movement in America*, by Peter C. Engelman, *The Journal of Clinical Investigation* 121, no. 10 (October 2011): 3782, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3195483/pdf/JCI59258.pdf. This book review provides a summary of how contraceptives were made illegal by law in the US in the late 19th century, and that legalization of all contraceptives in the US only occurred in 1972 after a long struggle to improve women's rights.

Cyberwarfare significantly changes the landscape of warfare, which raises the need for international cyberwar agreements. In my cyberwarfare storyline, I briefly explore what happens when malware is used to target physical hardware, babybots, resulting in loss of life, embryos. This storyline ending is intentionally brief, since it embodies the assumption that a stealth cyberwarfare act committed by a nation state actor, such as the USA, on an actor in a different country, the Ukraine, for example, could be executed in such a way that it would not reveal the perpetrator of the act, and result in no consequences for the perpetrator. This idea runs contrary to one of the arguments presented by Christianson in his article about Just War Theory and Cyberwar, in which he states that cyberwarfare would typically remain active only until "both sides have knocked out each other's software," at which point manual combat will take over again.[2] This argument assumes that cyberwarfare would be typically committed uncloaked, with all participants being aware of each other.

While the idea that cyber-attack perpetrators will eventually be located, which would allow for counterattacks, is supported in a 2019 book describing global cyberattacks and their perpetrators,[3] a 2019 cybersecurity report forecasts that nation state actors will increasingly use deception techniques to disguise themselves,[4] making the successful identification of threat actors increasingly challenging. I see this dilemma as proof that outlining international cyberwarfare agreements and norms is increasingly necessary. This thought is echoed in the

[2] Bruce Christianson, "Not Just Cyberwarfare," *Philosophy & Technology* 28, no. 3 (September 2015): 362, https://journals-scholarsportal-info.myaccess.library.utoronto.ca/pdf/22105433/v28i0003/359_njc.xml.
[3] Brian Nussbaum, "When Cyberwar Struck Its First Civilian Target," review of *Sandworm: A New Era of Cyberwar and the Hunt for the Kremlin's Most Dangerous Hackers*, by Andy Greenberg, *Nature* 575, no. 7782 (November 2019): 280–81, https://www-nature-com.myaccess.library.utoronto.ca/articles/d41586-019-03457-9.
[4] "8 Cybersecurity Trends to Watch In 2019," Booz Allen Hamilton (Booz Allen Hamilton Inc, January 31, 2019), https://www.boozallen.com/c/insight/publication/top-8-cybersecurity-trends-for-2019.html.

2018 scholarly article "Why the World Needs an International Cyberwar convention."[5] While my cyberwarfare storyline explores an international cyberattack being committed using futuristic technology, the lesson we can learn from it, the need for international cyberwar norms and agreements, is something that already applies today.

Another area that my story looks at that also applies to today is the complicated legalities surrounding artificial reproductive technologies. In my legalities and propaganda storyline, Sam and Lyla must suddenly deal with the legal complexities of their embryos being incubated and born in another country via babybots. A question I explore here is how the legal system deals with children being born in other countries via a reproductive technology that is completely decoupled from either parent, with distinct focus on how issues of citizenship come into play. It was surprising to find that this very issue has already been brought up in scholarly writing in response to some of the consequences of artificial reproductive technologies that currently exist. In a 2019 article in the Global Public Health journal, the authors look at the impacts of "Globalized quests for assisted conception" by reviewing research on reproductive travel and exploring the "clinical, ethical, legal, and regulatory complexities" involved.[6] It notes that there are many benefits to taking advantage of international reproductive opportunities, such as cheaper treatment options for example, but it also warns that there are many "legal ambiguities surrounding children conceived through international arrangements,"[7] which include the "legal

[5] Mette Eilstrup-Sangiovanni, "Why the World Needs an International Cyberwar Convention," *Philosophy & Technology* 31, no. 3 (September 2018): 379-407, https://link-springer-com.myaccess.library.utoronto.ca/content/pdf/10.1007/s13347-017-0271-5.pdf.
[6] Andrea Whittaker, Marcia C Inhorn, and Francoise Shenfield, "Globalised Quests for Assisted Conception: Reproductive Travel for Infertility and Involuntary Childlessness," *Global Public Health* 14, no. 12 (December 2019): 1669, https://www-tandfonline-com.myaccess.library.utoronto.ca/doi/pdf/10.1080/17441692.2019.1627479?needAccess=true.
[7] Ibid, 1682.

recognition of children" in the home country of their "intending parents."[8] While my legalities and propaganda storyline claims that rigorous legal arrangements regarding children born outside of their parents' home country are already in place, in real life, this is certainly an area that would need to be further developed, a sentiment echoed in the aforementioned article.[9]

My third storyline, which explores the impacts of the babybot technology on reproductive decision making, brings up the idea that women would embrace a technology like the babybot, and would use it strategically in career planning. A 2017 research article in the journal Human Reproduction already confirms that female employment is on the rise and is a major reason why women are delaying childbearing,[10] that career-oriented women are more likely to plan pregnancy,[11] and that career-oriented women are largely optimistic about "medical advancements" that enable delaying childbirth.[12] Another 2017 scholarly article that, among other things, looked at women's interest in freezing eggs determined that "most women… would consider elective egg freezing for themselves."[13] Considering all of these studies and findings, we can reasonably assume that women would embrace an even more empowering reproductive technology, like the babybot, making the exploration of what a world would look like with this technology a worthwhile endeavor.

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[8] Ibid, 1680.
[9] Ibid, 1682.
[10] Michael K Simoni, Lin Mu, and Stephen C Collins, "Women's Career Priority Is Associated with Attitudes Towards Family Planning and Ethical Acceptance of Reproductive Technologies," *Human Reproduction* 32, no. 10 (October 2017): 2070, https://journals-scholarsportal-info.myaccess.library.utoronto.ca/pdf/02681161/v32i0010/2069_wcpiawaeaort.xml.
[11] Ibid, 2072.
[12] Ibid.
[13] Deborah E Ikhena-Abel et al., "Is Employer Coverage of Elective Egg Freezing Coercive?: A Survey of Medical Students' Knowledge, Intentions, and Attitudes Towards Elective Egg Freezing and Employer Coverage," *Journal of Assisted Reproduction and Genetics* 34, no. 8 (August 2017): 1040, https://doi.org/10.1007/s10815-017-0956-9.

One of the potential impacts of the babybot on female reproductive decisions is that it would likely lead to many older women choosing to have children. While this is not covered in my story, it occurred to me while reflecting on it, and it seems important since it would likely result in a sharp birth rate increase. The authors of the article "A Generation of Childless Women: Lessons from the United States" interviewed many women without children, and found that "1 in 10 women at age 45 are childless yet want a baby."[14] This demonstrates a strong desire in older women to have children, and it therefore seems clear that many older women would choose to have children if a babybot-like reproductive technology were to become available.

A technology like the babybot would undoubtedly lead to many disruptive and interesting consequences, and every hypothetical scenario I have explored in this paper leads to its own set of further questions. If the babybot brought about a sudden major birth rate increase, or the median age of parents with young children dramatically increased, would nursing homes suddenly also need nurseries and daycares? If the babybot resulted in childbearing and, by extension, childrearing becoming a gender-neutral activity, would the gender wage gap eventually be closed? What if a country chose to target another country's babybots in cyberwarfare? Would the thought of targeting innocent beings drive countries to form shared norms agreements, or lead to a new version of the Geneva convention dedicated to the cyber realm? The potential impacts of a babybot-like technology touches on an extremely broad number of areas. This demonstrates the importance of challenging ourselves to consider all of these areas if a technology like the babybot, which was conceived in fiction, were to one day be born into reality.

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[14] Benjamin M Craig et al., "A Generation of Childless Women: Lessons from the United States," *Women's Health Issues* 24, no. 1 (January 2014): e26, https://journals-scholarsportal-info.myaccess.library.utoronto.ca/pdf/10493867/v24i0001/e21_agocwlftus.xml.

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