Is the development of artificial wombs ethically desirable?

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TABLE OF CONTENTS

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Abstract

This dissertation addresses the question of whether the further development of artificial wombs is ethically desirable. It is important to precede the existence of artificial wombs with an ethical analysis of both the valuable goals and the ethical problems associated with the technology. The technology required for artificial wombs capable of the entire gestation process does not currently exist. However, given the great strides made in artificial reproduction and neonatal care in the last four decades, the development of artificial wombs is no longer entirely that of science fiction. Following an introduction of the dissertation in Chapter I, Chapter II contains a review of the academic literature discussing the ethics of artificial wombs. Chapter III analyses the valuable goals that could result from the existence and use of artificial wombs. Chapters IV, V and VI each examine one set of ethical problems that could result from artificial wombs – including ethical problems relating to the experimental treatment phase, abortion, and commodification and commercialisation – and determines whether or not these problems are surmountable. Chapter VII discusses the results and relevance of the dissertation as well as an outlook on the future of the development of artificial wombs.

Chapter I: Introduction

1.1 Research question

This dissertation addresses the question of whether the further development of artificial wombs is ethically desirable. It is important to precede the existence of artificial wombs with an ethical analysis of both the valuable goals and the ethical problems associated with the technology. Artificial wombs are devices used for ectogenesis – the process of creating and gestating a human being entirely outside of the human body. Ectogenesis is accomplished by creating an embryo via *in vitro fertilisation* (IVF) and gestating it in an artificial womb.[1] Although artificial wombs do not currently exist, the technology will most likely arise from developments at both ends of the gestation spectrum: the creation of embryos via IVF, and the care for extremely premature neonates.

1.2 Artificial wombs

The technology required for artificial wombs capable of the entire gestation process does not currently exist. However, given the great strides made in artificial reproduction and neonatal care in the last four decades, the development of artificial wombs is no longer entirely that of science fiction. Currently, technology exists on both ends of the human gestation process – the ability to create embryos via IVF in the early stages, and to keep foetuses alive after only 22-24 weeks in the womb in the final stages. The challenge will be the creation of artificial womb technology that would be capable of the entire gestation process, including differentiation of body parts, formation of a central nervous system, and continued growth and development until birth. Furthermore, it should be clarified that the artificial wombs discussed in this dissertation would exist outside of the human body as an external device, as opposed to an artificial uterus grown via tissue engineering and transplanted into a person. In cases involving a tissue-engineered artificial womb which is transplanted into a woman, many of the same ethical issues surrounding organ transplantation – which at this stage is an ethically accepted practice – would arise. Whilst there could be other ethical issues relating to the reproductive nature of the transplanted organ, the gestation

[1] For the purpose of clarification, "ectogenesis" is the process and "artificial wombs" are the device.

process would occur inside a woman. Similarly, this dissertation will not address the ethical issues of using a woman in a persistent vegetative state as a gestational surrogate.[2] This dissertation examines the valuable goals and ethical issues that arise when the gestation process occurs entirely independent of the human body, in an external device. It is too early to tell what this device would look like or the specific technologies that would be involved.[3]

This dissertation examines the ethical desirability of the development of artificial wombs, because it is important to precede the existence of the technology with a set of ethical guidelines; in particular, recognising any potential ethical problems that could result from the technology. Whilst modern science has the ability to create a human embryo *in vitro*, as well as to keep increasingly younger neonates alive in incubators outside of their mother's body, the actual gestation process can, at this stage, only take place in a woman's body. There are many elements to consider in that process, including the inflow of nutrients, getting rid of wastes, how the foetus breathes, and perhaps most difficult to duplicate *in vitro* – the physical, chemical, hormonal, emotional and psychological interaction between the developing foetus and the woman gestating it. Unlike an incubator, an artificial womb must not only be able to sustain existing neonates, but must also be capable of the development of embryos and foetuses.

The desire for some people not only to have children, but to have additional control over when and how they procreate is unlikely to wane. This is evident from both the unwavering interest in and use of assisted reproductive technologies[4] as well as birth control[5] – both permitting people to decide if and

[2] As it is biologically possible for a woman to become pregnant, gestate and give birth (via Caesarean section) to a baby whilst in a persistent vegetative state (PVS), it may be possible to use these women as gestational surrogates. Rosalie Ber suggests obtaining prior consent from women for being gestational surrogates should they fall into a PVS, much like how many countries allows people to specify whether or not they would consent to being an organ donor. There are obviously many serious ethical issues relating to this particular scenario, although they will not be discussed in this dissertation. For further information see Rosalie Ber, "Ethical Issues in Gestational Surrogacy," *Theoretical Medicine and Bioethics* 21 (2000): 164-165.

[3] Tissue engineering may potentially be involved as one element of the creation of the artificial womb, but will only be considered in the context of external artificial wombs.

[4] According to the Center for Disease Control in the United States, in 2009 alone 146,244 cycles of assisted reproductive technologies (defined as any fertility treatments in which both sperm and eggs are handled) resulting in 45,870 live births and 60,190 infants. Currently, more than 1% of babies in America are born as a result of assisted reproductive technologies. (See: Center for

when they are going to have children. Once in existence, artificial wombs could be used for either complete or partial ectogenesis, the latter involving situations when an embryo/foetus is conceived naturally and implanted in a woman's uterus, but at some stage during the gestation process is transferred to an artificial womb. Artificial wombs would be yet another way of exercising reproductive autonomy, providing people with another way to procreate.

1.3 Research into artificial wombs

Whilst artificial wombs may seem futuristic, the idea of creating a human being outside of a woman's body is hardly novel. In the sixteenth century, Paracelsus provided a formula with which to create a "homunculus" – an artificial man with no soul – in an artificial womb.[6] This formula involves sealing a man's semen in the womb of a horse for 40 days (or until it begins to live, move and can easily be seen), and then nourishing it daily with human blood for 40 weeks until it becomes a human infant resembling those born of a woman, only significantly smaller.[7] Artificial wombs were also discussed and debated in the 1920s in the *To-day and To-morrow* book series, which will be discussed in Chapter II.

Chapter IV will discuss how the development of artificial wombs is likely to occur. Rather than attempting to specifically create a device capable of the entire gestation process, the development of artificial wombs is most likely to happen gradually, as already-existing technology – such as IVF[8] and incubators for

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Disease Control, "Assisted Reproductive Technology," last accessed 11 February 2012, http://www.cdc.gov/art/.). In the United Kingdom, A total of 122,043 babies were born (live births) following IVF and ICSI treatment that was started between 1992 and 2006. (See: Human Fertilisation and Embryology Authority, "Long-term data – birth rates," last accessed 11 February 2012 http://www.hfea.gov.uk/2588.html.).

[5] According to the Center for Disease Control in the United States, between 2006 and 2008, 99% of women who had ever had sexual intercourse had used at least one method of birth control. In the same period, approximately 93% had ever had a partner use the male condom and 82% of women had used the oral contraceptive pill. (See: WD Mosher and J. Jones, "Use of Contraception in the United States: 1982–2008," *Vital and Health Statistics* 23 (2010): 5.)

[6] Scott Gelfand, "Introduction" in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction*, ed. Scott Gelfand (Amsterdam: Rodopi, 2006), 3.

[7] Auroleus Phillipus Theophrastus Bombastus von Honenheim, aka Paracelsus, "Concerning the Nature of Things" in *The Hermetic and Alchemical Writings of Paracelsus, Vol. 1*, ed. Arthur E. Waite (New Hyde Park, NY: University Books, 1967), 124.

[8] Whilst I acknowledge that there are certainly ethical implications with IVF – both theoretical and practical – and these problems are, of course, related to ethical problems that may occur with artificial wombs, the ethical problems surrounding IVF are already discussed and debated extensively in the existing literature. See for example: Frank A. Chervenak, Laurence B.

premature neonates – advances. The most difficult part of the process will, in all likelihood, be bridging the gap between creating an embryo and implanting it in the artificial womb, and sustaining a late-term foetus/neonate in an incubator. Whilst incubators may become increasingly advanced, the difficulty will lie in making them capable of not only sustaining life, but also assisting in and continuing the physical development of the foetus/neonate's organs and systems.

There have been several notable research projects specifically involving early-stage artificial womb technology. There were some attempts at developing an artificial placenta in the 1950s and 1960s.[9] Whilst most of these experiments were able to maintain stable blood oxygen levels in their subjects attached to the artificial placenta for a short period, any attempts at longer periods of attachment to the artificial placenta resulted in the death of the subject.[10]

In the early 1980s, Thomas Schaffer, a neonatal physiologist, attempted to develop an artificial amniotic fluid which would help neonates survive longer.[11] He found that the reason so many premature babies do not survive is because their lungs are not developed enough to take in oxygen from the air, and as a result,

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McCullough and Zev Rosenwaks, "Ethical Dimensions of the Number of Embryos to be Transferred in In Vitro Fertilization," *Journal of Assisted Reproduction and Genetics* 11 (2001): 583-587; G. R. Dunstan, "In-Vitro Fertilization; the Ethics," *Human Reproduction* 1 (1985): 41-44; R. G. Edwards, "Fertilization of Human Eggs In Vitro: Moral, Ethics and the Law," *The Quarterly Review of Biology* 49 (1974): 3-26; John Harris, "*In Vitro* Fertilization: The Ethical Issues," *The Philosophical Quarterly* 33 (1983): 217-237; Elizabeth Heitman, "Social and Ethical Aspects of In Vitro Fertilization," *International Journal of Technology Assessment in Health Care* 15 (1999): 22-35; Edward G. Hughes, "Funding In Vitro Treatment for Persistent Subfertility: The Pain and the Politics," *Fertility and Sterility* 76 (2001): 431-432; Leon R. Kass, "Babies by Means of in Vitro Fertilization: Unethical Experiments on the Unborn?" *New England Journal of Medicine* 285 (1971): 1174-1179; Patrick Steptoe, "Historical Aspects of the Ethics of *in Vitro* Fertilization," *Annals of the New York Academy of Sciences* 442 (1985): 573-576; Mary Warnock, "In Vitro Fertilization: The Ethical Issues (II)," *The Philosophical Quarterly* 33 (1983): 238-249; R.M. Winston and A. H. Handyside, "New Challenges in Human In Vitro Research," *Science* 260 (1993): 932-936.

[9] See for example, John Callaghan and Jose Delos Angeles, "Long Term Extracorporeal Circulation in the Development of an Artificial Placenta for Respiratory Distress of the Newborn," *Surgical Forum* 12 (1961): 215-217; John Callaghan et al. "Study of Prepulmonary Bypass in the Development of an Artificial Placenta for Prematurity and Respiratory Distress Syndrome of the Newborn," *Journal of Thoracic and Cardiovascular Surgery* 44 (1962): 600-607; C.L. Sarin et al, "Further Development of an Artificial Placenta with the use of Membrane Oxegenator and Venovenous Perfusion," *Surgery* 60 (1966): 754-760; Geoffrey Chamberlain, "An Artificial Placenta: The Development of an Extracorporeal System for Maintenance of Immature Infants with Respiratory Problems," *American Journal of Obstetrics & Gynecology* 100 (1968): 615-626.

[10] Stephen Coleman, *The Ethics of Artificial Uteruses*, (Hants, England: Ashgate, 2004), 10.

[11] Amel Alghrani, "The Legal and Ethical Ramifications of Ectogenesis," *Asian Journal of WTO & International Health Law and Policy* 2 (2007): 193.

may survive longer if they would be able to breathe oxygenated liquid.[12] A clinical trial took place in 1996, where 13 infants born after 22-34 weeks with severe breathing difficulties were given oxygenated liquid between four hours and three days.[13] Seven[14] of the 13 babies were discharged from the hospital and appeared to be healthy several months later.[15]

In 1988, researchers in Bologna, Italy, headed by Dr. Carlo Bulletti implanted surplus IVF embryos into artificially perfused uteruses obtained from women who underwent a hysterectomy as a result of cervical cancer.[16] The article published on the study noted that "the present study was undertaken to obtain the first early human pregnancy *in vitro* because future complete ectogenesis should not be ruled out."[17] The researchers were able to successfully implant an embryo in the wall of the artificially perfused uterus, where it grew for 52 hours[18] before removing it for dissection.[19]

Research has also taken place into the creation of an artificial placenta. As mentioned above, efforts to develop a clinically applicable artificial placenta system commenced in the late 1950s.[20] In 1990, Yoshinori Kuwabara of the University of Tokyo used an artificial placenta to maintain mid- to late-stage goat foetuses, which were held in a tank of amniotic fluid and nourished through catheters.[21] The goat foetuses had to be given muscle relaxants because they were pulling the catheters out as they twisted and moved around in the tank.[22] Two of the goat foetuses involved in the study that were taken from the womb three weeks early survived until their normal term, but because of the muscle relaxant,

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[12] Ibid.
[13] Corrine Lowe Leach et al, "Partial Liquid Ventilation with Perflubron in Premature Infants with Severe Respiratory Distress Syndrome," *The New England Journal of Medicine* 335 (1996): 761.
[14] The other six babies were either withdrawn from the study or died.
[15] Leach, "Partial liquid ventilation," 764.
[16] Carlo Bulletti et al, "Early Human Pregnancy *in vitro* utilising an Artificially Perfused Uterus," *Fertility and Sterility* 49 (1988): 991-996.
[17] Ibid, p. 991.
[18] The embryos were only left to grow for 52 hours as a result of problems with the uterus, not with the embryos. Ibid., 995.
[19] Ibid.
[20] Nobuya Unno, "Development of an Artificial Placenta," in *Next Sex: Ars Electronica,* eds. G. Stocker and C. Shopf (New York and Vienna: Springer, 2000), 63.
[21] Jonathan Knight, "Artificial Wombs: An Out of Body Experience," *Nature* 419 (2002): 107.
[22] Ibid.

were unable to develop muscle tone, stand or breathe unassisted.[23] As a result, when removed from the ventilator, the goats died within hours.[24]

In 1993, the United States Patent Office granted a patent to Dr. William Cooper for a "placental chamber" – in other words, a primitive artificial womb.[25] The patent application describes Cooper's invention as a "life support system for a premature baby which remains attached to its placenta through its umbilical cord" and could be used to support foetuses after a few as ten weeks of *in utero* gestation.[26] However, Cooper's work is theoretical, and was not attempted in practical research.

Research has also taken place into the other end of gestation: the implantation of the fertilised egg into a uterus. Beginning in 2001, Dr. Hung-Ching Liu of Cornell University began to grow an artificial uterus using cells removed from a woman's uterus, hormones and growth factors.[27] The uterine tissue grew on biodegradable scaffolds modelled after the interior of the uterus.[28] The artificial uterus continued to grow after the scaffold model had dissolved. In unpublished work, Dr. Liu and her team found that when they placed surplus IVF embryos onto the uterus they attached themselves to the plugs of the endometrial cells six days after fertilisation, just as they do in a natural womb.[29] In 2003, Dr. Liu grew a mouse embryo almost to full term in three-dimensional engineered endometrial tissue, although it died days later.[30]

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[23] Nobuya, "Development of an Artificial Placenta," 996.
[24] Knight, "Artificial Wombs," 107.
[25] U.S. Patent Number 5,218,958 (filed 21 February 1993), last accessed 16 May 2012, available from: http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PALL&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.htm&r=1&f=G&l=50&s1=5218958.PN.&OS=PN/5218958&RS=PN/5218958.
[26] Ibid.
[27] Gretchen Reynolds, "Artificial Wombs: Will We Grow Babies Outside their Mothers' Bodies?" *Popular Science* 1 August 2005, last accessed 2 November 2010, http://www.popsci.com/scitech/article/2005-08/artificial-wombs; Alghrani, "Ectogenesis," 194.
[28] Reynolds, "Artificial Wombs," http://www.popsci.com/scitech/article/2005-08/artificial-wombs; Alghrani, "Ectogenesis," 194.
[29] Knight, "Artificial Wombs," 106-107.
[30] Hung-Ching Liu et al, "Ability of Three-Dimensional (3D) Engineered Endometrial Tissue to Support Mouse Gastrulation in vitro," *Fertility and Sterility* 80 (2003): 78; See also Colleen Carlston, "Artificial Wombs: Delivering on Fertile Promises," *Harvard Science Review* Fall (2008): 36.

Research was published in 2008 which attempted to create an artificial womb of sorts to test foetal monitoring systems, rather than having to conduct clinical testing on pregnant women.[31] The goal of the project was to create an artificial womb that replicates the acoustical state of a woman's abdomen. This was accomplished by applying various signals to speakers placed underneath water-filled rubber balloons, which simulated foetal heartbeat propagation through amniotic fluid of the placenta.[32] After comparative experimentation, it was found that the aforementioned system closely simulates acoustical conditions in the mother's abdomen.[33] Whilst the acoustical conditions *in utero* are an important and interesting part of foetal development, the "artificial womb" created in this research was merely a stand-in chamber for a pregnant woman, and was not a deliberate attempt to create an artificial womb capable of the entire (or even partial) gestation process. Nevertheless, it is interesting to note as the findings could potentially contribute to the creation of an artificial womb in the future.

Whilst these are examples of research attempts and theoretical approaches to specifically address components required for an artificial womb, it is more likely that artificial wombs will result from more mainstream research. The research in the aforementioned studies may prove to be useful in the development of artificial wombs, or could end up not being at all influential. It is, however, important to at least mention these specific research attempts at creating an artificial womb to convey that research in this area of assisted reproductive technology is occurring.

Given the significant developments made in assisted reproduction over the past 40 years, it is reasonable to believe that the technology will only continue to advance. This may potentially include the development of artificial wombs. However, the process may be long, and there is no way to accurately predict when the technology required for artificial wombs may be available. Regardless of when, whether or if the artificial womb is developed, it is, as explained previously, important to consider the ethical implications of the technology prior to its

[31] A.K. Mittra, N.K. Choudhary, and A.S. Zadgaonkar, "Development of an Artificial Womb for Acoustical Simulation of Mothers' Abdomen," *International Journal of Biomedical Engineering and Technology* 1 (2008): abstract.
[32] Ibid.
[33] Ibid.

existence and clinical use. This will ensure that proper ethical consideration was given to any problems that may result from the technology and that legal and ethical guidelines are in place. Moreover, the development of artificial wombs could lead to some more immediate benefits, such as improvements in the existing technology used in neonatal intensive care. As will be explained in Chapter IV, the developments in the technology used for neonatal care are early steps towards creating an artificial womb, and may result in both long-term (such as the ability to create and gestate a child entirely *in vitro*) and short-term (the ability to assist severely premature neonates) effects.

Emerging reproductive technologies, such as the artificial ovary,[34] signal the advancements that are being made in both artificial reproduction and tissue engineering, which may be considered stages in the development of the artificial womb. Furthermore, artificial wombs are most likely to come about from technological advances with incubators for neonates, progressing until these incubators – arguably, primitive artificial wombs – are capable of the entire gestation process. Moreover, developments in IVF, foetal medicine, tissue engineering, neonatal care, gynaecology, embryology, computer science and the human genome project all add to the body of knowledge necessary to create artificial wombs.[35] In other words, the knowledge and technology gained from research into the aforementioned areas could potentially be integral steps towards creating an artificial womb. Each new development in artificial reproduction is potentially a step towards artificial wombs.

1.4 Methodology

As already stated, the purpose of this dissertation is to answer the research question: Is the development of artificial wombs ethically desirable?

[34] See Stephan P. Krotz et al, "In vitro Maturation of Oocytes via the Pre-fabricated Self-Assembled Artificial Human Ovary," *Journal of Assisted Reproduction and Genetics* 27 (2010): 743-750.
[35] Frida Simonstein, "Artificial Reproduction Technologies (RTs): All the Way to the Artificial Womb?" *Medicine, Health Care and Philosophy: A European Journal* 9 (2006): 359.

1.4.1 Necessary conditions

In order for the development of artificial wombs to be considered ethically desirable, at least three conditions must be met:

> 1) Several of the objectives of the further development of artificial wombs must be valuable; and
>
> 2) Any ethical problems arising from the further development of artificial wombs must be surmountable; and
>
> 3) The development of artificial wombs must be technologically feasible.[36]

It is important that the first necessary condition is met because in order for the development of a type of technology to be deemed ethically desirable, it must demonstrate that it can produce valuable[37] objectives. If there were no valuable goals that could result from the development of artificial wombs, then the only potential results from the development of artificial wombs would be those that are neutral[38] or negative. Moreover, if the development of artificial wombs did not result in any valuable goals, then the development is also not ethically desirable, as it would not in any way be contributing anything of value to society.

In this methodology, the second necessary condition, "Any ethical problems arising from the existence and use of artificial wombs must be surmountable" means that any problems resulting from the existence and use of artificial wombs must not be so detrimental that they halt the development of artificial wombs. Any problems that arise must be able to be overcome. There must not be major blocks to its development. If the ethical problems resulting from the existence and use of artificial wombs are so severe that they cannot be overcome, then it is preferable to completely cease, and possibly even obstruct the development of artificial wombs.

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[36] This methodology is adapted from the methodology in Bert Gordijn, *Medical Utopias: Ethical Reflections about Emerging Medical Technologies* (Leuven: Peeters, 2006), 40.
[37] The concept of value will be discussed further in Chapter III.
[38] The outcomes could either be positive, negative or neutral, but Frankena does not discuss the possibility of a neutral outcome.

If the development of artificial wombs is not technologically feasible, then investing in the development of artificial wombs would not be ethically desirable. Attempting to develop a device that is technologically unfeasible would be a futile exercise and a waste of resources, and therefore ethically undesirable. Whilst the first two necessary conditions will be analysed in-depth in this dissertation, the third necessary condition – technological feasibility – will not be, as it is more an issue for science and medicine and is beyond the scope of the dissertation. Moreover, it is intrinsically difficult and in most scenarios even speculative, to predict the future of scientific and technological developments.

1.4.2 Questions

Three questions must be answered in order to determine whether the three necessary conditions for ethical desirability are met:

1) Are several of the objectives of the further development of artificial wombs valuable?

2) Are the ethical problems that arise from the further development of artificial wombs surmountable? And

3) Is the development of artificial wombs technologically feasible?

In order to answer the first two questions, I first conduct a review of the literature. This results in a list of valuable goals and ethical problems appearing in the literature, which are then analysed in the context of answering these two questions.

The first question is an axiological one, taking into account whether the goals of the development of artificial womb technology are, in fact, valuable. In order to answer this question, it is first important to determine what the goals of the development of artificial wombs are. This is accomplished by reviewing the literature and compiling a list of the valuable goals identified by the authors. These goals can be varying in nature, potentially pertaining to medical issues, the

wellbeing of the resulting child, societal equality issues, and interpersonal relationships.

In order to determine whether or not these goals are valuable, it is necessary to examine the goals resulting from the development of artificial wombs through the lens of a value theory. I have selected William Frankena's value theory for this purpose.

The second question – whether the ethical problems that could result from the existence and use of artificial wombs are surmountable – is a question of whether certain actions are permitted, forbidden or obligatory. First, the ethical problems that could result from the existence and use of artificial wombs must be identified. This is accomplished by completing a review of the literature, and compiling a list of the ethical problems identified by the authors. Once the list is compiled, I select three ethical problems that I find to be the most challenging, complex and important.

Subsequently, it must be determined whether these actions identified as ethical problems in the literature are permitted, forbidden or ethical obligations. In order to make that determination, each of the ethical problems that could potentially result from the existence and use of artificial wombs are considered via the principles established by the UNESCO Universal Declaration on Bioethics and Human Rights ("UNESCO Principles"). In other words, I consider each of the three ethical problems selected from those identified in the literature, and determine whether or not that action is permitted, forbidden or an ethical obligation according to the UNESCO Principles. If certain actions are absolutely necessary to develop artificial wombs, but they are specifically forbidden by the UNESCO Principles, then the development is ethically problematic and should not take place. It may be the case that certain stages of development may assist in the development of artificial wombs, but are not absolutely necessary for the development to occur. In these cases, if these actions are forbidden by the UNESCO Principles, then they should not take place; but because they are not absolutely crucial to the development of artificial wombs, it should not halt the development. It should also be noted that there may be certain situations where

some of the UNESCO Principles are not explicit about certain actions and provide guidelines that are vague or broad. In these cases, the UNESCO Principles can be interpreted various ways, as was likely intended during their formulation.

Lastly, as explained above, the third question is beyond the scope of this dissertation.

1.4.3 Limitations

It is possible to provide a reasonably complete answer to the first question, regarding the valuable goals that could potentially result from the development of artificial wombs. Chapter III of this dissertation examines and analyses the valuable goals identified in the literature resulting from the further development of artificial wombs in detail through the lens of Frankena's value theory. If Chapter III does, in fact, demonstrate that there several valuable goals resulting from the further development of artificial wombs, then the answer to the first question will be affirmative.

It will be impossible, however, to provide a definitive and comprehensive answer to the second question. This dissertation does not seek to analyse each and every ethical problem that might result from the existence and use of artificial wombs. Rather, this dissertation examines what I perceive to be the three most challenging, important and relevant problems associated with artificial wombs: (1) problems with the experimental treatment phase of development; (2) problems relating to abortion and (3) problems relating to commodification and/or commercialisation of various human biological materials and processes. Each of these sets of ethical problems are analysed using the UNESCO Principles. These 15 principles outline an internationally developed set of standards which are applied to each of the selected ethical problems in order to determine whether or not these problems are surmountable. Therefore, when conclusions are drawn at the end of this dissertation regarding whether the development of artificial wombs is ethically desirable, it will be important to bear in mind that the question can really only be answered on the basis of an analysis that has focused on only three sets of ethical problems (albeit the ones I have deemed to be the most important and challenging) and not an exhaustive list.

Lastly, answering the third question regarding technological feasibility is beyond the scope of this dissertation. Firstly, it is impossible to know whether the development of artificial wombs is scientifically and medically feasible. Perhaps there will be one stage in or aspect of the gestation process that can never be duplicated outside of a woman's body. At this stage, this is unknown. Secondly, it is impossible to know an exact timeframe of when (if at all) artificial wombs will be developed. Thirdly, it is impossible to predict whether researchers and medical professionals will even attempt to develop an artificial womb capable of the entire gestation process.

1.4.4 Normative instruments

Two normative instruments are used throughout this dissertation to analyse both the valuable goals and ethical problems, respectively. The discussion and analysis of the valuable goals utilises William Frankena's value theory, found in his volume entitled *Ethics*. The discussion of the ethical problems that could result from artificial wombs utilises UNESCO's Universal Declaration on Bioethics and Human Rights.

Frankena's value theory

In his volume entitled *Ethics*, William Frankena puts forth a theory on value.[39] First, Frankena distinguishes between moral and nonmoral values. He defines moral values as things that are good on moral grounds, such as a person, motive, intention, deed, or trait of character. Frankena then identifies six nonmoral values: utility values (they are useful); extrinsic values (they are a means to what is good); inherent values (the experience of contemplating them is good); intrinsic values (they are good in themselves); contributory values (they contribute to the intrinsically good life); and final values (they are good on the whole).[40] It should also be noted that some things can be good in more than one sense, such as knowledge.

[39] William Frankena, *Ethics*, 2nd ed. (Englewood Cliffs: Prentice Hall, 1973).

[40] Frankena, *Ethics*.

Frankena indicates that the task at hand is to determine on which grounds things – or rather, experiences, activities and lives – may accurately be classified as good, bad, desirable, or worthwhile as ends, or in themselves. The question of what is good as an end is what hedonistic and non-hedonistic theories attempt to answer. Frankena identifies himself as a quasi-hedonist, indicating that for something to be considered intrinsically valuable, it must be a satisfactory or enjoyable experience. However, he rejects the hedonist theory that nothing is intrinsically good unless it contains pleasure specifically, and opts for the broader, more inclusive concept of satisfactoriness instead. Frankena explains that while some suggest that things like life, health, truth, knowledge and beauty are intrinsically valuable, it is actually the *experience* of these values that is good in itself rather than merely the existence of them alone. As mentioned above, Frankena believes that every pleasure has some intrinsic goodness, yet an experience that is pleasant may also have "bad-making features" which could result in its total negative score (such as a "malicious pleasure"). He agrees with non-hedonists that malicious pleasure and the enjoyment of cruelty and ugliness are bad, but questions whether they are bad *qua* pleasures or enjoyments. He contends that they may be morally bad in themselves, or bad because they are symptoms of some defect, but stresses that their being bad in such senses must not be confused with their being bad *qua* pleasures or enjoyments.

Frankena speaks about "satisfactoriness" or "enjoyment" or "pleasantness" rather than "pleasure" or "happiness," as the latter two terms come with pre-existing connotations (such as "pleasure" suggesting a "physical or lower" pleasure than "happiness," for example) and cover a much narrower scope than the broader term of "satisfactoriness." He states that there is an entire range of satisfactoriness that experiences and lives may have – pleasure and happiness being but two examples. He also contends that some kind of satisfactoriness is a necessary condition of something being intrinsically good.

In addition to satisfactoriness, some kind or degree of excellence also makes experiences intrinsically good. Something that is already intrinsically good could therefore be enhanced with a degree of excellence. However, excellence on its own is not enough to make something intrinsically valuable – an element of

satisfactoriness must also be present. Furthermore, excellence is not absolutely required in order for something to be deemed to be intrinsically good. Consequently, Frankena theorises that things are intrinsically good by the presence of satisfactoriness or pleasure, and also some degree of excellence. Excellence, or the absence of excellence, can make an experience better or worse than it would be otherwise. If something is intrinsically bad, it is because of the presence of pain, unhappiness, some kind of defect, or lack of excellence. As a result, an enjoyable experience may be made bad by the presence of a defect, which negates the goodness of the experiences because of its enjoyableness, such as in the case of a malicious pleasure, which involves a moral defect. In other words, an experience may be made bad – or, at least, intrinsically worse – by the fact that having that experience is immoral.

The most important element of Frankena's theory is the emphasis on experience over the mere existence of something that determines its intrinsic value. Furthermore, the use of the broader term "satisfactoriness" over "pleasure" or "happiness" is far more inclusive and therefore broadens the scope of what is considered intrinsically good and does not tie the concept to the narrow perceptions of "pleasure" or "happiness" exclusively. Lastly, Frankena's incorporation of a degree of excellence in addition to something's satisfactoriness provides a more complete notion of intrinsic goodness.

I selected Frankena's value theory as one of my normative instruments for two primary reasons. Firstly, his theory represents a broad spectrum of value. As explained previously, unlike some hedonists who measure value in "pleasure," Frankena utilises the broader and more inclusive concept of "satisfactoriness," which I contend will result in a more nuanced application of the theory. Secondly, Frankena, as a lesser-known philosopher, can be viewed as being more ethically-neutral; in that, he is not already attached to a specific issue, cause or position.

Frankena's value theory does, indeed, have a significant weakness: the underdevelopment of what constitutes something being bad or negative. Whilst Frankena does give some indication of what makes something bad, he does so very briefly and without much explanation or detail. In fact, everything Frankena

provided regarding what makes something bad has been included in the previous paragraphs. Whilst he goes into great detail regarding the different types of value and satisfactoriness, the negative side is largely overlooked. This also leaves the portion of his value theory that discusses badness more open to interpretation. For this reason, I decided that this shortcoming can be dealt with by applying what Frankena does provide regarding bad-making features and the negative, to the list of valuable goals identified in the literature and using them in my analysis.

Universal Declaration on Bioethics and Human Rights

UNESCO's interest in bioethics began in the 1970s, paying particularly close attention to Member States' concerns over the relationship between scientific and technological progress and human rights.[41] In 1992, the Director-General of UNESCO established an International Bioethics Committee (IBC), whose most important task was to determine how an international instrument for the protection of the human genome could be drafted.[42] Also in 1992, a Scientific and Technical Orientation Committee was also formed, and carried out extensive consultations on five themes: genome research, embryology, neurosciences, gene therapy, and genetic testing.[43] Following these studies, the Group identified the issues that would most likely lead to the broadest consensus and proposed principles that would respond to any potential ethical concerns.

In 2001, during its 31st session, the General Conference confirmed UNESCO's leading position in bioethics by including the ethics of science and technology among the five priorities of the Organisation.[44] The mandate was then given in October 2003 at the 32nd session of the General Conference, indicating that it is opportune and desirable to establish a set of universal bioethics standards.[45] The Director-General of UNESCO requested that the IBC draft a preliminary text within less than two years.[46] The timetable for drafting the convention involved

[41] Henk A.M.J. ten Have and Michéle S. Jean, "Introduction," in *The UNESCO Universal Declaration of on Bioethics and Human Rights: Background, Principles and Application,* ed. Henk A.M.J. ten Have and Michéle S. Jean (Paris: UNESCO Publishing, 2009), 23-24.
[42] Ibid., 24.
[43] Ibid.
[44] Ibid., 25.
[45] Ibid., 26.
[46] Ibid., 26-27.

three stages: (1) consultations in written form from Member States on the scope and structure of the declaration in the form of hearings with intergovernmental organisations (IGOs) and nongovernmental organisations (NGOs), national bioethics committees, and also via conferences with national experts; (2) the drafting of the declaration by the IBC with input from consultations; and (3) the finalisation of the text at meetings of governmental experts.[47]

The consultations with Member States involved discussing the (1) aims and scope; (2) structure; and (3) content of the declaration.[48] The views of IGOs, NGOs, national bioethics committees and national experts were also taken into account.[49] During the drafting stage, members of the IBC realised that certain bioethical issues would be too difficult to reach consensus on and that cultural diversity and a plurality of viewpoints should be taken into consideration.[50] At a session of the IBC in 2004 during the drafting process, hearings of representatives of different religious and spiritual perspectives took place, with each speaker presenting how his or her religion's traditions viewed bioethics.[51] This resulted in two useful lessons: (1) that although there are differing moral views, it is possible to identify common values; and (2) it is necessary to strike a balance between autonomy and the place of family and solidarity among human beings by particular religious and cultural traditions.[52] Various debates occurred throughout the drafting process, including over the primacy of the human being and its link to respect for human dignity, and the link between bioethics and global problems such as health care and poverty.[53] The preliminary draft was published in February 2005.[54]

The Preliminary Draft Declaration was submitted to the Director-General of UNESCO who then submitted it to the Member States, who would ultimately decide whether or not the instrument would be adopted.[55] The draft was subjected

[47] Ibid., 27.
[48] Ibid., 28.
[49] Ibid., 29.
[50] Ibid., 30.
[51] Ibid., 31.
[52] Ibid.
[53] Ibid., 33-34.
[54] Ibid., 34.
[55] Ibid.

to political negotiations amongst the governmental experts representing the governments of the Member States, as is a statutory process required for any normative instrument.[56] The Director-General officially convened two meetings of governmental experts in April and June 2005 in order to finalise the draft.[57] Issues arose regarding the scope of the Declaration; whether it should apply to more traditional bioethical issues involving medicine and life sciences, or whether it should be expanded to include issues associated with the environment and the biosphere, and incorporate a more social dimension, particularly in developing countries.[58] Other debates included ones over the use of the word "should" versus "shall;" the use of "human being" versus "human person;" informed consent; the article on risk management; and the addition of two new principles on the protection of future generations and respect for vulnerability.[59] Finally, the title proposed by the IBC – "Universal Declaration on Bioethics and Human Rights" – was selected, and the Declaration was adopted by the General Conference on its 33rd session on 19 October 2005.[60]

A compromise was reached in the debate over the scope of the Declaration.[61] The scope of bioethics differs, based on the varying conceptions, definitions and histories of bioethics in each State.[62] Three views regarding the scope of bioethics were advanced: (1) medicine and health care; (2) the social context; and (3) the environment.[63] Ultimately, it was decided that the scope of the Declaration would be to address "ethical issues related to medicine, life sciences and associated technologies as applied to human beings, taking into account their social, legal and environmental dimensions."[64]

There are several aims of the Declaration, including "to provide a universal framework of principles and procedures to guide States in the formulation of their

[56] Ibid.
[57] Ibid.
[58] Ibid., 35.
[59] Ibid., 37-38.
[60] Ibid., 39.
[61] Ibid.
[62] Ibid.
[63] Ibid.
[64] Universal Declaration on Bioethics and Human Rights, 2005, Art. 1.

legislation, policies or other instruments in the field of bioethics;"[65] "to guide the actions of individuals, groups, communities, institutions and corporations, public and private;"[66] and "to promote respect for human dignity and human rights by ensuring respect for the life of human beings, and fundamental freedoms, consistent with international human rights law." [67] The other aims include recognising the importance of scientific research; [68] fostering dialogue about bioethics between stakeholders and society;[69] promoting equal access to medical, scientific and technological developments and sharing information;[70] safeguarding and promoting the interests of present and future generations;[71] and underlying the importance of biodiversity.[72]

Articles 3 to 17 of the Declaration comprise the 15 UNESCO Principles, which describe the various obligations and responsibilities of the moral subjects in relation to different categories of moral objects.[73] They are listed to reflect gradual widening of the range of moral objects: the individual human being itself; other human beings; human communities; humankind as a whole; and all living beings and their environment.[74] Whilst some of the principles were already widely accepted and perhaps even endorsed by previous instruments, these 15 principles are unique in that they strike a balance between individualist and communitarian moral perspectives.[75] For example, it includes principles of both autonomy and solidarity.[76]

The 15 principles are: human dignity and human rights;[77] benefit and harm;[78] autonomy and individual responsibility;[79] consent;[80] persons without the capacity

[65] Ibid., Art. 2(a).
[66] Ibid., Art. 2(b).
[67] Ibid., Art. 2(c).
[68] Ibid., Art. 2(d).
[69] Ibid., Art. 2(e).
[70] Ibid., Art. 2(f).
[71] Ibid., Art. 2(g).
[72] Ibid., Art. 2(h).
[73] Henk A.M.J. ten Have and Michéle S. Jean, "Introduction," 39-40.
[74] Ibid., 40.
[75] Ibid.
[76] Ibid.
[77] Universal Declaration on Bioethics and Human Rights, 2005, Art. 3.
[78] Ibid., Art. 4.
[79] Ibid., Art. 5.
[80] Ibid., Art. 6.

to consent;[81] respect for human vulnerability and personal integrity;[82] privacy and confidentiality; [83] equality, justice and equity; [84] non-discrimination and non-stigmatisation; [85] respect for cultural diversity and pluralism; [86] solidarity and cooperation;[87] social responsibility and health;[88] sharing of benefits;[89] protection of future generations; [90] and protection of the environment, the biosphere and biodiversity.[91]

The Declaration also includes clear provisions on the application of the principles.[92] These include decision-making and addressing bioethical issues; [93] ethics committees; [94] risk assessment and management; [95] and transnational practices. [96] It also explains the interrelation and complementarity of the principles, stating that the Declaration "is to be understood as a whole and the principles are to be understood as complimentary and interrelated. Each principle is to be considered in the context of the other principles, as appropriate and relevant in the circumstances."[97] Lastly, the Declaration also includes provisions on the role of States; [98] bioethics education, training and information; [99] international cooperation;[100] follow-up action by UNESCO;[101] limitations on the application of the principles; [102] and denial of acts contrary to human rights, fundamental freedoms and human dignity.[103]

[81] Ibid., Art. 7.
[82] Ibid., Art. 8.
[83] Ibid., Art. 9.
[84] Ibid., Art. 10.
[85] Ibid., Art. 11.
[86] Ibid., Art. 12.
[87] Ibid., Art. 13.
[88] Ibid., Art. 14.
[89] Ibid., Art. 15.
[90] Ibid., Art. 16.
[91] Ibid., Art. 17.
[92] Ibid., Art. 18-21.
[93] Ibid., Art. 18.
[94] Ibid., Art. 19.
[95] Ibid., Art. 20.
[96] Ibid., Art. 21.
[97] Ibid., Art. 26.
[98] Ibid., Art. 22.
[99] Ibid., Art. 23.
[100] Ibid., Art. 24.
[101] Ibid., Art. 25.
[102] Ibid., Art. 27.
[103] Ibid., Art. 28.

The UNESCO Principles found in the Universal Declaration on Bioethics and Human Rights were selected as the normative instrument for this dissertation because of their global consensus, perspective and influence. The drafting process described above conveys the various considerations given to a range of bioethical issues, the scope and meaning of the concept of bioethics, and cultural and religious differences. Whilst the Council of Europe does provide an international set of bioethics standards in the form of the European Convention on Human Rights and Biomedicine, the UNESCO Principles were chosen instead because of their global and therefore more universal scale. Despite the fact that the UNESCO Principles are not legally binding, the extensive drafting process resulted in an instrument that is as universally agreed-upon as possible, therefore leaving States in a position where they are more likely to adhere to the principles. The fact that the UNESCO Principles are not legally binding may be viewed as a weakness, however, because it is ultimately up to the States to adhere to the principles and to enact appropriate legislation. Furthermore, there is no reporting or monitoring mechanism to ensure that the UNESCO Principles are being applied. Another potential weakness of the UNESCO Principles is that it could be argued that ultimately, each of the Principles could be dealt with via one of the four principles of bioethics put forward by Beauchamp and Childress: autonomy, beneficence, nonmaleficence and justice.[104] However, whilst that may, to a certain extent, be accurate, I believe that the 15 UNESCO Principles do, in fact, offer a more nuanced approach to analysing ethical issues. Furthermore, the drafting process of the UNESCO Principles ensures that the ethical principles represented are widely accepted internationally.

In order to most effectively examine the potential ethical problems resulting from the existence and use of artificial wombs, it is necessary to do so against a strong, clear and universal normative instrument, and there is no other such instrument currently in existence. If a regional instrument or another set of principles put forward in academia were utilised for the normative analysis of this dissertation, it may only examine the ethical problems from a specific or regional, rather than global standpoint.

[104] See T.L. Beauchamp and J.F. Childress, *Principles of Biomedical Ethics*, New York City: Oxford University Press, 2001.

The use of the UNESCO Principles is also an example of the role of the State in the ethical debate concerning the development and implementation of artificial womb technology. The State's role in the ethical debate concerning the development of artificial womb technology (and indeed, other novel technologies) is that of the actor, whilst society is the recipient of the State's actions. The State's actions primarily take the form of regulations enacted regarding the research into artificial wombs, as well as how the technology is implemented once (and if) it exists. However, these actions should be informed by an ongoing societal debate, which should, in a democratic society, be reflected in the regulation implemented by the State. In agreeing to comply with and implement a set of international guidelines such as the UNESCO Principles, States subscribe to a specific set of ethical standards and ideally, use those as the basis of their domestic regulation.

1.5 Outline

Chapter II provides the results of a review of the existing literature on the ethics of artificial wombs, in order to ascertain what the literature deems to be the valuable goals and ethical problems associated with artificial wombs.

Chapter III explores the valuable goals that could potentially result from the existence and use of artificial wombs in detail.

The following three chapters (Chapters IV to VI) will each address one ethical problem area that results from artificial wombs and whether or not they are justifiable or surmountable.

There is, of course, no guarantee that the three ethical problems selected are, in fact, the most ethically challenging or problematic. However, the ethical problems discussed in this dissertation were chosen following an analysis of the existing literature on artificial wombs and the ethical problems identified in the literature. Based on this, three ethical problems were selected that stood out as being the most challenging and multi-faceted. As such, each problem raises questions that are generalisable to other ethical problems related to artificial wombs. Moreover, the three problems chosen represent various stages in the development of artificial

wombs, from the early experimental treatment stage to the problems that arise when the technology is fully developed. Lastly, two of the ethical problems chosen to be examined in this dissertation have not, at this stage, received a significant amount of attention in the existing literature, and therefore this dissertation aims to contribute a thorough ethical analysis to the ongoing debate surrounding the development of artificial wombs.

The three ethical problems analysed in this dissertation are: (1) problems relating to the experimental treatment phase of development; (2) problems relating to abortion; and (3) problems relating to commodification and/or commercialisation of various human biological materials and processes. Experimental treatment on embryos and foetuses was selected as an ethical problem because it presents a potentially significant stumbling block to the development of artificial wombs. The question of how and when, precisely, artificial wombs will come into existence will be addressed in this chapter. Secondly, the existence of artificial wombs will, undoubtedly, significantly impact the perception and practice of abortion. Clinical use of artificial wombs has been put forward as a "solution" to abortion, which is ethically problematic, specifically in relation to autonomy. Furthermore, ethical problems relating to the regulation of abortion and ending an artificial pregnancy will be addressed. Lastly, the commodification and/or commercialisation of human biological materials and processes, as well as foetuses or even babies, may result from the existence of artificial wombs. This could take place for a number of reasons, including for research purposes, to provide babies and/or foetuses for willing consumers, and to grow and then sell organs or tissue for transplantation purposes.

Ultimately, it is possible that the outcome of this dissertation could be that the development of artificial wombs is not ethically desirable. This conclusion could be reached if one of the ethical problems discussed was found to be insurmountable, and signalled that the development of artificial wombs should, unquestionably, be halted. It is impossible, however, to conclude that the development of artificial wombs is, in fact, definitively ethically desirable. Even if the three ethical problems examined in this dissertation are found to be surmountable, and they are deemed to be the most challenging and important, it

would be wrong to conclude that the development of artificial wombs is ethically desirable without examining each of the ethical problems that arise from the existence and use of artificial wombs. If it is determined that the development of artificial wombs is not ethically desirable, then States should not fund research into artificial womb technology.

Whilst embarking on a study with the knowledge that answering the research question conclusively is likely impossible and most certainly a limitation, the answer itself is not as important as the ethical analysis that took place attempting to answer the question. This holds particularly true for the analysis of the ethical problems discussed in this dissertation that have not yet been widely analysed in the existing literature.

Chapter VII will present the results of the dissertation; namely, whether the development of artificial wombs has met the three aforementioned criteria. It will then describe the relevance of this dissertation to both academic scholarship, as well as society. It will also look ahead to how the development of artificial wombs should be handled from an ethical and regulatory standpoint.

Chapter II: The ethics of artificial wombs: a review of the literature

2.1 Introduction

Whilst artificial wombs do not yet exist, the idea and concept of ectogenesis, though futuristic in nature, is not recent. The term "ectogenesis" was coined in 1923 by J.B.S. Haldane in his essay entitled *Daedalus, or Science and the Future.*[105] In his work, Haldane lists what he believes to be the six most important biological discoveries ever made. The list includes four discoveries "made before the dawn of history": (1) the domestication of animals, (2) the domestication of plants, (3) the domestication of fungi for the production of alcohol, and (4) the altered path of sexual selection (that is, the shift to women's faces and breasts as objects of men's attention and attraction).[106] The remaining two biological discoveries cited by Haldane did not yet exist: bactericide, and the artificial control of conception.[107] Haldane proceeds to provide a fictional essay written by an undergraduate student 150 years in the future (the year 2073), in which the student describes the birth of the first ectogenic child, which Haldane envisions would take place in 1951.[108] He then states that ectogenesis is "now universal," and that in England, more than 70 percent of babies are born via artificial wombs.[109] Whilst he laments the demise of the "former instinctive cycle" of reproduction due to ectogenesis, he concedes that "it is generally admitted that the effects of selection have more than counterbalanced these evils."[110]

Following Haldane's publication, five additional works were published over a six-year period specifically responding to concepts found in *Daedalus* on topics such as ectogenesis and the separation of sexuality from reproduction; the benefits for society and the individual of scientific control of human nature; and the notion that humans' biological and social behaviours were not natural, but naturalised.[111] In *Lysistrata, or Women's Future and Future Women* (1924), Nietzsche scholar

[105] J.B.S. Haldane, *Daedalus, or Science and the Future* (London: Kegan Paul, Trench, Trubner, 1924).
[106] Ibid.
[107] Ibid.
[108] Ibid.
[109] Ibid.
[110] Ibid.
[111] Susan Merrill Squier, *Babies in Bottles: Twentieth-Century Visions of Reproductive Technology* (New Brunswick: Rutgers University Press, 1994), 66.

Anthony Ludovici argues that ectogenesis is a feminist plot to escape not only pregnancy and reproduction, but also women's domestic role, and potentially men themselves.[112] In his book entitled *Hymen, or the Future of Marriage* (1927), sexologist Norman Haire, on the contrary, accepted ectogenesis as a way to liberate women from pregnancy, and to assist those who are unable to gestate.[113] Despite his call to eliminate the biological family, socialist physician Eden Paul rejected ectogenesis in his essay entitled *Chronos, or the Future of the Family* (1930), insisting that women cannot be freed from pregnancy, at least in the foreseeable future, and considers the inter-uterine stage of gestation to be crucial for both the mother and child.[114] In *Halcyon, or the Future of Monogamy* (1929) pacifist novelist Vera Brittain rejected ectogenesis, except as a last resort, claiming that the use of artificial wombs would jeopardise the welfare of the ectogenic children.[115] Finally, in *The World, the Flesh, and the Devil: An Enquiry into the Future of Three Enemies of the Rational Soul* (1929) X-ray crystallographer and molecular biologist J.D. Bernal contended that ectogenesis would be beneficial as it would replace imperfect human bodies with machines.[116] This debate took place primarily in the *To-day and To-morrow* book series – which includes the six aforementioned publications – and occurred within the context of some of the most prominent social concerns and fascinations of the 1920s: feminism and the role of women, and the movement for sexual reform.[117]

This first wave of the debate surrounding ectogenesis in the 1920s and 1930s was not included in the literature review because the authors did not discuss the ethical implications of ectogenesis or artificial wombs in a significant way. Whilst each of the publications mentioned ectogenesis, it was more in passing with a remark

[112] Anthony Ludovici, *Lysistrata, or Women's Future and Future Women* (London: Kegan Paul, Trench, Trubner, 1924). See also Rosemarie Tong, "Out of Body Gestation: In Whose Best Interests?," in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006), 62-63.
[113] Norman Haire, *Hymen, or the Future of Marriage* (London: Kegan Paul, Trench, Trubner, 1927). See also Tong, "Out of Body Gestation," 62-63.
[114] Eden Paul, *Chronos, or the Future of the Family* (London: Kegan Paul, Trench, Trubner, 1930). See also Aline Ferreira, "The Sexual Politics of Ectogenesis in the To-day and To-morrow Series," *Interdisciplinary Science Reviews* 34 (2009): 42; Tong, "Out of Body Gestation," 62-63.
[115] Vera Brittain, *Halcyon, or the Future of Monogamy* (London: Kegan Paul, Trench, Trubner, 1929). See also Tong, "Out of Body Gestation," 62-63.
[116] J.D. Bernal, *The World, the Flesh, and the Devil: An Enquiry into the Future of the Three Enemies of the Rational Soul* (London: Kegan Paul, Trench, Trubner, 1930). See also Tong, "Out of Body Gestation," 62-63.
[117] Ferreira, "Sexual Politics," 33; Squier, *Babies in Bottles*, 68.

as to whether or not it should be used, as opposed to a meaningful discussion on its ethical problems. Similarly, several works of popular fiction at that time – most notably, Aldous Huxley's *Brave New World* (1932) – predict utopian or dystopian worlds of the future that include ectogenesis. Again, because these works are fictional and do not discuss the ethical implications of ectogenesis in a significant way, they are not included in this literature review. It was, however, important to mention these publications in this chapter, as it conveys the extent to which artificial wombs as a concept have existed in the imagination and consciousness of the public for approximately the past 90 years.

This chapter takes into account journal articles, book chapters and monographs that discuss the ethical aspects of artificial wombs. It begins by discussing the methodology used in this chapter, providing the formula by which the search of the literature could be replicated. Following the discussion of methodology, the results of the literature search are presented. Each piece of literature analysed in this chapter was read and specific categories of information were noted. These include the date of the publication of the piece of literature, the type of publication in which it appeared, the valuable goals and ethical problems resulting from artificial wombs that were discussed in the literature, and finally, whether or not the authors believed that artificial wombs should be used. The findings in each of these categories will be presented, analysed and discussed, resulting in a comprehensive overview on the existing literature on the ethical implications of artificial wombs.

2.2 Methodology

Firstly, I decided that only academic non-fiction would be used in the literature review. This includes articles from peer-reviewed journals, chapters from edited volumes and monograph non-fictional academic books. This does not include other forms of non-academic non-fiction such as newspapers, magazines, blogs or other forms of popular media. Indeed, including literature from the popular media or that is fictional would have provided an interesting gauge of societal awareness of and attitudes towards the development of artificial wombs. However, I am neither a sociologist nor a cultural anthropologist and am, for the purpose of this dissertation, not interested in societal attitudes; I am primarily interested in

academic arguments surrounding the ethical implications of the development of artificial wombs, which is concentrated in academic writing. I do acknowledge that the non-inclusion of works of fiction and the popular media have some limitations, primarily regarding the more complete view of societal attitudes towards the development of artificial wombs that those genres could have provided, as well as a potentially larger set of ethical problems that may have been identified. As artificial wombs do not yet exist, the speculation in both fiction and the popular media has the same ability to raise ethical concerns as academia. However, this dissertation was limited to a thorough analysis of the academic non-fictional literature that discusses the ethical implications of the development of artificial wombs.

In order to locate articles on the ethical issues surrounding artificial wombs, I conducted searches on the following databases: PubMed, the Web of Science, Science Direct, Philosopher's Index, Wiley Science, SpringerLink, Oxford Journals,[118] SAGE Online Journals, Annual Reviews, GoogleScholar and BioMed Central. In each database, I conducted a search for "(ectogenesis OR "artificial womb" OR "artificial uterus") AND (ethic* OR moral*)." I excluded articles not written in the English language and any book reviews. This yielded 137 articles.

Next, I read the abstract of each article, and eliminated any articles that did not, in a significant way, focus on the ethics of artificial wombs. This narrowed the focus down to articles that specifically discuss the ethical implications of artificial wombs, eliminating many articles that focused solely on the medical and/or scientific and/or legal elements of artificial wombs. This step eliminated 55 articles. There were other articles in which it was unclear from the abstract whether the ethics of artificial wombs would be discussed in a significant[119] way, so I skimmed the article itself for any ethical discussion of artificial wombs. This eliminated a further 58 articles. Following these steps, I was left with 24 journal articles.

[118] This includes the journal *Human Reproduction*.

[119] By this I mean pieces of literature that go into at least some detail regarding either the valuable goals that could result from artificial wombs, or the ethical problems that could be associated with artificial wombs. Many pieces of literature came up in the literature search that merely mentioned artificial wombs in passing, but did not discuss the ethical implications of the technology in a meaningful way.

Lastly, I used the "snowball" method of looking up any articles or books cited in the references of articles yielded by the database searches that also fit the criteria described above. This resulted in three additional articles. The addition of these articles made a total of 27 articles for this literature review. The snowball method also resulted in 12 chapters from edited volumes, three chapters from monographs, and one monograph. This resulted in a total of 43 pieces[120] of literature that discuss the ethical issues surrounding artificial wombs. Thus, the pieces of literature mentioned in this chapter are only those that fit the narrow focus of discussing the ethical issues surrounding artificial wombs in a significant way. There are numerous other pieces that mention artificial wombs in passing, but do not specifically address any of the ethical implications of the technology.

2.3 Results

Whilst reading each piece, I noted the date of its publication, the type of publication, the valuable goals each piece associates with artificial wombs, the ethical problems raised regarding artificial wombs, and whether or not the author(s) believes that artificial wombs – once the technology exists and is proven safe – should be used in clinical practice.

2.3.1 Date of publication

The academic ethical debate[121] surrounding artificial wombs commenced in the 1970s,[122] originating in the context of its implications on gender. As conveyed in Table 1, there was not a significant amount of literature that discussed the ethical issues surrounding artificial wombs until the 2000s.[123] Five pieces were published

[120] In this literature review, I will refer to the articles, book chapters and monographs as "pieces," and the journal or book in which they appear as "publications."
[121] Based on the criteria discussed in section 2.2 of this chapter.
[122] Shulamith Firestone, *The Dialectic of Sex* (London: Jonathan Cape, 1970).
[123] Peter Singer and Deane Wells, *The Reproduction Revolution*, (Oxford: Oxford University Press, 1984); Gena Corea, *The Mother Machine: Reproductive Technologies from Artificial Insemination to Artificial Wombs*, (New York: Harper & Row, 1985); DN James, "Ectogenesis: a Reply to Singer and Wells," Bioethics 1 (1987): 80-99; Deane Wells, "Ectogenesis, Justice and Utility: a Reply to James," *Bioethics*. 1 (1987):372-9; Julien Murphy, "Is Pregnancy Necessary? Feminist Concerns about Ectogenesis," *Hypatia* 4 (1989): 66-84; Leslie Cannold, "Women, Ectogenesis and Ethical Theory," *Journal of Applied Philosophy* 12 (1995): 55-64; ML Lupton, "Artificial Wombs: Medical Miracle, Legal Nightmare," *Medicine and Law* 16(1997):621-33; Stephen Coleman, "A Surrogate for Surrogacy? – The Artificial Uterus," *Australian Journal of*

between 2000 and 2004.[124] Between 2005 and 2012, 28 pieces[125] were published that discussed the ethics of artificial wombs, indicating that the issue has risen to unprecedented prominence and may continue to be present in the ethical debate.

Professional and Applied Ethics 1 (1999): 49-60; ML Lupton, "The Role of the Artificial Uterus in Embryo Adoption and Neonatal Intensive Care," *Medicine and Law*18 (1999):613-29.

[124] Stephen Coleman, "Abortion and the Artificial Uterus," *Australian Journal of Professional and Applied Ethics* 4 (2002): 9-18; Christine Rosen, "Why Not Artificial Wombs?" *New Atlantis* Fall (2003):67-76; Nicholas Tonti-Filippini, "The Embryo Rescue Debate: Impregnating Women, Ectogenesis, and Restoration from Suspended Animation," *National Catholic Bioethics Quarterly* 3 (2003):111-37; Stellan Welin, "Reproductive Ectogenesis: the Third Era of Human Reproduction and some Moral Consequences." *Science and Engineering Ethics*. 10 (2004): 615-626; Coleman, *The Ethics of Artificial Uteruses*.

[125] Jim Davin and Christopher Kaczor, "Would Artificial Wombs Produce more Harm than Good?" *National Catholic Bioethics Quarterly* 5 (2005): 657; Christopher Kaczor, "Could Artificial Wombs End the Abortion Debate?" *National Catholic Bioethics Quarterly* 5 (2005):283-301; Jennifer S. Bard, "Immaculate Gestation? How will Ectogenesis Change Current Paradigms of Social Relationships and Values?" in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Scott Gelfand, "Ectogenesis and the Ethics of Care," in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Dien Ho, "Leaving People Alone: Liberalism, Ectogenesis, and the Limits of Medicine," in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Gregory Pence, "What's so Good about Natural Motherhood?" in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Joyce M. Raskin and Nadav A. Mazor. "The Artificial Womb and Human Subject Research" in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Maureen Sander-Staudt, "Of Machine Born? A Feminist Assessment of Ectogenesis and Artificial Wombs," in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Simonstein, "Artificial Reproduction Technologies," 359-365; Tong, "Out of Body Gestation,"; Joan Woolfrey, "Ectogenesis: Liberation, Technological Tyranny, or just More of the Same?" in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction,* ed. Scott Gelfand and John R. Shook (Amsterdam: Rodopi, 2006); Alghrani, "Ectogenesis," 189-211; Christopher Kaczor, "Artificial Wombs and Embryo Adoption," in *The Ethics of Embryo Adoption and the Catholic Tradition Moral Arguments, Economic Reality and Social Analysis,* ed. Sarah-Vaughan Brakman and Darlene Fozard Weaver (Heidelberg: Springer, 2007); Anna Smajdor, "The Moral Imperative for Ectogenesis," *Cambridge Quarterly of Healthcare Ethics* 16 (2007): 336-345; Carlston, "Artificial Wombs," 35-39; Emily Jackson, "Degendering Reproduction," *Medical Law Review* Autumn (2008): 346-368; Sarah Langford, "An End to Abortion? A Feminist Critique of the 'Ectogenetic Solution' to Abortion," *Women's Studies International Forum* 31 (2008): 263-269; Iain Brassington, "The Glass Womb," in *Reprogen-Ethics and the Future of Gender,* ed. Frida Simonstein (Heidelberg: Springer, 2009); Frida Simonstein, "Artificial Reproductive Technologies and the Advent of the Artificial Womb," in *Reprogen-Ethics and the Future of Gender*, ed. Frida Simonstein (Heidelberg: Springer, 2009); Tuija Takala, "Human Before Sex? Ectogenesis as a Way to Equality," in *Reprogen-Ethics and the Future of Gender,* ed. Frida Simonstein (Heidelberg: Springer, 2009); Emeka C. Ekeke, and Christian O. Uchegbue, "Solving the Problem of Infertility among Christians: a Bioethical Appraisal," *American Journal of Social and Management Sciences* 1 (2010): 201-208; Megan-Jane Johnston, "Ethics and Ectogenesis," *Australian Nursing Journal* 17 (2010): 33; David T. Reiber, "The Morality of Artificial Womb Technology," *The National Catholic Bioethics Quarterly,* Autumn (2010): 515-527; Jessica H. Schultz, "Development of Ectogenesis: How will Artificial Wombs Affect the Legal Status of a Fetus or Embryo?," *Chicago-Kent law Review* 84 (2010): 1-24; Eric Steiger, "Not of Woman Born: How Ectogenesis Will Change the Way We View Viability, Birth and the Status of the Unborn," *Journal of Law and Health* 23 (2010): 143-171; Jennifer S. Hendricks, "Of Woman Born? Technology, Relationships, and the Right to a Human Mother," *Law Publications and Other* Works (2011): 1-62; Timothy F. Murphy, "Research Priorities and the Future of

Table 1

Time period	Number of pieces
1970-1974	1
1975-1979	0
1980-1984	1
1985-1989	4
1990-1994	0
1995-1999	4
2000-2004	5
2005-2012	28

2.3.2 Type of publication

Unsurprisingly, a clear majority of the existing literature discussing the ethical implications of artificial wombs is found in ethics[126] publications.[127] However, nearly one-third of the literature reviewed came from gender,[128] law,[129] or philosophy[130] publications, indicating that the ethics of artificial wombs is an important gender issue and has legal relevance in terms of potential regulation for the technology. The vast minority of the literature is found in technology &

Pregnancy," *Cambridge Quarterly of Healthcare Ethics* 21 (2012): 78-89; Anna Smajdor, "In Defense of Ectogenesis," *Cambridge Quarterly of Healthcare Ethics* 21 (2012): 90-103.

[126] It should be noted that I am aware that ethics is a sub-discipline of philosophy, and yet I have categorised the two separately. This was done in order to separate the pieces that appeared in book or journals specifically about ethics, or containing the word "ethics" in the title, from the publications that appeared in a journal or book discussing the discipline of philosophy in the broader sense.

[127] Bard, "Immaculate Gestation," 149-158; Brassington, "The Glass Womb," 197-210; Coleman, "Abortion and the Artificial Uterus," 9-18; Coleman, *The Ethics of Artificial Uteruses;* Coleman, "A Surrogate for Surrogacy," 49-60; Davin and Kaczor, "Artificial Wombs," 657; Gelfand, "Ectogenesis," 89-108; Ho, "Leaving People Alone," 139-148; James, "Ectogenesis," 80-99; Kaczor, "Abortion debate," 283-301; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *The Reproduction Revolution;* Murphy, "Research Priorities," 78-89; Pence, "Natural Motherhood," 77-88; Raskin and Mazor, "Human Subject Research," 159-182; Reiber, "Morality of Artificial Womb," 515-527; Sander-Staudt, "Of Machine Born," 109-128; Smajdor, "Defense of Ectogenesis," 90-103; Smajdor, "Moral Imperative," 336-345; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-76; Tonti-Filippini, "Embryo Rescue Debate," 111-137; Welin, "Reproductive Ectogenesis," 615-626; Wells, "Ectogenesis," 372-379; Woolfrey, "Ectogenesis," 129-138.

[128] Corea, *The Mother Machine*; Firestone, *The Dialectic of Sex;* Langford, "An End to Abortion," 263-269; Murphy, "Is Pregnancy Necessary," 66-84.

[129] Alghrani, "Ectogenesis," 189-211; Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; Lupton, "Artificial Wombs," 621-33; Lupton, "The Role of the Artificial Uterus," 613-29; Schultz, "Development of Ectogenesis," 1-24; Steiger, "Not of Woman Born," 143-171.

[130] Cannold, "Women, Ectogenesis and Ethical Theory," 55-64; Kaczor, "Artificial Wombs and Embryo Adoption,"; Simonstein, "Artificial Reproduction Technologies (RTs): All the Way to the Artificial Womb?," 359-365.

society, [131] medical, [132] social & management science, [133] and scientific [134] publications.

Table 2

Type of publication	Number of pieces
Ethics	25
Law	7
Gender	4
Philosophy	3
Technology & Society	1
Medicine	1
Social & Management Science	1
Science	1

2.3.3 Valuable goals achieved using artificial wombs

In each publication, I noted the goals of artificial wombs that the author(s) deemed valuable. That is not to say that some or all of these goals could not be achieved through means other than artificial wombs, such as other forms of assisted reproduction. In other words, these are the goals the sources cited as valuable resulting from – but not necessarily *solely* a result of – artificial wombs. Table 3 indicates the 17 valuable goals of artificial wombs mentioned in the literature.

(Table 3 on next page.)

[131] Rosen, "Artificial Wombs," 67-76.
[132] Johnston, "Ethics and Ectogenesis," 33.
[133] Ekeke and Uchegbue, "Infertility among Christians," 201-208.
[134] Carlston, "Artificial Wombs," 35-39.

Table 3

Valuable goal	Number of pieces	Percentage[135] of pieces
Assisting those who are infertile or otherwise unable to gestate *in vivo*	28	65%
As an alternative to the death of the foetus following abortion of a pregnancy	23	53%
Assisting premature babies	22	51%
Having a safe/controlled environment during gestation	19	44%
May decrease gender inequality	19	44%
Women would not have to be pregnant	17	40%
Alternative to surrogacy	9	21%
Could result in healthier, less possessive mother/child relationships	8	19%
Benefits foetal medicine	7	16%
Growing embryos/foetuses to farm organs/tissues for transplant	6	14%
Could result in the adoption of leftover IVF embryos	4	9%
Allows homosexual couples to have their own genetic children without a surrogate	4	9%
Expands reproductive options/autonomy	4	9%
Saves foetuses when mother is dead/dying	4	9%
Growing a baby entirely in an artificial womb could guarantee paternity	3	7%
Moving multiple births to artificial womb	2	5%
Could reduce the use of reproductive cloning	1	2%

The most frequently mentioned goal of artificial wombs is assisting those who are unable to have their own genetic offspring naturally, either as a result of infertility, or an inability of the woman to be pregnant (as a result of a hysterectomy, age or known pregnancy-induced illness, for example). A total of 65% of the literature reviewed cited this as a valuable goal of artificial wombs.[136]

[135]Rounded to the nearest percent.

[136] Alghrani, "Ectogenesis," 189-211; Brassington, "The Glass Womb," 197-210; Coleman, *The Ethics of Artificial Uteruses;* Coleman, "A Surrogate for Surrogacy," 49-60; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; James, "Ectogenesis," 80-99; Kaczor, "Abortion Debate," 283-301; Johnston, "Ethics and Ectogenesis," 33; Kaczor, "Artificial Wombs,"; Lupton, "Artificial Wombs," 621-33; Murphy, "Is Pregnancy Necessary?," 66-84;

Utilising artificial womb technology as an alternative to the abortion of a foetus following the termination of a pregnancy was mentioned in 53% of the literature reviewed.[137] The existence of artificial womb technology would mean a shift in the concept and/or parameters of the viability of the foetus outside of its mother's body – currently the legal demarcation of when an abortion can occur in most jurisdictions. Therefore, the existence of artificial wombs would require changes to most existing abortion laws, and would create an alternative for women who would like to end their pregnancy, but not necessarily terminate their foetus. In these cases, the foetus could be removed from the mother's uterus and placed in an artificial womb for the duration of its gestation.

Using artificial wombs to save the lives of premature babies was also frequently cited, appearing in 51% of the literature.[138] In these instances, the sources are referring to transferring babies born severely prematurely into artificial wombs in order to complete their gestation process. Whilst this may not be the ultimate goal of artificial wombs – that being creating and gestating a human life entirely *in vitro* – the possibility of assisting premature babies is viewed as a valuable by-

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Murphy, "Research Priorities," 78-89; Pence, "Natural Motherhood?" 77-88; Raskin, "Human Subject Research," 159-182; Reiber, "Morality," 515-527; Rosen, "Why not Artificial Wombs?" 67-76; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *The Reproduction Revolution;* Smajdor, "Moral Imperative," 336-345; Steiger, "Not of Woman Born," 143-171; Wells, "Ectogenesis," 372-379; Woolfrey, "Ectogenesis," 129-138.

[137] Bard, "Immaculate Gestation," 149-158; Cannold, "Women, Ectogenesis and Ethical Theory," 55-64; Carlston, "Artificial Wombs," 35-39; Coleman, "Abortion and the Artificial Uterus," 9-18; Coleman, *The Ethics of Artificial Uteruses;* Corea, *The Mother Machine*; Davin and Kaczor, "Artificial Wombs," 657; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; James, "Ectogenesis," 80-99; Johnston, "Ethics and Ectogenesis," 33; Kaczor, "Abortion Debate?," 283-301; Kaczor, "Artificial Wombs,"; Lupton, "Artificial wombs," 621-33; Pence, "Natural Motherhood?" 77-88; Reiber, "Morality," 515-527; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24; Singer and Wells, *The Reproduction Revolution;* Steiger, "Not of Woman Born," 143-171; Tong, "Out of Body Gestation," 59-68; Wells, "Ectogenesis," 372-379.

[138] Alghrani, "Ectogenesis," 189-211; Bard, "Immaculate Gestation," 149-158; Brassington, "The Glass Womb," 197-210; Coleman, *The Ethics of Artificial Uteruses;* Ekeke and Uchegbue, "Infertility among Christians," 201-208; Firestone, *The Dialectic of Sex;* Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; James, "Ectogenesis," 80-99; Kaczor, "Artificial wombs,"; Lupton, "Artificial Wombs," 621-33; Lupton, "Artificial Uterus," 613-29; Pence, "Natural Motherhood?" 77-88; Reiber, "Morality," 515-527; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *The Reproduction Revolution;* Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-68; Woolfrey, "Ectogenesis," 129-138.

product of the existence of artificial womb technology, and therefore, a valuable goal of artificial wombs in general.

In addition, 44% of the sources said that having a guaranteed controlled, safe environment for gestation is a valuable goal of artificial wombs.[139] Once artificial wombs are perfected and proven safe, these sources suggest that they may be viewed as being a safer alternative to a mother's uterus, in that there is no chance of harm from alcohol, drugs, smoking, car accidents, or other unanticipated potentially harmful events.

The use of artificial wombs could also decrease inequality between men and women, 44% of the sources noted.[140] This category encompasses numerous gender issues cited by the sources, all based on the notion that a major source of inequality between men and women is that of pregnancy and the ability/responsibility to bear children. If neither parent was solely responsible for gestating the child, and each equally contributed to the conception of the child – that being with the donation of gametes – then the parents, in theory, would be truly equal[141] in terms of a hormonal connection to the child, gestating the child, responsibility for caring for the child, and other aspects of parenthood.

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[139] Alghrani, "Ectogenesis," 189-211; Carlston, "Artificial Wombs," 35-39; Coleman, "A Surrogate for Surrogacy," 49-60; Corea, *The Mother Machine*; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; Kaczor, "Abortion Debate," 283-301; Kaczor, "Artificial Wombs,"; Lupton, "Artificial Wombs," 621-33; Murphy, "Research Priorities," 78-89; Pence, "Natural Motherhood?" 77-88; Reiber, "Morality," 515-527; Rosen, "Artificial Wombs," 67-76; Sander-Staudt, "Of Machine Born," 109-128; Smajdor, "In Defense of Ectogenesis," 90-103; Singer and Wells, *The Reproduction Revolution;* Tong, "Out of Body Gestation," 59-68;

[140] Brassington, "The Glass Womb," 197-210; Carlston, "Artificial Wombs," 35-39; Coleman, *The Ethics of Artificial Uteruses;* Firestone, *The Dialectic of Sex;* Hendricks, "Of Woman Born," 1-62; Ho, "Leaving People Alone," 139-148; Murphy, "Is Pregnancy Necessary," 66-84; Murphy, "Research Priorities," 78-89; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *The Reproduction Revolution;* Smajdor, "In Defense of Ectogenesis," 90-103; Steiger, "Not of Woman Born," 143-171; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-68; Welin, "Reproductive Ectogenesis," 615-626; Woolfrey, "Ectogenesis," 129-138.

[141] It should be noted, however, that the acquisition of gametes from a woman is a more difficult and invasive procedure than it is for a man. In this instance, it is important to note that even though the process of obtaining the gametes would not be considered equal, the actual contribution of the gametes itself would be considered equal.

Another 40% of the sources contend that a valuable goal of artificial wombs is that women would no longer have to endure pregnancy.[142] As pregnancy could potentially endanger a woman's health and/or be uncomfortable, these sources suggest that artificial wombs would eliminate the need for pregnancy, or at least provide women with another reproductive option. Other authors suggest that some women would also elect to use artificial wombs in order to avoid the cosmetic – in additional to the physical – toll that pregnancy can have on a woman's body.

A further 21% of the sources state that artificial wombs would be superior to using surrogate mothers.[143] Firstly, a surrogate mother could develop an attachment to the baby she is carrying, which may lead to complications with the arrangements made with the baby's genetic parents. This would not be an issue with artificial wombs, as they are not human beings with the capacity to feel or grow attached to the foetus. Secondly, the use of surrogate mothers has the potential to be exploitative, if women are forced to carry children against their will, or turn to surrogacy as a way of earning money. Again, this would not occur with artificial wombs.

Nearly one-fifth of the sources stated that the existence of artificial wombs could lead to healthier and less possessive mother-child relationships.[144] These authors suggest that some mothers may harbour feelings of resentment towards their child after having to endure nine months of pregnancy whilst gestating the child, which resulted in a potentially painful and/or difficult childbirth. However, these authors suggest that if a mother does not have to gestate and give birth to her child –

[142] Brassington, "The Glass Womb," 197-210; Carlston, "Artificial Wombs," 35-39; Coleman, *The Ethics of Artificial Uteruses;* Corea, *The Mother Machine*; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Firestone, *The Dialectic of Sex;* Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Lupton, "The Role of the Artificial Uterus," 613-29; Reiber, "Morality," 515-527; Sander-Staudt, "Of Machine Born," 109-128; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," Singer and Wells, *The Reproduction Revolution;* Smajdor, "In Defense of Ectogenesis," 90-103; Tong, "Out of Body Gestation," 59-68; Woolfrey, "Ectogenesis," 129-138.
[143] Coleman, "A Surrogate for Surrogacy," 49-60; Hendricks, "Of Woman Born," 1-62; James, "Ectogenesis," 80-99; Johnston, "Ethics and Ectogenesis," 33; Singer and Wells, *The Reproduction Revolution;* Steiger, "Not of Woman Born," 143-171; Tong, "Out of Body Gestation," 59-68; Wells, "Ectogenesis," 372-379; Woolfrey, "Ectogenesis," 129-138.
[144] Coleman, *The Ethics of Artificial Uteruses;* Corea, *The Mother Machine*; Firestone, *The Dialectic of Sex;* Singer and Wells, *The Reproduction Revolution;* Smajdor, "In Defense of Ectogenesis," 90-103; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-68; Wells, "Ectogenesis," 372-379.

because she was able to use an artificial womb – then she may not have reason to harbour feelings of resentment towards her child. In addition, the authors contend that having to endure pregnancy and childbirth may result in mothers also being quite possessive of their children. Again, this may not occur if artificial wombs were available and mothers did not necessarily have to gestate and give birth to children. This, in turn, the authors argue, could lead to healthier and less possessive relationships between mothers and children.

Another 16% of the sources contend that the development and existence of artificial wombs will benefit foetal medicine.[145] Growing a foetus in an artificial womb will literally shed light into the gestation process, allowing doctors and surgeons to get a much closer look at how foetuses develop. In addition, foetal surgery may be easier with an artificial womb and, at the very least, it would not involve surgery for the mother as it would in *in vivo* gestation.

The issue of growing embryos or foetuses until a certain stage of their development, but not fully to term in artificial wombs in order to harvest their organs and tissues for transplant purposes was mentioned in 14% of the literature.[146] In this scenario, IVF embryos would be grown in artificial wombs into late-stage non-sentient embryos with differentiated parts. The organs and tissues would then be harvested and would continue their growth outside the artificial womb, ultimately being used for transplants.

Using artificial wombs to grow surplus IVF embryos in order for them to be adopted[147] was mentioned in 9% of the literature as a valuable goal of artificial

[145] Alghrani, "Ectogenesis," 189-211; Coleman, *The Ethics of Artificial Uteruses;* Coleman, "A Surrogate for Surrogacy," 49-60; Corea, *The Mother Machine*; Raskin, "Human Subject Research," 159-182; Pence, "Natural Motherhood?" 77-88; Takala, "Human Before Sex," 187-196.
[146] Coleman, *The Ethics of Artificial Uteruses;* Hendricks, "Of Woman Born," 1-62; James, "Ectogenesis," 80-99; Singer and Wells, *The Reproduction Revolution;* Tong, "Out of Body Gestation," 59-68; Wells, "Ectogenesis," 372-379.
[147] The authors that discussed this issue did not mention the order in which the adoption would take place: whether people could adopt the embryos and then grow them in artificial wombs, or whether the embryos would be grown in artificial wombs and then adopted. The literature leaves this open.

wombs.[148] If couples have unused frozen embryos leftover from IVF treatments, they could put them up for adoption, and the adoptive parents could gestate the embryo in an artificial womb.

Furthermore, 9% of the sources mention allowing homosexual couples to have their own genetic children as a valuable goal of artificial wombs.[149] This would especially pertain to homosexual male couples who would no longer need to use a surrogate mother to gestate their genetic children.

Another 9% of the literature discusses artificial wombs as a means of expanding reproductive options and autonomy, particularly for women.[150] If artificial wombs existed, women and/or couples would be able to determine whether to create and gestate their child *in vivo* or *in vitro*.

A further 9% of the sources state that artificial wombs would be useful in scenarios when a pregnant woman is dead or dying.[151] In the event of an accident or sudden illness threatening the life of a pregnant woman, her foetus could be transferred to an artificial womb, allowing it to complete the gestation process.

In addition, 7% of the sources suggest that the use of artificial wombs would provide a near guarantee of paternity.[152] In other words, if an embryo is created through IVF, which is then gestated in an artificial womb, the man who provided the sperm for the IVF treatment would know for a fact that he is the father of the child, providing there are no lab-related errors or switches.

[148] Lupton, "Artificial Uterus," 613-29; Reiber, "Morality," 515-527; Schultz, "Development of Ectogenesis," 1-24; Tonti-Filippini, "Embryo Rescue Debate," 111-137.
[149] Brassington, "The Glass Womb," 197-210; Murphy, "Is Pregnancy Necessary," 66-84; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186.
[150] Ho, "Leaving People Alone," 139-148; Murphy, "Is Pregnancy Necessary," 66-84; Pence, "Natural Motherhood?" 77-88; Sander-Staudt, "Of Machine Born," 109-128.
[151] Kaczor, "Abortion Debate," 283-301; Lupton, "Artificial wombs," 621-33; Raskin, "Human Subject Research," 159-182; Reiber, "Morality," 515-527.
[152] Corea, *The Mother Machine*; James, "Ectogenesis," 80-99; Tong, "Out of Body Gestation," 59-68.

Two pieces – or 5% – of the literature suggest that women who are pregnant with multiple foetuses could use artificial wombs to gestate some of the foetuses.[153] In other words, if a woman is pregnant with triplets, quadruplets, et cetera, she may decide to have one or more of the foetuses removed and placed in an artificial womb to continue their gestation process.

Lastly, one piece of literature[154] suggests that artificial wombs could be used to reduce the instances of cloning occurring. The authors of this piece explain that researchers in favour of attempting to create artificial wombs argue that the use of artificial wombs could reduce the use of cloning by providing people who were otherwise unable to have their own children (such as homosexual couples) with a method through which to have their own genetic children. In this case, the artificial womb would be used to gestate genetic children of their own, rather than cloning themselves.

The valuable goals cited by the sources reflect a wide variety of medical and social advances that may be made possible through the use of artificial wombs.

2.3.4 Ethical problems surrounding artificial wombs

An ethical problem is a problem with ethical dimensions associated with the research and development of artificial wombs, or the use of fully developed artificial womb technology used in clinical practice. A total of 23 different ethical problems were raised in the literature.

(Table 4 on next page.)

[153] Reiber, "Morality," 515-527; Rosen, "Artificial Wombs," 67-76.
[154] Ekeke and Uchegbue, "Infertility among Christians," 201-208.

Table 4

Ethical problem	Number of pieces	Percentage of pieces
Implications on the practice of and right to abortion	33	77%
Welfare of the ectogenic child	21	49%
No mother/child bond from pregnancy	16	37%
Implications on gender equality in reproduction: remove women's unique ability to have children; or used as a method to control women	16	37%
Prohibitive cost	14	33%
Eligibility for ectogenesis	11	26%
If embryos/foetuses that would have been aborted are moved to artificial wombs instead, it could result in a large number of unwanted babies	10	23%
Stigmatisation of users/non-users of ectogenesis	10	23%
Research & development issues	8	19%
Growing embryos/foetuses to farm organs/tissues for transplant	8	19%
Should there be state funding for research into artificial wombs?	6	14%
Unnaturalness	6	14%
Liability (if something goes wrong with the artificial womb during gestation)	6	14%
Terminating the ectogenic pregnancy	5	12%
Required by employers/insurers	4	9%
Commodification of babies	4	9%
Ownership of embryo/foetus (parental disagreement)	3	7%
Encouraging sexual irresponsibility	2	5%
Commodification of pregnancy	2	5%
Cloning	2	5%
Would allow homosexuals to have children	2	5%
Potential for eugenic programme	1	2%
Mandated embryo donation	1	2%

The most frequently cited ethical problem in the literature was the potential implications on the practice of and right to abortion. This issue was mentioned in 77% of the literature.[155] As explained in the previous section, if artificial wombs

[155] Alghrani, "Ectogenesis," 189-211; Bard, "Immaculate Gestation," 149-158; Brassington, "The Glass Womb," 197-210; Cannold, "Ectogenesis," 55-64; Carlston, "Artificial Wombs," 35-39;

existed and were used in clinical practice, it has the potential to shift the concept and limits of viability outside of the womb – the current legal demarcation for the permission of abortion in many jurisdictions. In other words, if artificial wombs existed, then all embryos and foetuses could potentially be considered viable outside of the womb, if it is not specified in abortion law that wombs include those that are both natural and artificial. If the law was not amended to reflect the existence of artificial wombs, then it could mean that abortion, as the practice currently exists, would no longer be legal, as embryos and foetuses would always be viable outside of a woman's womb. Consequently, most authors, whilst discussing how artificial wombs could potentially be viewed as a "solution" or "alternative" to abortion, also mention the fact that the existence and use of artificial wombs would require significant changes to the existing abortion regulation and framework – changes which have the potential to alter or possibly erode abortion rights and current practices.

The next most frequently mentioned ethical problem (mentioned in 49% of the pieces) is the welfare of the ectogenic child.[156] As the technology does not yet exist, there is no way of knowing the potential physical, psychological or emotional effects being gestated in an artificial womb could have on a child. As a

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Coleman, "Artificial Uterus," 9-18; Coleman, "A Surrogate for Surrogacy," 49-60; Coleman, *Ethics of Artificial Uteruses;* Corea, *The Mother Machine;* Davin and Kaczor, "Artificial Wombs," 657; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; James, "Ectogenesis," 80-99; Johnston, "Ethics and Ectogenesis," 33; Kaczor, "Abortion Debate," 283-301; Kaczor, "Artificial Wombs,"; Langford, "An End to Abortion," 263-269; Lupton, "Artificial Wombs," 621-633; Murphy, "Is Pregnancy Necessary," 66-84; Pence, "Natural Motherhood?" 77-88; Raskin, "Human Subject Research," 159-182; Reiber, "Morality," 515-527; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *Reproduction Revolution;* Steiger, "Not of Woman Born," 143-171; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-76; Welin, "Reproductive Ectogenesis," 615-626; Wells, "Ectogenesis," 372-379.

[156] Alghrani, "Ectogenesis," 189-211; Carlston, "Artificial Wombs," 35-39; Coleman, *Ethics of Artificial Uteruses;* Corea, *The Mother Machine;* Ekeke and Uchegbue, "Infertility among Christians," 201-208; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Ho, "Leaving People Alone," 139-148; James, "Ectogenesis," 80-99; Johnston, "Ethics and Ectogenesis," 33; Lupton, "Artificial Uterus," 613-629; Murphy, "Is Pregnancy Necessary," 66-84; Murphy, "Research Priorities," 78-89; Sander-Staudt, "Of Machine Born," 109-128; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *Reproduction Revolution;* Smajdor, "The Moral Imperative for Ectogenesis," 336-345; Smajdor, "Defense of Ectogenesis," 90-103; Steiger, "Not of Woman Born," 143-171; Tong, "Out of Body Gestation," 59-76; Tonti-Filippini, "Embryo Rescue Debate," 111-137.

result, the use of artificial wombs may be ethically problematic because it has the potential to be harmful for the resulting child.

A further 37% of the sources state that an ethical problem that could arise from artificial wombs would be the lack of a mother-child bond.[157] The sources discussed the physical, hormonal, emotional and psychological bond that forms between a mother and child during pregnancy, and questioned whether gestating a foetus in an artificial womb would have any effects on the baby.

A total of 37% of the literature mentioned various implications on gender equality in reproduction as a potential ethical problem resulting from artificial wombs.[158] These pieces contend that the existence and use of artificial wombs would essentially make the male and female roles in reproduction the same. This, in turn, could have the potential to alter gender roles in a potentially negative way, according to some authors. This could be viewed as removing a woman's unique ability to gestate and bear children. Other authors also discuss how relative gender equality in terms of reproduction via artificial wombs could also lead to women being told how to – or not to – gestate and bear their own children, which could be seen as an additional method of controlling women and their bodies.

A further 33% of the publications listed prohibitive cost as an ethical problem relating to artificial wombs.[159] Like most emerging technologies, artificial wombs

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[157] Alghrani, "Ectogenesis," 189-211; Carlston, "Artificial Wombs," 35-39; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; James, "Ectogenesis," 80-99; Lupton, "Artificial Uterus," 613-629; Pence, "Natural Motherhood?" 77-88; Rosen, "Why not Artificial Wombs," 67-76; Sander-Staudt, "Of Machine Born," 109-128; Singer and Wells, *Reproduction Revolution;* Smajdor, "The Moral Imperative for Ectogenesis," 336-345; Steiger, "Not of Woman Born," 143-171; Tong, "Out of Body Gestation," 59-76; Tonti-Filippini, "Embryo Rescue Debate," 111-137; Woolfrey, "Ectogenesis," 129-138.

[158] Bard, "Immaculate Gestation," 149-158; Brassington, "The Glass Womb," 197-210; Coleman, "Artificial Uterus," 9-18; Coleman, *Ethics of Artificial Uteruses;* Firestone, *Dialectic of Sex;* Hendricks, "Of Woman Born," 1-62; Ho, "Leaving People Alone," 139-148; Jackson, "Degendering Reproduction," 346-368; Langford, "An End to Abortion," 263-269; Murphy, "Is Pregnancy Necessary," 66-84; Sander-Staudt, "Of Machine Born," 109-128; Singer and Wells, *Reproduction Revolution;* Smajdor, "The Moral Imperative for Ectogenesis," 336-345; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-76; Woolfrey, "Ectogenesis," 129-138.

[159] Alghrani, "Ectogenesis," 189-211; Bard, "Immaculate Gestation," 149-158; Coleman, "Artificial Uterus," 9-18; Coleman, "A Surrogate for Surrogacy," 49-60; Coleman, *Ethics of Artificial Uteruses;* Ekeke and Uchegbue, "Infertility among Christians," 201-208; Hendricks, "Of Woman Born," 1-62; Jackson, "Degendering Reproduction," 346-368; James, "Ectogenesis," 80-

would most likely only be available to those wealthy enough to afford them. This could create a class divide amongst those who can and cannot afford to avoid pregnancy, as well as between children who were and were not gestated in artificial wombs.

Another 26% of the sources mentioned the eligibility to use artificial wombs as an ethical problem.[160] In other words, who would be most eligible to use artificial wombs? Would priority be given to people with infertility problems, or women who were unable to have children as a result of a hysterectomy? Or could a woman who simply did not want to be pregnant, but could afford to use an artificial womb be permitted to use it?

Another 23% of the sources stated that unwanted babies are another ethical problem that could result from artificial wombs.[161] If artificial wombs are available as an option for expecting women who do not want to remain pregnant, yet do not want to kill their foetus, this could create a large number of unwanted babies which may end up being a burden on the State.

A potential stigmatisation of women who did or did not use artificial wombs was mentioned by 23% of the sources as a potential ethical problem.[162] On one hand, will women who decide to use an artificial womb be seen as lazy or unsuitable mothers? On the other hand, if artificial wombs are proven to be even safer than

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99; Murphy, "Is Pregnancy Necessary," 66-84; Pence, "Natural Motherhood?" 77-88; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Welin, "Reproductive Ectogenesis," 615-626.

[160] Alghrani, "Ectogenesis," 189-211; Coleman, *Ethics of Artificial Uteruses;* Gelfand, "Ectogenesis," 89-108; James, "Ectogenesis," 80-99; Lupton, "Artificial Wombs," 621-633; Lupton, "Artificial Uterus," 613-629; Murphy, "Is Pregnancy Necessary," 66-84; Pence, "Natural Motherhood?" 77-88; Smajdor, "The Moral Imperative for Ectogenesis," 336-345; Wells, "Ectogenesis," 372-379; Woolfrey, "Ectogenesis," 129-138.

[161] Alghrani, "Ectogenesis," 189-211; Bard, "Immaculate Gestation," 149-158; Carlston, "Artificial Wombs," 35-39; Coleman, "Artificial Uterus," 9-18; Coleman, *Ethics of Artificial Uteruses;* Davin and Kaczor, "Artificial Wombs," 657; Kaczor, "Abortion Debate," 283-301; Lupton, "Artificial Wombs," 621-633; Sander-Staudt, "Of Machine Born," 109-128; Singer and Wells, *Reproduction Revolution.*

[162] Gelfand, "Ectogenesis," 89-108; Ho, "Leaving People Alone," 139-148; Jackson, "Degendering Reproduction," 346-368; Jackson, "Degendering Reproduction," 346-368; Pence, "Natural Motherhood?" 77-88; Rosen, "Why not Artificial Wombs," 67-76; Sander-Staudt, "Of Machine Born," 109-128; Takala, "Human Before Sex," 187-196; Tong, "Out of Body Gestation," 59-76; Welin, "Reproductive Ectogenesis," 615-626.

natural gestation, would a woman be seen as careless or negligent if she did *not* use an artificial womb to gestate her children?

Nineteen percent of the literature raised questions regarding how the research and development into artificial wombs would take place.[163] Authors wondered if and how clinical trials would take place, and what, specifically, the research and development process leading up to artificial wombs would look like.

As mentioned in the previous section, the issue of using artificial wombs to grow embryos or foetuses in order to harvest their organs and tissues for transplant purposes was mentioned in 19% of the literature as an ethical problem, as well as a valuable goal.[164] Despite the fact that having more organs and tissues for transplant purposes would be a valuable goal, it is also ethically troublesome, as it would involve creating and partially gestating human beings solely for the purpose of their parts. Indeed, the several pieces of literature that cite partially growing embryos or foetuses in order to harvest their organs are the same that cited this very issue as a valuable goal. The discussion about this stems from one piece[165] of literature which presented this issue as both an ethical problem and a valuable goal, and then was subsequently discussed in a similar manner by other authors.

Fourteen percent of the sources discussed whether or not State funding could or should be used for research into artificial wombs, as there are other treatments for infertility, and there may be other areas that require research more urgently.[166] This includes some authors who argue that the State *not* providing funding for the

[163] Carlston, "Artificial Wombs," 35-39; Coleman, *Ethics of Artificial Uteruses;* Hendricks, "Of Woman Born," 1-62; Kaczor, "Abortion Debate," 283-301; Raskin, "Human Subject Research," 159-182; Reiber, "Morality," 515-527; Schultz, "Development of Ectogenesis," 1-24; Smajdor, "Defense of Ectogenesis," 90-103.
[164] Coleman, *Ethics of Artificial Uteruses;* Hendricks, "Of Woman Born," 1-62; James, "Ectogenesis," 80-99; Reiber, "Morality," 515-527; Singer and Wells, *Reproduction Revolution;* Steiger, "Not of Woman Born," 143-171; Tong, "Out of Body Gestation," 59-76; Wells, "Ectogenesis," 372-379.
[165] Singer and Wells, *The Reproduction Revolution*.
[166] Coleman, *Ethics of Artificial Uteruses;* Ho, "Leaving People Alone," 139-148; Murphy, "Research Priorities," 78-89; Smajdor, "Defense of Ectogenesis," 90-103; Tong, "Out of Body Gestation," 59-76; Wells, "Ectogenesis," 372-379.

development of artificial wombs would be ethically problematic, and other authors arguing the opposite.

Fourteen percent of the sources stated that artificial wombs are simply unnatural, which is an ethical problem in and of itself.[167] These sources question the use of artificial womb technology because it is something that is not natural, and therefore determine that it should not be used.

A further 14% of the sources suggested that liability is another ethical problem arising from artificial wombs.[168] If something goes wrong with the artificial womb, who is responsible and held liable? Would the responsibility lie with the parents, the doctors, the technicians, or someone else?

An additional 12% of the sources listed terminating the ectogenic pregnancy as an ethical problem associated with artificial wombs.[169] Would parents be allowed to switch off an artificial womb if, during the gestation process, they decide that they are unwilling or unable to have a child? Would that be equivalent to (legally) having an abortion, or would it be viewed as murder given the viability of the foetus outside of the human body?

Nine percent of the literature stated that if artificial wombs were used in regular clinical practice, it could potentially lead to the ethically problematic scenario of having employers or insurance providers require women to use artificial wombs rather than gestate naturally.[170] Employers may view artificial wombs as superior to natural gestation and childbirth as women would not require time off prior to, during or following the birth of their child, and may cut down on maternity (or parental) leave in general. Similarly, insurance providers may require their

[167] Coleman, *Ethics of Artificial Uteruses;* Ekeke and Uchegbue, "Infertility among Christians," 201-208; Firestone, *Dialectic of Sex;* Ho, "Leaving People Alone," 139-148; Singer and Wells, *Reproduction Revolution;* Tong, "Out of Body Gestation," 59-76.
[168] Alghrani, "Ectogenesis," 189-211; Corea, *The Mother Machine;* Jackson, "Degendering Reproduction," 346-368; Pence, "Natural Motherhood?" 77-88; Sander-Staudt, "Of Machine Born," 109-128; Schultz, "Development of Ectogenesis," 1-24.
[169] Alghrani, "Ectogenesis," 189-211; Reiber, "Morality," 515-527; Schultz, "Development of Ectogenesis," 1-24; Simonstein, "Artificial Reproductive Technologies," 177-186; Steiger, "Not of Woman Born," 143-171.
[170] Carlston, "Artificial Wombs," 35-39; Ekeke and Uchegbue, "Infertility among Christians," 201-208; Hendricks, "Of Woman Born," 1-62; Reiber, "Morality," 515-527.

customers to use artificial wombs rather than gestate naturally in order to cut down on medical costs incurred during and after pregnancy and childbirth.

A further 9% of the literature mentioned the potential commodification of babies as an ethical problem resulting from the existence and use of artificial wombs.[171] The authors argue that if artificial wombs were used, then the resulting baby could be viewed and possibly treated as a commodity.

Ethical problems surrounding the ownership of the embryo and foetus were discussed in 7% of the literature.[172] If a couple decides to create an embryo or a foetus, which parent has ownership or guardianship rights of the embryo or foetus? What would happen if one parent would like to terminate the pregnancy but the other does not?

Two sources (or 5% of the literature)[173] claimed that the existence of artificial wombs would encourage sexual promiscuity and irresponsibility, as they could be used as a form of birth control. These authors suggest that the availability of artificial wombs – meaning that a pregnancy can be ended without ending the life of the foetus – would lead to sexual promiscuity because it would provide a "relatively easy, guilt-free way of avoiding an unwanted pregnancy."[174] In this scenario, the authors contend that, following a bout of sexual irresponsibility and becoming pregnant, women would elect to have foetal (or embryo) transplant surgery and continue their foetus's gestation in an artificial womb, suggesting that this procedure (and artificial wombs themselves) could be used as a form of birth control; the availability of which would encourage sexual promiscuity and irresponsibility. If artificial wombs were genuinely viewed as a viable alternative to other forms of contraception, it would mean that women would make the deliberate decision to forego traditional methods of contraception (such as the contraceptive pill, condoms, the morning-after pill, intrauterine devices, et cetera)

[171] Ekeke and Uchegbue, "Infertility among Christians," 201-208; Hendricks, "Of Woman Born," 1-62; Reiber, "Morality," 515-527; Schultz, "Development of Ectogenesis," 1-24.
[172] Alghrani, "Ectogenesis," 189-211; Jackson, "Degendering Reproduction," 346-368; Schultz, "Development of Ectogenesis," 1-24.
[173] Davin and Kaczor, "Artificial Wombs," 657; Ekeke and Uchegbue, "Infertility among Christians," 201-208.
[174] Davin and Kaczor, "Artificial Wombs," 657.

in favour of risking becoming pregnant, and then undergoing a foetal (or embryo) transplant procedure and placing her foetus (or embryo) in an artificial womb for the remainder of its gestation. Whilst some women, after finding out they are pregnant, may decide to undergo a foetal transplant and place their foetus in an artificial womb rather than aborting it, it is unlikely that the existence of this option for dealing with an unplanned pregnancy would lead to increased sexual promiscuity and irresponsibility.

Another two sources suggested that artificial wombs could lead to the commodification of pregnancy.[175] Although this has already happened to a certain extent with surrogate mothers, artificial wombs may increase the commodification.

Two sources also stated that artificial wombs could lead to the practice of cloning.[176]

Another two sources stated that the use of artificial wombs is ethically problematic because it would allow homosexual couples to have their own genetic children.[177] Interestingly, this was also cited by other authors as a valuable goal of artificial wombs, indicating the wide spectrum of views towards the potential reproductive technology.

One source argued that the use of artificial wombs could lead to a eugenic programme being put into action.[178]

Lastly, one source contended that if artificial wombs existed, it could result in the ethically problematic scenario of requiring spare IVF embryos to be gestated and put up for adoption.[179]

[175] Rosen, "Why not Artificial Wombs," 67-76; Schultz, "Development of Ectogenesis," 1-24.
[176] James, "Ectogenesis," 80-99; Reiber, "Morality," 515-527.
[177] Ekeke and Uchegbue, "Infertility among Christians," 201-208; Reiber, "Morality," 515-527.
[178] Corea, *The Mother Machine*.
[179] Schultz, "Development of Ectogenesis," 1-24.

2.3.5 Should artificial wombs be used?

Table 5

Should artificial wombs be used?	Number of pieces	Percentage of pieces
Yes[180]	23	54%
Does not address	13	30%
No	7	16%

In the conclusion of most pieces reviewed, the author(s) would generally state whether or not they believe that artificial wombs should be used, once the technology exists. This took into account both the valuable goals and the ethical problems they had identified previously, and on balance, determined whether or not artificial wombs should be utilised. More than half (54%) of the sources[181] contend that artificial wombs should be used when the technology becomes available, whilst 16% of the sources[182] argue that artificial wombs should not be used. Lastly, 30% of the sources do not address whether or not artificial wombs should be used.[183]

2.4 Conclusion

The existing literature on artificial wombs provides useful insights into the current ethical perceptions of artificial womb technology, such as the goals that were

[180] The "Yes" category includes authors who stipulate that artificial wombs should be used in some circumstances (such as to help premature babies or as an alternative to the death of the foetus following the abortion of a pregnancy) but not in other cases (such as for a fertility treatment).
[181] Brassington, "The Glass Womb," 197-210; Coleman, *Ethics of Artificial Uteruses;* Corea, *The Mother Machine;* Firestone, *Dialectic of Sex;* Gelfand, "Ectogenesis," 89-108; Hendricks, "Of Woman Born," 1-62; Ho, "Leaving People Alone," 139-148; Jackson, "Degendering Reproduction," 346-368; Kaczor, "Abortion Debate," 283-301; Kaczor, "Artificial Wombs,"; Lupton, "Artificial Wombs," 621-633; Lupton, "Artificial Uterus," 613-629; Pence, "Natural Motherhood?" 77-88; Raskin, "Human Subject Research," 159-182; Reiber, "Morality," 515-527; Smajdor, "In Defense of Ectogenesis," 90-103; Simonstein, "Artificial Reproductive Technologies," 359-365; Simonstein, "Artificial Reproductive Technologies," 177-186; Singer and Wells, *Reproduction Revolution;* Steiger, "Not of Woman Born," 143-171; Takala, "Human Before Sex," 187-196; Welin, "Reproductive Ectogenesis," 615-626; Wells, "Ectogenesis," 372-379.
[182] Coleman, "Artificial Uterus," 9-18; Coleman, "A Surrogate for Surrogacy," 49-60; Ekeke and Uchegbue, "Infertility among Christians," 201-208; James, "Ectogenesis," 80-99; Sander-Staudt, "Of Machine Born," 109-128; Tong, "Out of Body Gestation," 59-76; Woolfrey, "Ectogenesis," 129-138.
[183] Alghrani, "Ectogenesis," 189-211; Bard, "Immaculate Gestation," 149-158; Cannold, "Ectogenesis," 55-64; Carlston, "Artificial Wombs," 35-39; Davin and Kaczor, "Artificial Wombs," 657; Johnston, "Ethics and Ectogenesis," 33; Langford, "An End to Abortion," 263-269; Murphy, "Is Pregnancy Necessary," 66-84; Murphy, "Research Priorities," 78-89; Rosen, "Why not Artificial Wombs," 67-76; Schultz, "Development of Ectogenesis," 1-24; Smajdor, "The Moral Imperative for Ectogenesis," 336-345; Tonti-Filippini, "Embryo Rescue Debate," 111-137.

identified as being valuable, and the aspects of artificial womb technology that the authors found to be problematic. Firstly, it must be noted that the past seven years have seen a dramatic increase in the number of journal articles, books and chapters written discussing the ethics of artificial wombs. In fact, pieces of literature published between 2005 and 2012 represent 65% of the existing literature. This indicates that the potential ethical implications associated with artificial wombs are rising to prominence as a significant issue, not only in the field of ethics, specifically, but also in the fields of law, gender, medicine, technology, and the wider discipline of philosophy (in addition to the ethics sub-discipline).

As discussed in the beginning of this chapter, the first wave of discussion of ectogenesis coincided with the first wave of feminism, and as noted in Section 2.3.2, the first pieces of literature discussing the ethics of artificial wombs coincide with the second wave of feminism. However, it is interesting to note that the recent significant increase in the pieces of literature discussing the ethics of artificial wombs is occurring for the most part (although not entirely) outside of the realm of a wave of feminism or a specific feminist movement. This indicates that, although artificial wombs would most certainly have implications on gender (as mentioned throughout this chapter), recently, scholars have found the subject of the ethics of artificial wombs to be a relevant and important topic not necessarily solely confined to gender issues and/or feminism. In other words, artificial wombs are no longer only viewed as a feminist or women's issue: it is now widely recognised that artificial wombs would have implications on society as a whole.

Another significant result of the literature review is that more than half of the sources thought that artificial wombs should be used in some capacity. This includes authors who believe that artificial wombs should only be used in certain conditions for certain purposes – typically, as a way of gestating a foetus that would have otherwise been aborted, or saving the lives of premature babies, as opposed to being used to for the entire gestation process. Only 16% of the literature indicated that artificial wombs, for varying reasons, should not be used. It is also important to note that 30% of the literature merely discussed the ethics of

artificial wombs without indicating whether or not artificial wombs should be used when the technology comes into existence, therefore taking a neutral stance.

There was a wide range of 17 valuable goals that could result from artificial wombs mentioned in the literature. Of those valuable goals, six were mentioned far more frequently than others, appearing in between 42 and 65% of the literature. These include assisting those who are infertile or otherwise unable to gestate *in vivo* (65%), using artificial wombs to finish gestating the foetus following the abortion of a pregnancy (53%), assisting premature babies (51%), women would not have to be pregnant (44%), and the possible decrease in gender inequality (42%). Again, far from solely being a women's or feminist issue alone, the most frequently-listed valuable goals of artificial wombs discussed in the literature involve potential situations of value for premature babies, both homosexual and heterosexual individuals and couples who would like children but are unable to create/gestate/bear them on their own, society as a whole (with a possible shift in gender roles), and, indeed, women. In other words, the valuable goals that could result from artificial wombs would not only be beneficial for women, but also for men who want to be fathers, and babies born prematurely. Moreover, the possible far-reaching societal consequences of artificial wombs on gender and workplace roles have the potential to positively impact entire future generations by allowing them to grow up in a world without (or with less) gender inequality. Whilst it is certainly possible that some may not view these as valuable goals and, in fact, may instead see them as ethical problems, the fact that they would be valuable to at least a portion of society is enough to be included in this category. The other valuable goals discussed in the literature were mentioned in around 20% of the literature at most, with seven of the valuable goals being mentioned in fewer than 10% of the literature. An analysis of these valuable goals will occur in the following chapter.

Furthermore, the existing literature discussed 23 potential ethical problems that could result from artificial wombs. One ethical problem was mentioned in 77% of the literature: the potential implications on the practice of and right to abortion. Even pieces of literature that listed artificial wombs being used to gestate foetuses following the abortion of a pregnancy as a valuable goal also acknowledged that

whilst this may be the case, there is also the potential for the erosion of existing abortion rights and practices, which for some would be a serious ethical problem. This is such a multifaceted ethical issue that it will be discussed later in Chapter V.

Four other ethical problems are mentioned in at least one-third of the literature: the welfare of the ectogenic child (49%), a lack of a mother/child bond from natural pregnancy (37%), the potentially negative implications on gender equality in reproduction (35%), and the prohibitive cost (33%). The remaining ethical problems were listed less frequently, including nine ethical problems being mentioned in fewer than 10% of the pieces of literature. The problems range from being serious and controversial – such as whether State funding could or should be used to fund research on artificial wombs – to far-fetched, such as the suggestion that artificial wombs could be used as a form of birth control and therefore encourage sexual promiscuity and irresponsibility.

Aside from the potential implications on abortion rights and practices, the other two ethical problems mentioned in the literature that I found the most interesting and complex were the potential ethical problems with the research and development phase leading up to the existence of artificial wombs, and the possible commodification and/or commercialisation that could result from the existence of artificial wombs. These ethical problems will be discussed in Chapters IV and VI, respectively. In those chapters, I will also address whether or not these problems are surmountable.

Chapter III: Valuable goals resulting from artificial wombs

3.1 Introduction

This chapter analyses each of the valuable goals listed in the literature through the lens of Frankena's value theory, which was explained in detail in the methodology section of Chapter I. Each of the goals discussed in this chapter are included because they are mentioned in the literature as having some sort of value, resulting from the existence and/or use of artificial wombs. However, that is not to say that questionable means could not be used to achieve these goals. These goals are simply assessed on the basis of whether or not they contain some element of value, according to Frankena's value theory. This will include both the positive and negative aspects of each valuable goal. Again, these are the valuable goals listed by the authors in the literature review *and not necessarily the goals that I regard as valuable*. Ethical problems that could potentially result from artificial wombs – including some related to these valuable goals – are discussed in subsequent chapters.

As discussed in Chapter I, Frankena identifies six nonmoral values: utility values (they are useful); extrinsic values (they are a means to what is good); inherent values (the experience of contemplating them is good); intrinsic values (they are good in themselves); contributory values (they contribute to the intrinsically good life); and final values (they are good on the whole).[184] For the purpose of this dissertation, utility value will not be discussed in this chapter, as it will apply to most of the goals regarded as valuable in the literature, as they are likely to contain elements of usefulness. Goals regarded as valuable in the literature will be analysed based on the remaining nonmoral values, and whether they have any bad-making features which could result in the goal having a total negative score.

[184] Frankena, *Ethics*.

3.2 Goals regarded as valuable in the literature

3.2.1 Assisting those who are infertile or otherwise unable to have children *in vivo*

This goal is extrinsically valuable because it is a means to what is good – allowing people who would like to have a child to have the ability to do so. For these people, having a child of their own is what they consider to be "good." Moreover, the experience of having a child for someone who wants one is undoubtedly a satisfactory experience and therefore good in itself, and intrinsically valuable. Allowing people who want children the ability to have children also has contributory value, as it contributes to the intrinsically good life for those whose intrinsically good life involves having their own genetic children. According to Frankena, an intrinsically good life is the life it would be rational to choose, and would be a "mixed life," consisting of activities and experiences that are enjoyable or both excellent in some degree and enjoyable. Whilst this makes up the *content* of an intrinsically good life, it also must have a *pattern*. For Frankena, this means that "the best life one is capable of must have form, not just in the sense of pattern, but in the sense of being inspired by a certain attitude, posture, or 'life-style'" – a concept also known as "subjective form." He notes that the content, pattern and subjective form of the good life will differ from person to person and, to a large extent, depend on an individual's personal experiences. With regards to the negative, allowing people who are infertile or otherwise unable to have children the opportunity to do so could potentially have the bad-making feature of giving people the ability to create babies in a laboratory for improper uses, such as selling them or using them for research purposes or for their organs. However, as this is unlikely to constitute anywhere near the majority of uses of artificial wombs and it is likely that there will be regulation in place prohibiting these uses, this bad-making feature is not enough to give this goal a total negative score.

3.2.2 An alternative to the death of the foetus following the abortion of a pregnancy

Currently, if a mother seeks to terminate her pregnancy, it inevitably results in the death of the foetus. The two are inextricably linked. The motives of ending the

pregnancy versus ending the life of the foetus do not matter, as the end result is the same. Indeed, women decide to end pregnancies for several reasons, which fall into three (typically overlapping) categories: not wanting to be pregnant, not wanting to become a genetic mother, and wanting to end the life of the foetus (for example, in cases where the foetus has severe deformities and is incompatible with life).[185] The practice of abortion, as it currently exists, ends both the pregnancy and the life of the foetus. However, if artificial wombs existed and were used in regular clinical practice, the end of a pregnancy would not necessarily mean the death of a foetus. A woman would have the option of ending her pregnancy and transferring the foetus to an artificial womb, where it would finish the gestation process. Therefore, the woman would no longer be pregnant, but the foetus would remain alive. This is extrinsically valuable as it is a means to what is good for both the mother – being able to end her pregnancy without aborting the foetus – as well as the foetus, which has the opportunity to finish the gestation process and live. This "good" is also intrinsically valuable for both the mother and foetus. In this case, what is "good" for the mother is being able to end her pregnancy, and also having the option of keeping her foetus alive. For instance, the pregnant woman may want to end her pregnancy, but finds traditional abortion (that results in the certain death of the foetus) to be morally unacceptable. For this woman, being able to end her pregnancy without killing her foetus would be considered "good" (according to Frankena's value theory) as it allows her to achieve both of her desired objectives. Furthermore, this goal would also be intrinsically valuable for the foetus, as giving a foetus the opportunity to be born that it would not have otherwise had, is good in itself. In this case, the opportunity to be born and remain alive could be viewed as being satisfactory for the foetus, and therefore, good in itself.

Conversely, if the ability to transfer a foetus to an artificial womb resulted in all women seeking abortions being forced to place their foetus in an artificial womb, thereby violating their autonomy, this goal could certainly have a bad-making feature. Along the same lines, another potential bad-making feature would be that requiring a woman to transfer her foetus to an artificial womb against her will

[185] This issue will be discussed further in Chapter V.

would force her to become a genetic mother, which, if this is something she does not want, would constitute a bad-making feature. However, these scenarios are both purely speculative. There is also a chance that artificial wombs could come into existence, and women would still have all the abortion options currently available. These issues will be discussed in greater detail in Chapter V.

In any event, providing women with the expansion of reproductive options by allowing them to end a pregnancy without ending the life of the foetus is – if medically possible – likely to occur when artificial wombs come into existence. However, the bad-making features associated with this goal are, at this stage, speculative. As such, these bad-making features are not enough to give this goal a total negative score.

3.2.3 Assisting premature babies

The development of artificial wombs will, if nothing else, improve the capacity to keep severely premature babies alive – potentially even in various stages of development. With each step towards the creation of an artificial womb, research into creating womb-like conditions for the growing foetus – or in this case, premature baby – has the potential to progress. The ability to sustain a human life that would have otherwise ended is extrinsically valuable as it is a means to what it good – saving the life of a premature baby and granting the experience of being parents to the parents of the baby. Both the experience of being alive for the baby and the experience of being able to keep their premature baby alive for the parents are intrinsically valuable because they are good in themselves and certainly constitute a satisfactory experience for parents who wish to keep their child alive. Furthermore, granting parents the opportunity to keep their premature baby alive has contributory value, as the addition of the baby to their family would contribute to the intrinsically good life for them because having a child (that was kept alive by an artificial womb) would, for them, be an integral part of a life consisting of activities and experiences that are enjoyable. This goal does not appear to have any bad-making features.

3.2.4 Women would not have to be pregnant

Whilst some women may thoroughly enjoy being pregnant, for others it can be a painful experience and potentially even life-threatening. Artificial wombs would give women the opportunity to decide whether to become pregnant themselves, or to outsource the pregnancy to an artificial womb. For women who suffer from pregnancy-induced diseases such as preeclampsia, this would allow them to maintain their own health, as well as have their own genetic child without using a surrogate. This would provide these women with the experience of being a mother without being pregnant, which those who choose this option would find satisfactory. In this case, having a baby without being pregnant via an artificial womb would be extrinsically valuable, as it is the means that provides the satisfactory experience of being a mother without the requirement and potential danger or discomfort of pregnancy. Strictly speaking from the woman's perspective, this goal does not appear to have any bad-making features. However, if considered from the developing child's perspective, being gestated in an artificial womb rather than a woman's uterus may lead to various complications for the child physically, psychologically or emotionally. At this stage, the consequences on the child are unknown. Moreover, this particular goal, as put forward in the literature, is exclusively about the woman, rather than the foetus; therefore any potential harm to the resulting child should not adversely affect this particular goal. As such, this goal does not have a total negative score.

3.2.5 Having a safe/controlled environment during gestation

When a woman is pregnant, there is always a risk that the foetus could be harmed. This could occur through conscious decisions made by the mother, such as by smoking or drinking alcohol, or by an uncontrollable event, such as a car accident. If artificial wombs existed, it would eliminate these potential harms from the gestation process. This element of protection of the foetus, which would lead to its healthy birth, is extrinsically valuable because it is a means to what is intrinsically good – in this case, a safe gestation and the birth of a healthy baby. The experience of having a safe gestation and being born healthy are satisfactory for the baby and the parents, and therefore is intrinsically valuable. Having a healthy baby that was gestated in a safe and controlled environment has contributory value as it contributes to the intrinsically good life for the baby and the parents, as

it is integral to a life consisting of activities and experiences that are enjoyable. For the parents, this means being the parents of a healthy baby. For the baby, being born healthy via a safe and controlled environment in an artificial womb contributes to its intrinsically good life in that it allows the baby to have the potential to have a life consisting of activities and experiences that are enjoyable. Conversely, having a controlled environment during gestation may prove to be less safe or beneficial for the foetus than a woman's uterus. Again, this is something that will not be known until the technology becomes available. As such, any possible bad-making features do not result in a total negative score for this goal.

3.2.6 May decrease gender inequality

If artificial wombs existed, infertile couples – or anyone with access to gametes or embryos – would be able to have their own genetic children without the use of a surrogate and would contribute equally to their creation. Although technically, it is a far more invasive procedure to obtain a woman's eggs than a man's sperm, once the gametes have been retrieved and an embryo created via IVF, both parents contribute equally to the conception and gestation of their child. This would most likely also mean that the mother would not breastfeed the baby,[186] and therefore would be on equal biological footing with the father – in other words, there would be no reason for the mother to take a career break to stay with the baby any more so than the father. Consequently, this could signal a shift in both parenting roles and the role of men and women in the workplace, and in turn, potentially alter gender roles in society as a whole. For example, women of child-bearing years may be currently discriminated against in the workplace – even if they have no plans of ever having children – solely for the reason that there is the possibility that they might request a significant amount of time off from their position in order to have and raise children. If "parental leave" rather than "maternity leave" became the norm, and fathers were just as likely to take significant amounts of time off from work – or at least were provided with that opportunity – it could provide further advancement in the workplace for women in general.

[186] Because breastfeeding, as it currently exists, occurs because a woman has just been pregnant and has given birth. If a woman was not pregnant prior to the birth of her child, she would most likely not be able to breastfeed, unless, of course, new technology was developed that would permit this.

It is important to note that artificial wombs could, at best, *decrease* gender inequality,[187] and are unlikely to eliminate it altogether. Whilst the existence of artificial wombs could have subsequent effects on numerous facets of society over time, the two areas immediately affected will be reproduction (in terms of more equal contribution from both males and females) and roles in the workplace (resulting from a blurring of traditional parental roles, as well as potentially more expansive effects for women in general, such as allowing more opportunities for advancement or permitting women to work in traditionally male-dominated areas). In other words, the existence of artificial wombs will not *stop* gender discrimination in general, but potentially may decrease it in some aspects of society.

These changes could be viewed as being satisfactory by many groups: women, men, parents, and employees – many of whom may welcome these changes. Therefore, decreasing gender inequality is extrinsically valuable, as it is a means to the experience of living in a more gender-equal society, and would be satisfactory to many. However, it must be noted that a decrease in gender inequality would not be a satisfactory experience everyone; for example, those who are strongly in favour of traditional gender roles in reproduction and society as a whole. For people with these views, decreasing gender equality would have bad-making features, such as giving more responsibility to men with regards to child care, as well as putting women on more equal footing to men in the workplace. Overall, however, a more gender-equal society would most likely produce more satisfactory than dissatisfactory experiences, and therefore, would not have a total negative score.

3.2.7 An alternative to surrogacy

Whilst a surrogate mother may become attached to the child she is carrying, resulting in her having second thoughts about turning the baby over to its genetic or social parents, the same would not be true for an artificial womb. Essentially, artificial wombs offer more effective surrogacy by eliminating the need for a

[187] The extent to which this will be the case is debatable, but it is, nonetheless, mentioned as a valuable goal in the literature.

genetically unrelated third party, and therefore avoiding a further set of potential complications. Using artificial wombs in lieu of surrogates is extrinsically valuable as it is a means to allowing people to have their own genetic children without the use of a surrogate and the potential resulting complications. It also has contributory value, as having children for those using the artificial womb would contribute to their concept of the intrinsically good life, as having a child for these parents would contribute to a life consisting of activities and experiences that are enjoyable. If, however, it is determined that gestating and giving birth in a woman's uterus is safer than in an artificial womb, then it would not be beneficial to the foetus being gestated to be located in an artificial womb. Rather, having an artificial womb as an alternative to surrogacy could be viewed as being negative for the foetus/child. In addition, women who work as surrogate mothers may not view artificial wombs as a positive development, as they could be seen as a business competitor, particularly if artificial wombs are proven to be safer and more effective than natural gestation. However, the existence of these two hypothetical bad-making features is not enough to give this goal an overall negative score.

3.2.8 Healthier, less possessive mother/child relationships

Some of the authors suggest that if women no longer had to go through the pain of giving birth, it would lead to healthier and less possessive relationships with their children. Children would no longer "owe" their mothers for giving birth to them, and mothers could not harbour animosity towards their children for the pregnancy and birthing process, therefore leading to a more functional relationship. These considerations are based on the presupposition that mothers might, in fact, harbour some sort of resentment towards their children for the pain and discomfort of pregnancy and childbirth. Obviously, this is most likely not the case with all mothers. As a result, these considerations are not generalisable to all mother/child relationships, as not all mother/child relationships are possessive or unhealthy. Having said that, using artificial wombs to foster healthier mother/child relationships would be extrinsically good as it is potentially a means to more positive familial relationships.

There is certainly no guarantee that mothers will in all (or even most) cases be possessive of their children as a result of gestating and giving birth to them. In fact, it is simply one outcome: there is also the possibility that mothers could become *less* protective of their children if they do not bear and gestate them, and artificial wombs could lead to *less* healthy mother/child relationships. That is, of course, difficult to argue, as that is most likely not the case with mothers who have adopted children, or who have used the services of surrogates. However, this scenario is just as hypothetical as the one put forward by the authors who suggest that artificial wombs could lead to less possessive mother/child relationships. As the goal itself is the fostering of less possessive mother/child relationships – regardless of whether or not this scenario is realistic or certain to happen in every circumstance – it does not have any major bad-making features, nor does it have a total negative score.

3.2.9 Benefits foetal medicine

Growing a foetus in an artificial womb would benefit foetal medicine by providing doctors with easier access to the foetus. This would allow doctors to more easily perform surgery on the foetus and observe its development. Furthermore, an artificial womb would (literally) shed some light into the mysteries of foetal development and gestation, beyond what can be seen in ultrasounds. This would not only benefit foetuses grown in artificial wombs, but foetal medicine in general, as the knowledge gained from observing and interacting with the gestation process in an artificial womb can be applied to *in vivo* pregnancies as well. This is extrinsically valuable because it is a means to providing better care for all pregnant women and foetuses in general, in addition to those gestated in artificial wombs. As the only outcome of this goal is to assist and benefit foetal medicine in general – for those foetuses gestated in both natural and artificial wombs – there do not appear to be any bad-making features, or a total negative score.

3.2.10 Growing embryos/foetuses to farm organs/tissues for transplant

There will always be a need for organs and tissues for transplant purposes, countered with a severe shortage of both. At present, organs and tissues must be donated either from a living or deceased donor, the involvement of which includes

numerous obstacles such as consent from family members (if the donor is deceased) and willingness to participate (in living donors). If artificial wombs existed, it would be possible to grow embryos and foetuses to a certain stage in their development when their organs and tissues can be harvested, and then continue to grow the parts through other means on their own and not as part of a foetus. This scenario has the potential to create organs and tissues required for transplant on an as-needed basis, without the obstacles of consent or waiting for an organ donor to die. This would be extrinsically valuable as it would be a means to obtaining organs and tissues for people who need them in order to allow them to lead healthier and longer lives. It also has contributory value, as the use of artificial wombs to grow organs and tissues for transplant purposes would contribute to the intrinsically good life for the recipients of the organs and tissues,[188] because for the recipients, living a healthy life with their new organs would allow them to lead a life consisting of activities and experiences that are enjoyable.

This goal is, indeed, also ethically problematic for several reasons. Firstly, the source of the eggs and sperm used to create the embryos/foetuses must be considered. Were they obtained from donors? Did the donors consent to their gametes being used for these purposes and not for the creation of a child? If this goal were to be considered valuable – or even ethical – the gametes used for the creation of the embryo/foetus would have to be obtained with all proper consent, or created artificially using stem cells, if/when such technology is available.[189]

Secondly, growing embryos or foetuses to any stage in order to use them for their organs or tissues is also ethically problematic. This practice could be viewed as part of a "slippery slope" towards growing entire human persons for their parts, and leading to the overall commodification of the human body. Others may argue that embryos could be grown up until a certain stage – such as up until they develop a central nervous system and the ability to feel pain – and then used for

[188] It should also be noted that this achieving this valuable goal also can be viewed as being ethically problematic. This will be discussed in Chapter VI.
[189] See, for example: A.J. Newsom and A.C. Smajdor, "Artificial Gametes: New Paths to Parenthood?" *Journal of Medical Ethics* 31(2005): 184-186.

the creation of various organs and tissues.[190] However, even those who argue in favour of growing embryos to a certain stage would agree that growing them beyond the point of the development of a nervous system is, in fact, ethically problematic and should not occur. This goal certainly has bad-making features. Despite the fact that there is a severe shortage of organs and tissues, the creation of late-stage embryos or foetuses to help alleviate the shortage is ethically problematic. Unless it is clearly specified and regulated, even the growing of embryos to the point of the development of a nervous system should not occur. The only possible way this goal could be ethically acceptable would be if the growing of embryos was only permissible up until the point of the development of the nervous system. If this were to occur, very clear regulation would be required, specifying that embryos could not be grown past that stage. Even in that scenario, however, there are enough bad-making features that some would argue that there would be a total negative score. In scenarios involving later-stage embryos or foetuses, the bad-making features are enough to give this goal a total negative score. The ethical problems associated with growing embryos/foetuses for their organs/tissues will be discussed in greater detail in Chapter VI.

3.2.11 Adoption of leftover IVF embryos

The authors suggest that one possible use for leftover embryos from IVF treatments would be for other couples to adopt them and gestate them in artificial wombs (if one of the parents is unwilling or unable to gestate and bear the child herself). This would, of course, require the consent of the genetic parents of the embryo. This would be seen as being intrinsically valuable by those who view an embryo as a human person, because they would view this as saving the embryos' lives and allowing them to be gestated and born, as opposed to being confined to a life in a freezer or being used for research purposes. This would therefore provide another option for couples with unused embryos: allowing them to decide whether to freeze and store them, destroy them, donate them to research, or put them up for adoption. Moreover, using artificial wombs to gestate adopted embryos is extrinsically valuable, as it is a means to providing people who are unable to create their own genetic embryo and also unable to gestate and bear their own

[190] See: Singer and Wells, *The Reproduction Revolution*, 138

children the opportunity to adopt an embryo that would have been unused otherwise.

One potentially negative aspect of this goal is that the adoption of leftover IVF embryos could mean that there are fewer embryos available for research purposes. Of course, the use of the embryos should strictly depend on the purposes for which the creators of the embryo consent. When given another choice regarding what should happen to their unused IVF embryos, couples who would have previously chosen to donate their embryos to research may now donate them instead for adoption. However, the possibility that there might be fewer embryos for research purposes – a practice that is opposed by some – is not enough to give this goal a total negative score.

3.2.12 Allowing homosexual couples to have their own genetic children without a surrogate

This is extrinsically valuable as it is a means to expand the ability for people to have their own genetic children to further reaches of society. It also has contributory value, as it contributes to the intrinsically good life for homosexual couples, which for them would consist of activities and experiences that are enjoyable; namely, having their own genetic children. To those who oppose permitting homosexual couples having their own genetic children (or any children at all), this would be viewed as a bad-making feature. However, on balance, that is not enough to result in a total negative score.

3.2.13 Expanding reproductive options/autonomy

This increases individual autonomy, giving both individuals who would like to have their own genetic children a way to do so without the use of surrogates, as well as providing another option for fertile couples and/or women. It does not suggest that artificial wombs would take the place of natural gestation, but merely would provide another option. This is extrinsically valuable as it provides more options as means of having children, allowing parents to decide how they would like to gestate their children. Those who oppose most expansion of reproductive autonomy and believe that procreation should happen as naturally as possible would not view this goal as being valuable. However, like most other emerging

technologies, artificial wombs would be an option, and not something people would be forced to use.[191] As such, this goal does not have a total negative score.

3.2.14 Saving foetuses when the mother is dead or dying

If artificial wombs existed, the death of the mother would not necessarily mean the death of the foetus. If a pregnant woman became seriously ill and her death was imminent, she could undergo foetal transplant surgery to place the foetus in an artificial womb for the remainder of its gestation in an attempt to save its life. Similarly, if a pregnant woman is killed in a car accident, for example, and the foetus was still alive, it could be possible to transplant the foetus into an artificial womb. In these cases, the foetus would have no other chance of survival, so it is extrinsically valuable for the foetus, as it is a means for it to stay alive. It could also be extrinsically valuable for the baby's father and the rest of the family, as it would be a means to completing the gestation process begun by the woman who was killed or seriously injured. As this goal does not appear to have any bad-making features, it does not have a total negative score.

3.2.15 Complete ectogenesis guarantees paternity

These authors argue that if a woman becomes pregnant naturally, a man has no way of truly knowing if the child is genetically his own (without taking a paternity test), as there is a chance that another man could have impregnated her. In cases of complete artificial gestation, where the embryo is created *in vitro* and grown in an artificial womb, it can – barring any lab-related or intentional switches or errors – guarantee a baby's paternity. The father of the child would be the person who provided his sperm to create the embryo. This would, in fact, be a valuable goal if there was a way to unequivocally ensure that the father's sperm is used in the creation of the embryo, and prevent any lab-related or intentional switches or errors. This goal is extrinsically valuable as it is a means to ensuring fathers that they are, in fact, the genetic father of their offspring and potentially granting peace of mind. It is, however, unlikely that this will be the primary purpose for the use of artificial wombs, but rather a side effect of the technology. Furthermore, there

[191] Ideally, at least.

are no bad-making features resulting from this goal. As a result, this goal does not have a total negative score.

3.2.16 Moving multiple births to an artificial womb

If a woman is pregnant with twins, triplets, quadruplets, et cetera, she could have foetal transplant surgery to move one or more of the foetuses to an artificial womb in order to make the pregnancy easier and safer. This is extrinsically valuable as it is a means to achieving a safer and healthier pregnancy and in turn, safer and healthier children and mothers. Indeed, if the transplant surgery was in any way unsafe for either the mother or the foetuses, then this procedure should not be performed. However, as the goal of the procedure would be for a safer gestation for both the mother and foetuses, it is unlikely that it would be permitted to occur if it was in any way deemed unsafe or harmful. As a result, assuming that the procedure is safe for both the mother and foetuses, this goal does not have a total negative score.

3.2.17 May reduce reproductive cloning

The concept that the existence of artificial wombs would somehow reduce reproductive cloning was addressed by the authors of one article. The authors themselves are not claiming that this would occur; rather, they state that "pro-artificial researchers and other bio-ethicists argue that artificial womb [sic] will reduce the tendency to cloning [sic]."[192] Yet, they do not specify the connection between reproductive cloning and the existence of artificial wombs, nor do they provide any further details of the connection, or any evidence to support their claim. Indeed, reducing reproductive cloning could, in fact, be viewed as having value. However, I do not see the connection between the existence of artificial wombs and a potential reduction in reproductive cloning. If someone decides to create an embryo via cloning, the embryo still must be gestated in either a natural or artificial womb. Therefore, it is difficult to see how the existence of artificial wombs could, in any way, lead to a reduction in reproductive cloning. These are two separate issues.

[192] Ekeke and Uchegbue, "Infertility among Christians," 203. It should also be noted that none of the other literature reviewed for this dissertation mentioned a reduction of reproductive cloning as a valuable goal associated with artificial wombs.

3.3 Conclusion

Applying Frankena's value theory, it is evident that numerous goals of artificial wombs do, in fact, possess nonmoral value. Both the positive and negative aspects of these goals were analysed in order to determine whether or not they had a total positive or negative score, according to Frankena's value theory. Examining the valuable goals that could result from the existence and use of artificial wombs is important because if there were no valuable goals resulting from the technology, then the development of artificial wombs would not be ethically desirable. However, given that there are numerous valuable goals, this criterion has been met.

Chapter IV: Ethical problems relating to experimental treatment on embryos and foetuses in the development of artificial wombs

4.1 Introduction

In order for any medical procedure or device – such as an artificial womb – to be used in regular clinical practice, it first must undergo a period of research and/or experimental treatment. Once an artificial womb is created, the next phase in its development will be to see if it is capable of gestation. In all likelihood, the first attempts at the use of an artificial womb will be partial, rather than full ectogenesis, meaning that it will involve the removal of a foetus from a woman's uterus and placing it in an artificial womb to complete the gestation[193] process. These first instances of the use of artificial wombs would be experimental treatments, and would most likely only occur in situations in which the foetus would otherwise die.

Arguably, early-stage artificial wombs exist today in the form of incubators for extremely premature infants. When experimental treatments on foetuses using artificial wombs occur, they would likely occur in the context of keeping increasingly younger neonates alive. As artificial wombs became more technologically sophisticated, younger neonates and foetuses could be placed in the artificial wombs, thereby pushing back the age of viability outside of the human body.[194] Eventually, this could lead to foetal transplants from a woman's uterus to an artificial womb in cases where the mother is, for whatever reason, unable to continue her pregnancy and the foetus would otherwise die. This could lead to embryo transplants as well, in scenarios where a woman only recently became pregnant but was unable to continue the pregnancy for medical reasons.

The final step in the development of artificial wombs would involve creating an embryo via IVF and implanting it in an artificial womb for the duration of its

[193] In this dissertation, "gestation" or the "gestation process" will refer to the process of foetal development from conception until birth. This term is applicable in situations in which a woman is gestating a foetus in her uterus, or in situations where gestation is taking place in an artificial womb. Furthermore, the gestation process could potentially be split between a woman's uterus and an artificial womb.

[194] The concept of viability outside of the human body is important, particularly in the context of abortion and abortion regulation, which will be discussed in the following chapter.

gestation. The entire creation and gestation process would occur outside of the human body. Whilst the situations described in the previous paragraph were scenarios in which the experimental treatment was for the foetus or neonate (regarding it as the patient in the scenario), the first situations where an embryo is created and gestated entirely in an artificial womb could constitute experimental fertility treatment in situations when a woman is physically unable to gestate a child (i.e. if she has had a hysterectomy). Just as procedures such as IVF and artificial insemination are considered fertility treatments for people who wish to become parents, using an artificial womb for the entire gestation process for women unable [195] to become pregnant could also be considered a fertility treatment.

In all likelihood, the first time that complete, external gestation in an artificial womb would occur would be when an embryo is created via IVF, and where implantation in the woman is imminent. If the woman, for whatever reason – including an accident or last-minute diagnosis with a condition that would prevent her from being able to become pregnant – is unable to have the embryo implanted, then the embryo could be implanted in an artificial womb instead. In this situation, the parents envisioned a natural gestation in a woman's womb, but due to a last-minute accident or medical discovery, she is unable to gestate the child. As a result, an artificial womb is used for gestation – rather than a human surrogate – to complete the fertility treatment process.

Once the experimental treatment stage is over, the final step in the development of artificial wombs would be deliberate complete ectogenesis: parents would make a conscious decision to create an embryo via IVF and implant it directly into an artificial womb for its entire gestation. However, it is unlikely that doctors would permit this type of use of an artificial womb unless the previous stages in the development were proven to be safe and successful.

[195] Once proven to be safe, artificial wombs could also be used by those who are able to become pregnant but would prefer to use an artificial womb instead. As those scenarios are considered non-therapeutic, they are not considered fertility treatment, but would be considered enhancement.

It must be noted that the two scenarios which are likely to give rise to the use of artificial wombs – rescue technology used to save foetuses/neonates, and treatment for infertility/creating a baby – are two separate situations, with very different ethical implications. Using an artificial womb as rescue technology to save a foetus/neonate would have ethical issues similar to those currently faced in situations involving neonatal intensive care. This will be discussed later in this chapter. In addition, once the experimental treatment phase has occurred and artificial wombs are used in clinical practice, they could also be used as a way of creating a baby entirely *in vitro,* or be considered a type of fertility treatment. In this case, I have specified that the first uses of an artificial womb to create and gestate a child entirely *in vitro* will likely be in cases when other fertility treatments – such as traditional IVF treatments – have not worked, and the artificial womb is used to gestate other IVF embryos the parents have created. Indeed, the artificial womb technology itself is the same regardless of whether it is being used by an infertile couple, or a woman who is fertile but chooses not to be pregnant, for example.

Whether infertility can be considered a disease, and whether fertility treatment technically "treats" anything at all is debatable.[196] Some may argue that so-called fertility treatments do not actually treat a person's infertility, meaning that they do not cure whatever is physically wrong with the person and alter their body to the

[196] For further information, see, for example: Helen Allan, "Experiences of Infertility: Liminality and the Role of the Fertility Clinic," *Nursing Inquiry* 14(2007): 132-139; Gay Becker and Robert D. Nachtigall, "Eager for Medicalisation: The Social Production of Infertility as a Disease," *Sociology of Health & Illness* 14(1992): 456-471; Gay Becker, Robert D. Nachtigall, "'Born to be a Mother': The Cultural Construction of Risk in Infertility Treatment in the U.S.," *Social Science & Medicine* 39(1994): 507-518; Ann V. Bell, "Beyond (Financial) Accessibility: Inequalities Within the Medicalisation of Infertility," *Sociology of Health & Illness* 32(2010): 631-646; Peter Conrad and Valerie Leiter, "Medicalization, Markets and Consumers," *Journal of Health and Social Behavior* 45(2004): 158-176; W.J. Dondorp and G.M.W.R. de Wert, "Fertility Preservation for Health Women: Ethical Aspects," *Human Reproduction* 24(2009): 1779-1785; Carrie Friese et al., "Rethinking the Biological Clock: Eleventh-Hour Moms, Miracle Moms and the Meanings of Age-Related Infertility," *Social Science & Medicine* 63(2006): 1550-1560; Elizabeth Heitman, "Social and Ethical Aspects of In Vitro Fertilization," *International Journal of Technology Assessment in Health Care* 15(1999): 22-35; Abha Khetarpal and Satendra Singh, "Infertility: Why Can't We Classify this Inability as a Disability?" *Australasian Medical Journal* 5(2012): 334-339; Varada Madge, "Infertility, Women and Assisted Reproductive Technologies," *Indian Journal of Gender Studies* 18(2011): 1-26; Jennifer A. Parks, "On the Use of IVF by Post-Menopausal Women," *Hypatia* 14(1999): 77-96; Anna Smajdor, "The Ethics of IVF over 40," *Maturitas* 69(2011): 37-40; Cecile M.T. Gijsbers van Wijk, et al., "Gender Perspectives and Quality of Care: Towards Appropriate and Adequate Health Care for Women," *Social Science & Medicine* 43(1996): 707-720.

point of them being able to conceive and/or gestate children naturally. Rather, fertility treatment offers a means for people to have children who are not otherwise able to do so, and in that sense, could be compared to adoption (which would not be considered a medical treatment).

The criteria for determining which embryos[197] would be transferred to artificial wombs would most likely be similar to the criteria currently used to determine which embryos are implanted in a woman's uterus following IVF. In other words, parents who elect to undergo testing themselves and have their embryos undergo PGD should be permitted to do so, in accordance with existing legal and ethical guidelines, in jurisdictions where this testing is legal. Conversely, parents can also make the decision to create one embryo (or several) and implant the embryo(s) into an artificial womb without undergoing testing; again, similar to currently existing situations involving IVF and implantation into a woman's uterus. Indeed, there are numerous ethical issues surrounding embryo selection and PGD, such as whether couples should be tested prior to the creation of the embryos, and if so, what these tests should include (such as current risks, the development of late-onset disease, and/or the possibility of genetic disease), and whether all embryos should be tested prior to transfer. There is not yet a consensus on whether PDG should be forbidden, permitted or compulsory, and the ethical questions surrounding PGD and embryo selection certainly apply to situations involving artificial wombs. However, these ethical issues are not *specific* to artificial wombs – they arise in any situations involving IVF and implantation into natural or artificial wombs. As such – added to the fact that this issue was not brought up at all in the existing literature as a problem specific to artificial wombs – it will not be dealt with in detail in this dissertation. Whilst I do acknowledge that the ethical issues surrounding PGD and embryo selection are important, these issues have been debated and discussed extensively in the existing literature.[198] It must also be

[197] The criteria for transferring foetuses to artificial wombs are a separate issue. As will be explained in the following paragraph, the transfer to foetuses to artificial wombs would constitute therapeutic treatment for the foetus, in that, for whatever reason, it is unable to continue its gestation in a woman's uterus and, in order to survive, must be transferred to an artificial womb. Of course, like any therapeutic treatment, the medical staff must ensure that the treatment – in this case, the transfer of the foetus to an artificial womb – would not be detrimental to the health of the patient, or futile.

[198] See for example: C. Cameron and R. Williamson, "Is There an Ethical Difference Between Preimplantation Genetic Diagnosis and Abortion?" *Journal of Medical Ethics* 29 (2003): 90-92;

noted that like any forms of technology, the embryo selection process used in IVF (and that will likely be used if artificial wombs are used in clinical practice) will evolve and advance over time.

Artificial wombs will be able to be used for both therapeutic and non-therapeutic purposes. Artificial wombs have the potential to be therapeutic for both the embryo/foetus, as well as the mother. In situations when a developing embryo or foetus is transferred to an artificial womb in order to continue the gestation process, it is considered therapeutic for the embryo/foetus. In situations where a woman is physically unable to gestate a child (as a result of a lack of uterus, for example) then an artificial womb could be viewed as a type of fertility treatment,[199] as discussed above. Conversely, artificial wombs can also be used for non-therapeutic – or enhancement – purposes, such as for comfort (i.e. the mother would not have to go through the pain and discomfort of pregnancy and childbirth), convenience (for example, the mother would not have to take time off from work during or following a pregnancy, which may lead to career advancement), or cosmetic purposes (for example, a woman may not want to gain weight or experience the other bodily changes associated with pregnancy and childbirth). As discussed above, the first instances of artificial wombs being used in experimental treatment will most likely occur in scenarios which are therapeutic for the embryo/foetus. This would be followed by scenarios that are therapeutic fertility treatments for a woman unable gestate her own child. At some stage in the future, the tables may turn completely and artificial wombs may be

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Guido de Wert, "Preimplantation Genetic Diagnosis: The Ethics of Intermediate Cases," *Human Reproduction* 20 (2005): 3261-3266; S. J. Fasouliotis and J.G. Schenker, "Preimplantation Genetic Diagnois Principles and Ethics," *Human Reproduction* 13 (1998): 2283-2245; Sigal Klipstein, "Preimplantation Genetic Diagnosis: Technological Promise and Ethical Perils," *Fertility and Sterility* 83 (2005): 1347-1353; Bartha M. Knoppers, Sylvie Bordet and Rosario M. Isasi, "Preimplantation Genetic Diagnosis: An Overview of Socio-Ethical and Legal Considerations," *Genomics and Human Genetics* 7 (2006): 201-221; Anver Kuliev and Yury Verlinsky, "Preimplantation Diagnosis: A Realistic Option for Assisted Reproduction and Genetic Practice," *Current Opinion in Obstetrics & Gynecology* 17 (2005): 179-183; G. Pennings, R. Schots and I. Liebaers, "Ethical Considerations on Preimplantation Genetic Diagnosis for HLA Typing to Match a Future Child as a Donor of Haematopoietic Stem Cells to a Sibling," *Human Reproduction* 17 (2002): 534-538; John A. Robertson, "Extending Preimplantation Genetic Diagnosis: The Ethical Debate," *Human Reproduction* 18 (2003): 465-471; Jackie Leach Scully, Sarah Banks and Tom W. Shakespeare, "Chance, Choice and Control: Lay Debate on Prenatal Social Sex Selection," *Social Science & Medicine* 63 (2006): 21-31; Sirpa Soini, et al., "The Interface between Assisted Reproductive Technologies and Genetics: Technical, Social and Ethical and Legal issues," *European Journal of Human Genetics* 14 (2006): 588-645.

[199] If one accepts fertility treatment to, in fact, be a "treatment."

viewed as the safer and more-controllable option and may become the preference of doctors, health insurers and perhaps even employers.

Ideally, non-therapeutic uses of artificial wombs would not be permitted until the technology is proven to be safe and effective and is used in regular clinical practice. However, evidence from the use of IVF and other reproductive technologies suggest otherwise. Many new and emerging reproductive technologies are used in regular clinical practice, despite the fact that they may not be proven safe and effective, nor regulated,[200] and are only withdrawn if shown to be harmful or unsafe. Whether this will be the case with artificial wombs is not yet known. Perhaps greater consideration will be given to artificial womb technology, as it will have the capacity to create a human person entirely outside of the human body for the first time, unlike any existing technologies. Ideally, several steps would occur before artificial wombs are used in clinical practice. These include extensive clinical trials on animals (taking into account several generations of animals) and long-term follow-up research. There has been concern from various groups that long-term follow-up data is not currently being collected on existing reproductive technologies to determine whether the therapies are safe or harmful.[201] Furthermore, any research *should* take place within an

[200] Ireland is an example of a country where IVF and other reproductive technologies are left unregulated but still take place.

[201] See, for example: W. Dondorp and G. de Wert, "Innovative Reproductive Technologies: Risks and Responsibilities," *Human Reproduction* 26(2011): 1604-1608; Tom P. Fleming, et al., "The Embryo and its Future," *Biology of Reproduction* 71(2004): 1046-1054; K.S. Grace, K.D. Sinclair, "Assisted Reproductive Technology, Epigenetics, and Long-Term Health: A Developmental Time Bomb Still Ticking," *Seminars in Reproductive Medicine* 27(2009): 409-416; Michele Hansen, "Assisted Reproductive Technologies and the Risk of Birth Defences – A Systematic Review," *Human Reproduction* 20(2005): 328-338; Lene Koch, "IVF – An Irrational Choice?" *Reproductive and Genetic Engineering: Journal of International Feminist Analysis* 3(1990); D. Lucifero, et al., "Potential Significance of Genomic Imprinting Defects for Reproduction and Assisted Reproductive Technology," *Human Reproduction Update* 10(2004): 3-18; Emily L. Niemitz, et al., "Epigenetics and Assisted Reproductive Technology: A Call for Investigation," *American Journal of Human Genetics* 74(2004): 599-609; Christine K. Olson, et al., "In Vitro Fertilization is Associated with an Increase in Major Birth Defects," *Fertility and Sterility* 84(2005): 1308-1315; Uma M. Reddy, et al., "Infertility, Assisted Reproductive Technology, and Adverse Pregnancy Outcomes: Executive Summary of a National Institute of Child Health and Human Development Workshop," *Obstetrics & Gynecology* 109(2007): 967-977; Laura A. Schieve, et al., "Are Children Born After Assisted Reproductive Technology at Increased Risk for Adverse Health Outcomes?" *Obstetrics & Gynecology* 103(2004): 1154-1163; Jeremy G. Thompson, et al., "Epigenetic Risks Related to Assisted Reproductive Technologies: Short- and Long-term Consequences for the Health of Children Conceived through Assisted Reproduction Technology: More Reason for Caution?" *Human Reproduction* 17(2002): 2783-2786; Bradley J. Van Voorhis, "Outcomes from Assisted Reproductive Technology," *Obstetrics & Gynecology* 107(2006): 183-200; Mary Anne

established regulatory framework, based on well-developed ethical guidelines. However, as discussed above, based on the past 40 years of reproductive medicine, there is certainly no guarantee that this can or will occur.

As explained in the paragraphs above, it is highly likely that the first attempts at artificial womb use would be to keep a foetus or young neonate alive – along the same lines as the incubators that exist today, only more advanced and better able to mimic the environment and functions of a woman's uterus. Therefore, as the experimental treatment route is likely to be the first step in utilising artificial wombs – and may ultimately lead to the technology becoming advanced enough to undertake the complete gestation process – this chapter will primarily focus on this scenario. It is, however, acknowledged that the complete creation and gestation of a human being *in vitro* presents a separate and complex set of ethical challenges. Whilst some of these ethical problems will be discussed in subsequent chapters, the focus of this chapter will be exclusively on the ethical problems with the experimental treatment stage of the development of artificial wombs.

The results of the literature review in Chapter II indicate that 19% of the literature discusses ethical issues with the research and development of artificial wombs. However, aside from one chapter in an edited volume, the remaining pieces of literature only mention the issue in passing, rather than providing an in-depth discussion of any potential ethical problems. As there is a lack of detailed inquiry into the ethical obstacles with the research into and experimental treatment required for the development of artificial wombs, and that is an area worthy of discussion, this chapter will explore these issues in depth. It is important to analyse the ethical issues surrounding experimental treatment in the development of artificial wombs because it is a crucial and unavoidable step in the development process, and if the ethical problems with experimental treatment are deemed to be insurmountable, then further development of artificial womb technology should not occur. This chapter will examine some of the ethical issues arising from the research into and experimental treatment on embryos and foetuses leading up to complete ectogenesis in an artificial womb, via the Universal Declaration on

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Warren, "IVF and Women's Interests: An Analysis of Feminist Concerns," *Bioethics* 2(1988): 37-57.

Bioethics and Human Rights. This chapter will begin by discussing the ethics of neonatal intensive care, as many of the same issues arise with potential experimental treatment involving artificial wombs, at least in the early stages of development. It will examine two of the ethical problems arising from the experimental treatment phase of the development of artificial wombs: the benefit/harm of the treatment, and issues surrounding consent.

4.2 The ethics of foetal and neonatal intensive care

As mentioned above, an early-stage artificial womb currently exists in the form of the incubators used to keep premature neonates alive by helping to facilitate their breathing and providing an environment as close to a natural womb as possible. With infants this young, it is not simply the case of attempting to save the life of every neonate; physicians and parents must also take into account the implications of prolonging the life of the neonate, which may include permanent disability and/or a life of physical pain and suffering. Similarly, in the future, as artificial wombs progress and attempts are made at transferring increasingly younger foetuses or neonates to the device, physicians and parents will have to critically consider whether this action is in the best interest of the patient.

The existence and use of artificial wombs will have an impact on the concept of viability. Whilst one concept of viability suggests that it is the point at which a baby is born alive,[202] another concept, put forth by two landmark court rulings, indicates that viability occurs when the foetus has the capability of meaningful life outside the mother's womb.[203] Artificial wombs will complicate things further by adding another dimension to the equation: scenarios in which the foetus/neonate is, in fact, viable outside of the mother's womb – because it is in an artificial womb – but is unable to survive outside of some sort of womb, artificial or natural. As a result, a distinction will have to be made between viability outside of a women's uterus, and viability outside of *any* womb – natural or artificial. The age of viability itself is a fluid concept, as it differs greatly depending on factors such as geographic location, birth weight, availability of technology, and whether

[202] Rance v Mid-Downs HA [1991] 1 QB 587, [1991] 1 All ER 801 (QBD).
[203] See Roe v Wade 410 US 113 at 163 (1973) and C v S [1988] QB 135, [1987] 1 All ER 1230. (A U.S. Supreme Court case which made abortion legal.)

or not it is a multiple pregnancy.[204] The British Association of Perinatal Medicine introduced the concept of a "threshold of viability," meaning a period from 21-26 weeks of gestation where a baby born at that stage is potentially – but not definitely – viable.[205]

4.2.1 What constitutes experimental treatment?

This prompts the question of what would determine where neonatal intensive care (using incubators) ends, and where experimental treatment on foetuses using artificial wombs would begin. In order to answer that question, it is important to consider the four types of potential treatment: therapy, experimental therapy, therapeutic experiments, and non-therapeutic experiments. Therapy, as discussed above, involves treatment which will allow the body to heal, return to normal, and/or compensate for a deficiency in some area. Experimental therapy – or experimental treatment – is treatment given to a patient in situations where there is little or no evidence that the treatment is effective. Experimental therapy is done on a case-by-case basis, in situations when the doctor believes the therapy may be beneficial for the patient. Therapeutic experimentation occurs in a larger-scale trial, involving a specific protocol and tests conducted on a group of patients. Lastly, non-therapeutic experimentation is the earliest-stage trials which test for toxicity and potential danger or harm in treatments, without deliberately attempting to use the treatment as therapy. This chapter examines the experimental therapy (or experimental treatment) phase of the development of artificial wombs.

At this stage, incubators and medical equipment used on preterm infants are essentially early-stage artificial wombs. They are designed to sustain the infant's life by mimicking the actions of the mother's womb as accurately as possible. It is likely that as this equipment becomes more advanced and able to sustain younger and younger lives, the distinction between neonatal intensive care and the use of

[204] British Medical Association, "Abortion Time Limits," last modified 17 June 2005, last accessed 13 April 2011, available from http://www.bma.org.uk/ethics/reproduction_genetics/AbortionTimeLimits.jsp?page=6.
[205] The British Association of Perinatal Medicine, "Memorandum – Foetuses and Newborn Infants at the Threshold of Viability A Framework for Practice," July 2000, last accessed 13 April 2011, available from http://www.bapm.org/documents/publications/threshold.pdf.

artificial wombs would blur. Arguably, taking an evidence-based approach[206] to ethical decision-making, *any* use of neonatal intensive care would be considered experimental treatment for infants for whom its benefits and results are highly uncertain.[207] In other words, because the outcome of treatment given to extremely premature neonates is never known for certain, each time a neonate is given intensive care, it could be considered experimental treatment. As a result, essentially the same sort of experimental treatment would occur with artificial wombs as currently is given with neonatal intensive care. Taking this into consideration even further blurs the line between the current use of medical technology to sustain the life of preterm babies, and the first uses of artificial wombs.

Moreover, there is the question of the actual artificial womb equipment. When does an incubator used for neonatal intensive care officially become an artificial womb? Is there a specific stage in the advancement of the technology that signals the shift from incubator to artificial womb? Is it simply a direct correlation with the age of the foetus or neonate being placed in the device? Will it still be considered an incubator until it has reached the potential to complete the full gestation process from IVF-created embryo, resulting in a live birth? Again, this is all a grey area. If parents are more comfortable with the term "incubator," then perhaps medical staff will continue to use it rather than possibly exacerbating an already stressful situation by placing their child in an "artificial womb," which may make them uneasy and less confident in the technology. It is, however, too early at this stage to attempt to discern when, specifically, this shift in terminology will take place.

4.3 Benefit/harm of the treatment

When determining whether or not to place a neonate or foetus in an artificial womb to continue its gestation, many ethical questions that arise could be categorised under "benefit/harm" – in other words, any action taken should result in benefits to the patient being maximised, and any harm being minimised. This,

[206] Meaning that ethical decisions are made based on evidence from previous treatments/procedures/actions.
[207] Jon Tyson, "Evidence-Based Ethics and the Care of Premature Infants," *The Future of Children* 5(1995): 203.

the second of the UNESCO Principles, should be taken into consideration before any medical treatment is undertaken, whether it is in clinical practice, experimental treatment, or any other form of research.[208]

Similar to situations involving neonatal intensive care, the potential benefits and harms for the patient are largely dependent upon its stage of development. The survival rate for babies born during the threshold of viability varies. The National Institute of Child Health & Human Development's Neonatal Research Network (NRN) collected data on preterm infants born between 1998 and 2003 at hospitals within the NRN. The survey provided the following outcomes[209] for the infants in the sample:

Table 6

	Outcomes at 18 to 22 Months Corrected Age[210]			
Gestational Age (in completed weeks)	**Death Before NICU Discharge**	**Death after NICU Discharge**	**Death or Profound Neurodevelopmental Impairment**	**Death or Moderate to Severe Neurodevelopmental Impairment**
22 weeks	95%	95%	98%	99%
23 weeks	74%	74%	84%	91%
24 weeks	44%	44%	57%	72%
25 weeks	24%	25%	38%	54%

This is only one study and cannot represent all preterm babies, but it is clear from this data that the survival rates for babies born in the threshold of viability are not high.

In situations where doctors and parents are considering placing a neonate/foetus into an artificial womb, any other viable options to keep the neonate/foetus alive have likely been exhausted. Specifically, there are three scenarios which are likely to lead to the first uses of artificial wombs at an early stage of development. The first instance would be if a pregnant woman was dying – for instance, after being

[208] Universal Declaration on Bioethics and Human Rights, 2005, Art. 4.
[209] National Institute of Child Health & Human Development's Neonatal Research Network, "Extremely Preterm Birth Outcome Data," last modified 10 July 2010, last accessed 13 April 2011, available from http://www.nichd.nih.gov/about/org/cdbpm/pp/prog_epbo/dataShow.cfm. See also JE Tyson et al, "Intensive Care for Extreme Prematurity: Moving beyond Gestational Age." *New England Journal of Medicine* 358 (2008): 1672-1681.
[210] Determination of death/profound neurodevelopmental impairment and death/moderate to severe neurodevelopmental impairment based on 4,165 infants whose outcomes were known at 18 to 22 months corrected age; determination of death based on a denominator of all 4,446 cohort infants.

involved in an accident – and the foetus would die for certain if not placed in an artificial womb.[211] Secondly, if a pregnant woman would die if the pregnancy continued, but the foetus was not developed enough to be placed in an existing neonatal intensive care incubator, it may be transferred to an artificial womb.[212] Lastly, if severe medical problems with the foetus were detected, and it was impossible to provide *in vivo* treatment and the foetus would otherwise die, then the foetus may be removed and placed in an artificial womb in order to receive the treatment required.[213]

In each of those scenarios, the use of the artificial womb would be the only alternative to the certain death of the foetus. However, similar to the issues currently raised when deciding whether to administer neonatal intensive care to extremely premature or low-birth-weight neonates, the benefits and harms of the experimental treatment must be taken into account. In situations like these, simply keeping the foetus alive is not enough to constitute "benefit": the potential harm done to the foetus through the experimental treatment via the use of an artificial womb – such as possible disabilities and quality of life in general – must be taken into account.

There are four questions that should be taken into consideration when weighing the potential harm for the child[214] associated with experimental treatment using artificial wombs,[215] which can be drawn from the potential harm to a child receiving neonatal intensive care.[216] Firstly, what is the projected suffering, burden and pain for the child?[217] If there is a significant chance that the child's life will be burdened with pain and suffering, then that must be taken into account

[211] Raskin and Mazor, "Human Subject Research," 172.
[212] Ibid.
[213] Ibid.
[214] There are benefits and harms for both the parents and the child resulting from artificial wombs. For example, children can benefit from artificial wombs as they are a means to gestate them, but could potentially be harmful for children, if at some stage it is found that gestating children in artificial wombs causes them to develop certain defects. This chapter will only discuss the benefits and harms for the child.
[215] Sauer writes about neonatology, not artificially wombs, but the same potential harms would face children gestated in an artificial womb as experiment treatment, as children who are treated in neonatal intensive care face.
[216] Pieter J. J. Sauer, "Ethical Dilemmas in Neonatology: Recommendations of the Ethics Working Group of the CESP (Confederation of European Specialists in Paediatrics)," *European Journal or Pediatrics* 160 (2011): 366.
[217] Ibid.

when determining whether or not to prolong his or her life. Whilst there are always slim chances of a "miracle baby" that somehow fully or mostly normally develops, if there is, in fact, a large chance that the child would die shortly after completion of gestation, or would lead a life full of pain and suffering, then it can be argued that keeping the foetus/neonate alive would cause more harm than benefit. In those cases, it may be best to allow the patient to die with minimal suffering.[218]

Secondly, will the child ever be able to interact and/or communicate with his or her environment, and if so, to what extent?[219] His or her quality of life would be severely diminished if he or she would be so severely disabled that communication and interaction with the world and others would be impossible. Even if the child is able to physically develop at least somewhat normally, if he or she is not able to interact and/or communicate with others, then the child may be physically alive, but at what cost? Would the person have an existence in which a he or she is able to be aware of his or her surroundings, communicate, make decisions and perform other basic functions to a certain extent? Whilst there is an entire spectrum of communication ability that the child could have, ranging from full communication capabilities, to not being able to communicate at all, if the child is not able to communicate any decisions for him or herself and would be completely dependent upon care from parents or guardians, it can be argued that the child would lead a life that may be very difficult. In cases like these, I think that keeping the foetus or neonate alive may also cause more harm than benefit. That is, of course, not to say that all infants without the capacity to interact with others should be allowed or encouraged to die. It is just important to take this aspect of their development into consideration when weighing benefits and harms.

Thirdly, will the child be dependent on medical care, and if so, to what extent and for how long?[220] Similar to the two aforementioned scenarios, the fact that the child may be permanently reliant upon medical care must be taken into consideration. Would the child be confined to a life in a hospital? Would the child

[218] Ibid., 367.
[219] Ibid., 366.
[220] Ibid.

ever mentally develop, or would he or she be permanently infantile? How severely is the child disabled and what level of medical care would be required? If it is highly likely that the child would not survive without dependence on medical care, then it must be taken into consideration when determining whether or not to allow a foetus/neonate to continue its gestation in an artificial womb. Again, like the previous categories, the future reliance of the child on medical care would exist on a spectrum between requiring little-to-no medical care, to never being able to leave the hospital and being attached to life-sustaining machines indefinitely. Knowingly continuing the gestation of a foetus/neonate that is destined for a life inside a hospital attached to life-sustaining machines may cause more harm than benefit.

Lastly, what is the life expectancy of the child?[221] The child's life expectancy must be balanced against the burden and intensity of the experimental treatment and its potential current and future harm to the child. Does the foetus/neonate have an identifiable condition that doctors know will cause it to die shortly after the completion of gestation? If the foetus/neonate is in such a condition that it is highly unlikely for it to survive following gestation in an artificial womb, and would experience significant pain and suffering, then the most beneficial action may be to provide the child with pain relievers to make its short life as comfortable as possible. However, a short life expectancy alone is not grounds itself to cease all treatment or allow the patient to die. Indeed, the patient should be made as comfortable as possible, and this includes not using any treatment that will make its already-short life in any way painful or uncomfortable.

Naturally, there may be instances where a foetus or neonate was placed in an artificial womb to continue its gestation and develops into a normal and healthy baby. It is also not to say that any or all foetuses or neonates with the potential to be disabled, reliant upon medical care, or developmentally challenged in any way should be aborted, or in this case, should not be placed in an artificial womb.

[221] Ibid.

As with any treatment, in order to proceed, there should be a positive balance of benefits over harms for the patient. In situations involving the potential placement of embryos/foetuses in an artificial womb for experimental treatment, each of the four questions mentioned above should be taken into consideration: (1) What is the projected suffering, burden and pain for the child?; (2) Will the child ever be able to interact and/or communicate with his or her environment, and if so, to what extent?; (3) Will the child be dependent on medical care, and if so, to what extent and for how long?; and (4) What is the life expectancy of the child? Once these questions are answered, if it is evident that the experimental treatment in an artificial womb would be of more benefit than harm to the patient, a multidisciplinary discussion should then take place between doctors, nurses, counsellors and the parents of the patient, in order to determine what is in the best interests of the patient.

Unfortunately, determining the benefits and harms of a treatment is not black and white. Each situation is different, and there will be varying degrees of both benefits and harms in each case. There is no specific formula to determine whether or not to use experimental treatment involving artificial wombs on embryos/foetuses – it should be done on a case-by-case basis. The best interest of the patient must always be considered – and that does not always mean using the experimental treatment. In scenarios when it is evident that the patient could benefit from the experimental treatment in an artificial womb, there is the potential to save and or/improve the lives of foetuses or neonates that would not otherwise have survived.

4.4 Consent

In addition to the potential benefits or harms caused by the experimental treatment, another ethical issue that arises when considering whether to place a foetus/neonate in an artificial womb is that of consent. When neonatal intensive care and eventually artificial wombs as such are used as experimental treatment, the parents must be clearly informed about the treatment and any potential side effects or risks, and should explicitly consent to its use.[222]

[222] Tyson, "Evidence-Based Ethics," 203.

The fourth and fifth UNESCO Principles both address the issue of consent. The fourth principle states that any therapeutic medical intervention and scientific research should only be carried out with the prior, free and informed consent of the person concerned, based on adequate information.[223] Moreover, consent can be withdrawn by the person at any stage and for any reason without disadvantage or prejudice.[224] The fifth principle specifically addresses persons without the capacity to consent, which would be applicable in cases concerning foetuses and neonates.[225] This principle states that authorisation for medical practice and research should be obtained in accordance with the best interest of the person and in accordance with domestic law.[226]

As explained in the fifth UNESCO Principle in terms of authorisation for medical practice and research on persons without the capacity to consent, the State can potentially play a role in the consent process by providing some level of domestic regulation of medical practice and research. This could occur through the enactment of regulations on the conditions necessary to obtain various types of consent, specifically in situations when the patients cannot grant their own consent (such as foetuses/neonates continuing their gestation in artificial wombs). However, at most, the State can provide relatively broad regulation protecting those without the capacity to consent and stipulating who should grant consent on their behalf, and under what circumstances. It would be a cumbersome process to pass legislation that could effectively provide stipulations for *all* situations when parental consent must be given, under which circumstances more responsibility is given to the doctors, how the decision-making process should occur, and what course of action should be taken as a result. As every situation involving foetuses/neonates is different, it would be difficult to attempt to legislate for all potential scenarios. Moreover, as the quantity and quality of information required for informed consent of the parents does change regardless of the level of regulation, the State must rely on the judgment and medical knowledge of the doctors. As such, the role of the State in situations involving the care of

[223] Universal Declaration on Bioethics and Human Rights, 2005, Art. 6.
[224] Ibid., Art. 6.
[225] Ibid., Art. 7.
[226] Ibid.

foetuses/neonates is somewhat limited, and the instances of foetal/neonatal care are dealt with on more of a case-by-case basis, with the decision-making process involving primarily the parents and doctors.

Parents of extremely premature babies face the unenviable task of having to make decisions regarding the treatment or non-treatment of their children. On the one hand, some believe that parents have the obligation to provide treatment for their children under any and all circumstances. On the other hand, others believe that caring for a child may involve requesting the discontinuation of treatment when the parents – after sufficient information and counselling – make the decision that their child's life would involve so much unrelieved suffering that allowing the child to die is the best way to care for him or her.[227]

One example of a set of guidelines on parental consent is the Review of the Guidance on Research Use of Foetuses and Foetal Material (also known as the Polkinghorne Report) of 1989, which dealt specifically with the issue.[228] The Polkinghorne Report states: "The written consent of the mother must be obtained before any research or therapy involving the foetus or foetal tissue takes place. Sufficient explanation should be offered to make the act of consent valid."[229] The report also stipulates that consent to abortion must be obtained before consent to the use of the foetus and without reference to the possibility of that use,[230] and also that consent should be obtained prior to any proposed tests on the foetus for transmissible disease.[231] Furthermore, the Polkinghorne Report specifies that paternal consent is not a prerequisite to foetal use.[232] The report has been criticised for not adequately answering certain objections to any requirement for maternal consent, as well as for its reasoning rejecting the case for the requirement of paternal consent or consultation.[233]

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[227] Sauer, "Ethical Dilemmas," 366-367.
[228] John Polkinghorne, et al., "Review of the Guidance on the Research Use of Foetuses and Foetal Material," (London: HMSO, 1989): Cmnd 762.
[229] Polkinghorne, "Foetal Material," 4.1.
[230] Ibid., 4.2.
[231] Ibid., 4.5.
[232] Ibid., 4.3.
[233] John Keown, "The Polkinghorne Report: Nice Recommendations, Shame about the Reasoning," *Journal of Medical Ethics* 19(1993): 116.

The role of the doctors in the decision-making process is to determine the futility or effectiveness of the treatment. At this stage, the doctor will consider the proportionality of the treatment, weighing the benefits and harms, in a process described in the previous section. It is then up to the parents to determine what treatment or non-treatment is in the child's best interest. Indeed, parents are only faced with the option of whether or not the treatment is in their child's best interest in situations when the doctor has deemed the treatment to be at least potentially effective. As with any experimental treatment, the outcome of the treatment is not known for certain. Therefore, it is the responsibility of the doctor to properly inform the parents of all the possible outcomes – both positive and negative – prior to them deciding whether or not to grant consent for the treatment.

The steps leading up to making an informed decision regarding an extremely premature baby are riddled with complications for both the parents and the medical professionals involved. Firstly, parents of extremely premature babies are not always provided with consistently accurate information regarding the condition of their child. For example, medical professionals may give parents information communicated via euphemisms, vague statements or half-truths that may shield them from information about uncertainties or controversies surrounding their child's treatment, and prevent them from making informed decisions regarding the treatment.[234] Along the same lines, parents who find themselves in the position of having to grant their consent for the treatment or non-treatment of their foetus or neonate come from different cultural, religious, educational and socioeconomic backgrounds, as well as varying age groups. This means that each parent or set of parents may be working with varying sets of values, which may, in turn, result in different decision-making processes regarding their child's treatment. For example, parents of certain religions may deny various medical procedures for their child on the basis of religion, or parents from a low-income background make take the cost of a lifetime of medical care for their child into consideration when deciding whether or not to grant consent for treatment. As a result of the aforementioned differences, it is highly unlikely

[234] Helen Harrison, "The Principles for Family-Centered Neonatal Care," *Pediatrics* 92 (1993): 644.

that there is one specific way that information regarding their children should be delivered by doctors to all parents. Consequently, it may be difficult for doctors to determine the manner in which they inform parents, as well as the amount and detail of information that should be given.

Secondly, the fact that the parents must make a very difficult decision under extreme stress and emotion also is a factor. However, that is not an excuse to shelter parents from crucial information regarding their child. For example, medical professionals may assume that parents of extremely premature babies are too overwhelmed to process information or make rational decisions, or be reluctant to discuss possible treatment complications with parents or poor development outcomes, for fear that it would disrupt the "bonding" process and lead to parenting disorders.[235] An appropriate balance must be struck between providing the parents with the necessary information and approaching the subject with sensitivity towards their difficult decision.

Thirdly, medical professionals may have difficulty presenting parents with a "united front" in order to avoid any confusion that might result from parents finding out that there are medical or ethical differences of opinion among the medical staff.[236] This could occur if different members of the medical staff – such as doctors, nurses or counsellors – hold varying moral views on when and how treatment should be given to the foetuses/neonates. It is acknowledged that medical professionals approach their jobs from varying ethical stances which determine both how and whether they decide to treat the patients – an exercise of their professional autonomy.[237] This is certainly their right as medical

[235] Ibid.
[236] Ibid.
[237] The ethics of medical professionals is an issue that is debated extensively in the literature. See, for example: Ruth Baumann-Holzle, Marco Maffezzoni and Hans Ulrich Bucher, "A Framework for Ethical Decision Making in Neonatal Intensive Care," *Acta Paediatrica* 94 (2005): 1777-1783; William C. Frederick, David Wasieleski and James Weber, "Values, Ethics and Moral Reasoning among Healthcare Professionals: A Survey," *HEC Forum* 12 (2000): 124-140; Andrew Freeman, et al., "Health Professionals' Enactment of their Accountability Obligations: Doing the Best They Can," *Social Science & Medicine* 69 (2009): 1063-1071; R. Grundstein-Amado, "Differences in Ethical Decision-Making Processes among Nurses and Doctors," *Journal of Advanced Nursing* 17 (1992): 129-137; E. Manias and A. Street, "The Interplay of Knowledge and Decision Making Between Nurses and Doctors in Critical Care," *International Journal of Nursing* Studies 38 (2001): 129-140; L. Monterosso, et al., "The Role of the Neonatal Intensive Care Nurse in Decision-Making: Advocacy, Involvement in Ethical Decisions and Communication,"

professionals. For instance, the doctor involved may believe that personhood begins at conception and therefore every effort and attempt should be made to save the life of the foetus/neonate. The attending nurse, however, may be wary of providing the patient with treatment, based on his or her experience treating foetuses/neonates in the past. In this scenario, the doctor and nurse may present the parents with conflicting suggestions of how the patient should be treated, thereby making an already complicated situation for the parents even more difficult.

Fourthly, parents may be influenced by media coverage of "miracle babies" or "miracle therapies."[238] Whilst many successes in neonatology receive media attention, the failures are far less widely publicised, which may therefore give parents unrealistic expectations regarding the treatment of their child.[239] Unfortunately, these "miracle babies" are typically the exception, rather than the rule, but because of the media coverage, parents may believe that their child has far better odds than is the case.

Lastly, despite evidence that parents are not adversely affected by participating in decision-making,[240] some medical professionals believe that the full involvement of parents in the decision-making process may result in parental guilt or other psychological difficulties.[241] However, information regarding their child's prognosis or condition should not be withheld from parents, regardless of whether medical professionals' efforts to the contrary were well-intentioned.[242] Moreover, the information should be accurate, specific, detailed, meaningful and complete,

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International Journal of Nursing Practice 11 (2005): 108-117; K. Oberle and D. Hughes, "Doctors' and Nurses' Perceptions of Ethical Problems in End-of-Life Decisions," *Journal of Advanced Nursing* 33 (2001): 707-715; Linda Olson, "Hospital Nurses' Perceptions of the Ethical Climate of Their Work Setting," *Journal of Nursing Scholarship* 30 (1998): 345-349; Tanya Sudia-Robinson, "Ethical Implications of Newborn Screening, Life-Limiting Conditions, and Palliative Care," *The American Journal of Maternal/Child Nursing* 36 (2011): 188-196.

[238] Ibid.

[239] Ibid.

[240] D.G. Benfield, S.A. Leib, SA, and J.H. Vollman, "Grief Responses of Parents to Neonatal Death and Parental Participation," *Pediatrics* 62 (1978): 171-177.

[241] Harrison, "Family-Centered Neonatal Care," 644.

[242] Ibid.

and parents should be made aware of any medical or ethical differences in opinion among staff.[243]

One suggestion of how to respond to consent issues before they arise is to provide parents with the opportunity to grant advance consent treatment directives, completed during the prenatal period. This would involve parents putting in writing their specific requests and directions regarding the treatment and resuscitation of their child should he or she be born extremely prematurely or seriously ill.[244] However, this is not a viable option for several reasons. Firstly, expectant parents may be emotional or protective of their embryo/foetus, which therefore may impact their instructions whilst providing advance consent. Secondly, parents may be unsure of how they would react to a particular situation – in this case, addressing the needs of their extremely premature or ill child – until they are actually faced with the situation itself. Whilst this may be true, this is probably a case of there never being an ideal time to seek or grant parental consent. Thirdly, it is impossible to obtain prior consent for all the potential scenarios that could occur with the foetus/neonate. Even if a seemingly exhaustive list of all the possible situations that could occur was composed, there will almost certainly be other unanticipated and/or unique scenarios that take place. Lastly, presenting the parents with a set of possible complications with the gestation, birth and with their embryo/foetus could potentially cause expectant parents significant worry and distress about their child's looming arrival. For all these reasons, the option of pre-birth consent must be rejected.

4.5 Conclusion

The development of artificial wombs is a gradual process. The current stage of development is taking place in the form of the use of incubators for extremely premature neonates. As discussed previously, when dealing with the youngest and most vulnerable neonates, each use of an incubator constitutes experimental treatment, as each case is unique and the outcome of the treatment is unknown. From this stage, experimental treatment using incubators will advance, eventually being utilised by younger and younger neonates, and eventually, foetuses and

[243] Ibid.
[244] Ibid.

embryos. At some stage in the future, once the technology is proven to be safe and effective, the entire gestation process could potentially take place in artificial wombs. This would begin as experimental fertility treatment, in situations when implantation of an embryo created via IVF in the uterus of a woman was imminent, but a last minute occurrence prevents implantation in the mother's womb from taking place, therefore requiring an artificial womb as a substitute.

As mentioned earlier in this chapter, the final stage in the development of artificial womb technology would occur when parents deliberately make the decision to create an embryo via IVF and implant and gestate it in an artificial womb, with absolutely no intention of implantation in a human womb. This scenario was not dealt with in this chapter because by the time that artificial wombs would be available to the general public as a legitimate option for a woman becoming pregnant and gestating a child, they would no longer be considered experimental treatment. By that stage, artificial wombs would be viewed along the same lines as a human surrogate in terms of safety and being a viable option for those who wish to become pregnant but are unable to do so. Indeed, there are numerous ethical problems that arise from artificial wombs being used in clinical practice, some of which will be addressed in subsequent chapters.

As with any experimental treatment, the benefits and harms of the treatment must be taken into account prior to making the decision whether or not to administer the treatment. In situations involving foetuses or neonates, these decisions surrounding treatment or non-treatment literally result in life or death for the patient. However, when determining whether or not to use experimental treatments such as artificial wombs on foetuses or neonates, it is not as black and white as whether the patient will live or die – there is an additional possibility of the patient surviving, but destined to a life of suffering or varying degrees of disability and/or a lifetime of hospitalisation. Parents and medical professionals must take into account all possible scenarios and the benefits and harms attached to them when making the decision of whether or not to treat the patient. Along the same lines, parents should be provided with complete and detailed information regarding their child's condition or prognosis, and all the potential resulting benefits and harms.

Given the gradual nature of the development of artificial wombs via experimental treatment, it is possible to see how the technology may, at some stage, become a reality. Any ethical issues that arise whilst using advanced incubators/early artificial wombs will not be new – they are the same problems regarding consent and benefit/harm of the treatment that already arise with, and are an accepted part of neonatal intensive care. None of these ethical problems have been deemed to be insurmountable, as neonatal intensive care using incubators regularly occurs.

Furthermore, the development process of artificial wombs will be slow and closely monitored, ensuring that each of the advancements made on the artificial womb are safe, effective, and result in a device that is as close to a natural uterus as possible. As these advancements will take place on a device that is an accepted part of medical practice – incubators for extremely premature neonates – it is not unreasonable to believe that the development of the next generation of incubators – artificial wombs – might result from a series of incremental next steps in neonatal care. Far from the sudden introduction of radical new technology, the development of the artificial womb simply coincides with the natural progression of incubator technology. As a result, it is concluded that any ethical problems arising from this stage are not insurmountable, and that the further development of artificial wombs should be encouraged.

Moreover, once the artificial wombs become advanced enough to gestate embryos, they can also be viewed as advancement in fertility treatment. The scenario in which an embryo was created via IVF and implantation in a woman was imminent, but was unable to occur because of a last minute complication, is a combination of being fertility treatment for the parents, as well as treatment for the embryo. Using this logic, the ethical problems arising from this scenario are similar to those discussed above, in which an incubator/artificial womb is used to continue the gestation of a foetus or neonate. As discussed above, these problems are not insurmountable. However, deliberately choosing to use an artificial womb for the entire gestation process – in lieu of a human surrogate – is exclusively a fertility treatment, and presents a new set of ethical challenges than those mentioned above. As previously stated, once this stage of development is a reality

and artificial wombs are used in regular clinical practice, the resulting ethical challenges are not related to the experimental treatment leading to the development of artificial wombs, as the technology has already been developed, and are therefore not discussed in this chapter. Some of the ethical challenges that could result from the use of artificial wombs in clinical practice are discussed in subsequent chapters.

Chapter V: Ethical problems relating to abortion resulting from the clinical practice of artificial womb technology

5.1 Introduction

As discussed in previous chapters, artificial wombs are not devices that will simply come into existence one day out of nowhere, forever changing reproduction, neonatal care, and abortion. Rather, the technology required for artificial wombs will gradually come into use as incubators for severely prematurely born infants become more advanced. Therefore, the notion of using artificial wombs to continue the gestation process following the abortion of a pregnancy is not only a distinct possibility, but was also the one most widely discussed in the literature.[245] Indeed, using existing incubator technology for extremely premature infants, foetuses or neonates from late-term abortions could technically finish the gestation process outside of a woman's uterus.[246] As technology surrounding artificial wombs/increasingly advanced neonatal incubators progresses, this scenario becomes increasingly possible.

The existence of the artificial womb and its clinical practice is highly likely to impact the current practice and concept of abortion. The impact on the practice of abortion ranges from issues relating to autonomy, human rights and human dignity, to scenarios that provide women with a possible alternative to the termination of their foetuses. Moreover, as will be discussed later in this chapter, the existence of artificial wombs could potentially change the concept of abortion from one that currently exists (where the termination of the pregnancy and the foetus are inextricably linked) to one that only involves the termination of the pregnancy. This chapter examines the potential consequences on the concept and practice of abortion resulting from the existence and use of artificial womb technology. It will begin with my stance on the moral status of the embryo: a gradualist approach. It is important to first clarify my stance on the moral status of the embryo because this position is the basis of many of my arguments throughout the chapter, including the potential human rights and human dignity of embryos.

[245] See Chapter II.
[246] That is, if they were removed through a foetal evacuation procedure, rather than using current abortion techniques. This distinction will be further explained later in this chapter.

The ethical problems related to abortion that could result from the existence and use of artificial womb technology will be grouped into three categories in this chapter. Firstly, the ethical problem of potentially forcing women to use an artificial womb to finish the gestation process following the termination of a pregnancy will be discussed. Secondly, this chapter explores the ethical problems surrounding ending the artificial gestation process; for example, in situations when the parents become either unwilling or unable to be parents to the ectogenic child. Lastly, this chapter considers the ethical problems that could result from the altering of the legal regulation of abortion in preparation for the existence of artificial wombs, including a potential erosion of abortion rights. The analysis of each area of ethical problems will begin with the existing debate on the issue, followed by an assessment of the impact on the current practice and concept of abortion, and an analysis of each problem using the UNESCO Principles, and whether or not it is surmountable.

5.2 The moral status of the embryo

In order to have a thorough and accurate analysis of various aspects of abortion, particularly in relation to artificial wombs, it is first necessary to discuss a critical part of the abortion debate: when human personhood begins. In other words: what is the moral status of the embryo? Indeed, one's view and moral stance on the beginning of human personhood hugely influences one's position in the abortion debate.

It should be noted that the terms "human being" and "person" are not, in fact, interchangeable. Whilst "human being" refers to a member of the species *Homo sapiens*, a "person" is a being worthy of full rights and protections, including the right to life. It should also be noted that in my discussion of this issue, I have adopted Gordijn's use of the term "worthiness of protection" over referring to an embryo or foetus's "right to life" or whether or not it is a "person" or has "moral status" when analysing the varying viewpoints.[247] I find the term "worthiness of protection" to be more precise than the latter terms, as it allows for a broader

[247] Gordijn, *Medical Utopias*, 95.

spectrum of potential worthiness of protection in varying degrees rather than placing an embryo or foetus in more rigid categories of either being a person or not, or having a "right to life" or not.[248]

When considering the potential worthiness of protection of the embryo, there are two views: the conceptionalist view and the non-conceptionalist view.[249] Conceptionalists believe that an embryo is worthy of the full protection afforded to completely developed human persons, starting at the moment of conception. Conversely, non-conceptionalists believe that the extent to which an embryo (or foetus or infant) is worthy of protection is entirely dependent upon its stage of development. There are two types of non-conceptionalists. The first type holds a gradualist view, and believes that whilst an embryo is not worthy of full rights and protections at conception, it gradually becomes worthier of protection as it develops into a later-stage embryo, foetus and eventually, an infant. The second type of non-conceptionalists – non-gradualist non-conceptionalists – believes that the point at which full worthiness of protection is achieved occurs relatively suddenly some time after birth.[250]

For the purpose of this dissertation, I will take a gradualist stance, as I subscribe to the view that an embryo becomes increasingly worthy of protection with each stage of development, the most significant stages being external viability (as in, viability outside of *any* womb – natural or artificial) and birth. As embryos and foetuses develop and acquire certain characteristics as they reach various stages in the development process, they become increasingly worthy of protection. The closer the foetus becomes to being fully formed, externally viable and capable of survival outside of a natural or artificial womb, the more worthiness of protection it is afforded. Full worthiness of protection is granted at birth, when the infant is no longer dependent on the physiology of womb – natural or artificial – and is able to exist[251] on its own.[252] Ideally, no single actor determines the need or

[248] Although, it should be noted that I have adopted the term "worthiness of protection" from a conceptionalist's argument.
[249] For further explanation of these terms, see Gordijn, *Medical Utopias,* 91-97.
[250] Michael Tooley, Abortion and Infanticide (New York: Oxford Press, 1983).
[251] In this case, "existing" refers to being able to breathe and carry out bodily functions autonomously, rather than being inside a natural or artificial womb. Indeed, the infant will be

requirements for worthiness of protection – this should include input and involvement in a societal debate from the State, the medical community and members of society. This is an evolving process that should take place via an ongoing societal debate which is ultimately reflected in the law.

As explained previously, birth is when the highest level of worthiness of protection is achieved because the infant is no longer dependent upon a womb – natural or artificial – to exist and/or develop. An infant, after being born, has achieved the highest level of worthiness of protection, which continues (at the same level) throughout its life. For example, various stages of development alter the embryo's physical state (a zygote versus an embryo versus a foetus), which contributes to making it worthy of varying levels of protection because it is gradually developing into a fully formed[253] person (and fully formed persons are worthy of full protection). These stages include the implantation of the embryo in a womb, the development of a central nervous system, external viability, the birth itself, and the development of consciousness.[254] In addition, the location of the embryo should be considered in *some* situations, as an embryo created *in vitro* but not yet implanted is not as worthy of protection as an embryo that has been implanted in a womb, for instance. In this particular situation, the location of the embryo – as in, the implantation in a womb (natural or artificial) – is another stage of development in both the natural and artificial gestation processes, because in order for the embryo to develop, it must be implanted in a womb. Embryos that are frozen, for example, have not yet progressed to the next stage of development (implantation) and are therefore less worthy of protection than embryos that have been implanted in a womb (natural or artificial).

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dependent on other persons for nourishment and must be supplied with food, taken care of, et cetera. However, at that stage, it is capable of survival without being attached to a womb.

[252] Or with *reasonable* medical intervention for the purpose of sustaining its life or assisting with certain bodily functions, as opposed to medical interventions required to continue its development.

[253] Being fully formed is not the same as being fully developed. Being fully formed refers to an infant having reached a stage where his or her body parts, internal organs, et cetera are formed to the point of being able to function without being connected to and dependent on a natural or artificial womb. Indeed, development occurs throughout childhood, adolescence, adulthood, old age, et cetera.

[254] Gordijn, *Medical Utopias*, 93.

Indeed, there are problematic aspects of the gradualist view. Most significantly, it is far more difficult to argue in favour of a gradualist approach taking into account the potential existence of artificial wombs. Currently – prior to the existence of artificial wombs – it is easier to argue that birth/external viability should be the point at which full worthiness of protection is achieved as, prior to that stage, the embryo/foetus is located inside the body of a person, and fully dependent on her for both development and survival. In that scenario, if the embryo/foetus is not located inside a woman's womb, there is no chance of survival until the point of external viability/birth. However, if artificial wombs existed, all embryos and foetuses would technically always be viable outside of a woman's womb, as they could continue their gestation process in an artificial womb. If an embryo/foetus is gestated in an artificial womb, then at no stage is it fully dependent on a person for development and survival. Whilst the removal of a dependency on a person for development and survival may make the point of external viability/birth appear to be arbitrarily chosen, I believe that it still represents the most important stage of development and the point at which full worthiness of protection should be granted. This is the case because external viability/birth still represents the point when a foetus becomes a fully formed infant, capable of life outside of *any* womb, natural or artificial.

Furthermore, it could be argued that another weakness in the gradualist stance is that external viability/birth is simply one stage of development for a person, and that development continues throughout childhood, adolescence, adulthood and old age. A person is not afforded increasing levels of worthiness of protection as he or she develops and ages, because full worthiness of protection is granted at birth and remains constant throughout a person's life. It can be argued that external viability/birth is just as significant as other stages of development. However, as explained previously, I believe that external viability/birth is the most significant stage, as it is the point at which an infant is fully formed and capable of life without being dependent on a natural or artificial womb.

Despite these two weaknesses in the gradualist stance, given the other positions, this is, for me, the least problematic and strongest option.

In order to further substantiate the gradualist view, I will disqualify examples of the conceptionalist view and the non-gradualist non-conceptionalist view. In order to do so, I will first refute Gordijn's conceptionalist view, followed by Tooley's non-gradualist non-conceptionalist view on the worthiness of protection of the embryo.

I have chosen Gordijn and Tooley's arguments for several reasons. Gordijn was chosen on the basis that his arguments were reached with an absence of reliance upon religion or specific religious values or beliefs. As some view religion as highly subjective, and it would be easy for them to refute religion-based arguments solely on the basis that they do not subscribe to this viewpoint, I have decided not to focus on any religious arguments and utilise more inclusive theories. Furthermore, I found Gordijn's arguments to be logical and convincing, as they provide a systematic explanation of his conceptionalism and the reasons behind it. Tooley was chosen because he is a highly influential and widely cited non-conceptionalist. His arguments are also logical and convincing, as he provides a clear rationale behind his non-conceptionalist views, including infanticide.

5.2.1 The conceptionalist view

Gordijn presents three arguments to support his conceptionalist view: (1) the *reductio ad absurdum* argument; (2) the defence of the weak argument; and (3) the caution argument.[255]

Gordijn's *reductio ad absurdum* argument questions the non-conceptionalist belief that being worthy of protection is attributed to certain characteristics – such as consciousness, a certain degree of independence, et cetera – that an embryo is unlikely to be able to possess.[256] Gordijn argues that for this argument to be consistent, those who subscribe to it would also have to believe that individuals who once possessed those characteristics but have since lost them – such as individuals in a coma, or who are mentally disabled – would not be worthy of

[255] Ibid., 96.
[256] Ibid.

protection, which he contends is refuted by the moral *common sense*.[257] In his view, this non-conceptionalist argument results in absurd consequences (*reductio ad absurdum*) and therefore must be rejected.

As a gradualist, I object to Gordijn's first argument. To begin with, this argument oversimplifies the non-conceptionalist view, claiming that worthiness of protection is granted solely based on the possession of certain characteristics. Whilst this is, to a certain extent, true, I would argue that *in addition* to simply acquiring various characteristics, the embryo must, more significantly, reach certain stages of development, ultimately culminating in the granting of full worthiness of protection at birth. As a gradualist, I would grant worthiness of protection based on the stage of development: a foetus is worthy of more protection than a zygote/embryo;[258] a born infant is worthy of more protection than a foetus. Within each of these stages, worthiness of protection increases alongside the stage of development (i.e. a later-term foetus is worthy of more protection than an early-stage foetus). Once an infant is born and is externally viable (outside of any uterus – natural or artificial[259]), it is then worthy of full protection; as in, the same protection afforded to any child, adult, or elderly person. Worthiness of protection does not increase after birth, despite the fact that the infant will reach further stages of development, such as becoming a child, a teenager, an adult, et cetera. Once full worthiness of protection is achieved, it cannot be strengthened, revoked or diminished.

Whilst the two concepts of acquisition of characteristics and stages of development appear to be similar, there is actually a distinct difference between the two: the *acquisition of characteristics* can occur at any stage of development (i.e. acquiring a central nervous system, acquiring the ability to feel pain, acquiring the ability to hear, et cetera), whilst *stages of development* indicate reaching a certain irreversible temporal and physical point (i.e. stages such as

[257] Ibid.
[258] As a zygote becomes an embryo so soon after the joining of gametes, I will consider them to be one stage of development.
[259] A premature neonate would also be granted full worthiness of protection, even if it is dependent upon an incubator for a certain period of time. In this scenario, the incubator would not serve the function of assisting in the neonate's development, but rather used as a treatment to keep it alive until it can sustain itself. For further discussion of this issue, see Chapter IV.

becoming a zygote/embryo, foetus, infant, toddler, child, teenager, adult, elderly person, et cetera). Indeed, the acquisitions of certain characteristics are often the benchmarks of reaching various stages of development (i.e. when a foetus becomes an infant it not only acquires the characteristic of being externally viable and being able to breathe and exist on its own without being inside its mother's womb, but it also enters a new stage of development, developing from a foetus into an infant). However, they are not the same thing. The acquiring of characteristics is essentially a checklist of capabilities and functions, and does not necessarily represent progression to different stages of development. For example, an embryo could physically remain an embryo (as in, it would appear the same as any other embryo under a microscope), but could somehow acquire the ability to see or hear. In this clearly hypothetical scenario, the entity itself – in this case, an embryo – has not reached a new stage of development, but has merely acquired new characteristics. It is still, for all intents and purposes, an embryo; now it is a more highly functioning embryo. On the other side of the development spectrum, an adult could lose his or her sight, yet would still remain at the same stage of development (an adult) and not regress into being a child, infant, foetus, et cetera because of a lack of a certain characteristic.[260]

Most importantly (as for gradualists, worthiness of protection is linked to stages of development), characteristics are reversible; stages of development (also known as ageing) are not. Once a stage of development is achieved, it cannot be reversed.[261] Moreover, as stipulated above, once a foetus/neonate has become externally viable, it is then entitled to full worthiness of protection, which does not increase or decrease with age. Once an embryo becomes a foetus, it cannot return to being an embryo. Once people have become elderly, regardless of any modifications they may make to their bodies, they are still people at an advanced stage in their lives. For example, if an adult is in a coma, then even though he or she is no longer conscious or independent, it does not mean that he or she is no longer an adult (his or her current stage of development). In other words, the fact

[260] My position as a gradualist is regarding the creation and beginning of life, and has no consequences on end-of-life care. This is, indeed, a very important issue, but not one dealt with in my position in this dissertation, which focuses on the creation and beginning of life.
[261] For example, a person cannot go from being an adult to being a child following a car accident which has left him or her with the limited mental capabilities of a young child. The characteristic may have vanished, but the adult retains his or her stage of development.

that the adult in a coma has lost certain characteristics does not affect his or her stage of physical and temporal development/the ageing process. So to respond to Gordijn's argument, worthiness of protection should be granted based on stages of development, which are irreversible, unlike the acquisition of certain characteristics. Therefore, Gordijn's first argument to support conceptualism – the *reductio ad absurdum* argument – that if embryos are not worthy of protection because they lack certain characteristics (primarily consciousness and independence), then the same must hold true for those who have lost those characteristics (such as a person in a coma), must be rejected.

Gordijn's second argument – the defence of the weak – contends that the unborn are the weakest members of society and cannot impart their own interests, and as a result, must be protected by society from any procedures which would not be considered ethically viable in stronger groups. Consequently, he rejects the non-conceptionalist views, as it would permit such treatment.

Firstly, the basis of this argument – that embryos/foetuses are the weakest members of society and therefore must be protected as they cannot protect themselves – assumes that "the unborn" are, in fact, members of society. This is certainly not a universally held belief. The word "society" usually implies some sort of membership, interaction, or relationship with others. The members of a society are organised in structured social relationships according to a unique culture. [262] Whilst there may be a relationship between a woman and the embryo/foetus growing inside of her,[263] and the woman is undeniably a member of society, the embryo/foetus is not. The embryo/foetus could be considered a *part*

[262] This is part of Anthony Giddens's definition of society, which is, in its entirety: "A society is a system of interrelationships which connects individuals together. Britain, France and the United States are societies in this sense. They include millions of people. Others, like the earliest hunting and gathering societies, can be as small as thirty or forty people. All societies are united by the fact that their members are organized in structured social relationships according to a unique culture. No cultures could exist without societies. But equally, no society could exist without culture. Without culture we could not be 'human' at all, in the sense which we usually understand that term. We would have no language in which to express ourselves, no sense of self-consciousness, and our ability to think or reason would be severely limited." Anthony Giddens, *Sociology* (Cambridge: Polity Press, 2001), 22.

[263] I say that there "may" be a relationship between a woman and the embryo/foetus growing inside of her because in cases where a woman is not aware she is pregnant until she gives birth, there is no perceived relationship – aside from the obvious biological relationship – between the woman and her embryo/foetus.

or a *component* of society, but not a member. The embryo/foetus is not involved in any structured social relationships directly (again, aside from the woman gestating it) and has no involvement with wider culture on a conscious level, and therefore cannot be counted as a member of society. Gordijn never elaborates how and why "the unborn" are, in fact, members of society, nor provides any definition or concept of society to substantiate this claim. Given the fact that there is no universally agreed-upon moral status of the embryo, this is a very bold claim to make, particularly with no further explanation provided. This is essential in his argument, as the premise of the argument – acknowledgement of membership in society for embryos/foetuses – can be rejected on the grounds that, as demonstrated above, embryos/foetuses are not members of society as they are not involved in any structured relationships (aside from possible interaction with the woman gestating it) and are not involved with culture.

As entities that do not yet exist outside of a laboratory or a woman's uterus, it is difficult to imagine how embryos/foetuses could possibly be members of society. Indeed, it is possible for an embryo/foetus to have some sort of interaction (although primarily a biological one) with the woman gestating it, and yes, this woman is a member of society. However, when an embryo/foetus is gestating inside a woman, for all intents and purposes – and given its location – it can be considered *part* of the woman, rather than its own person. Furthermore, to say that embryos/foetuses are members of society implies that they are *all* members of society, without exception. This does not take into account the varying levels of interaction between an embryo/foetus and the woman gestating it. For example, some women desperately want to be mothers and have a deep personal connection to and interaction with her embryo/foetus from the time she finds out she is pregnant. The woman and her family may feel as though they have formed a relationship with the embryo/foetus, but the embryo/foetus is largely a passive participant in the relationship. At most, it could be argued that the embryo/foetus is part of a familial unit, but not wider society. In other cases, women do not know that they are pregnant at all until they give birth. In the second scenario – albeit a rare one – there is no interaction[264] between the woman and the embryo/foetus she

[264] Aside from biological interaction.

is gestating. As the most that an embryo/foetus is capable of in terms of being part or a member of society is interaction with the woman gestating it, and even *that* is not taking place, that embryo/foetus fails to qualify as a part of society, let alone a member of society. As embryos/foetuses are not members of society, Gordijn's second argument must be rejected.

Gordijn's final argument – the caution argument – states that as long as no compelling arguments have been made for granting embryos little or no protection, then care must be taken to ensure that they must be granted the same worthiness of protection as a fully developed adult human being. In the interest of consistency, Gordijn goes on to argue that embryos should also not be subjected to any procedures which would not be ethically justifiable in adult human beings. In other words, because at this stage it is unclear as to whether and to what extent embryos are worthy of protection, then the use of embryos should – in the interest of caution – "be evaluated as if it were clearly immoral."[265] At some stage in the future, it might be more solidly determined, Gordijn argues, whether embryos are entitled to full protection; therefore, it would be cautious to treat them currently as being entitled to full protection.

This argument is also not convincing. Firstly, the basis of the argument is that at this stage, it is not known to what extent embryos should be protected; this presupposes that there is little known about the embryo and its capabilities. Gordijn argues that at some stage in the future, it might perhaps be determined that embryos are entitled to full protection. Not only is this consideration hypothetical, but it goes against a view that many currently hold: that embryos are not worthy of full protection. I agree with Gordijn that whilst there is currently no consensus on the level of worthiness of protection of the embryo, in the future, some level of value – either granting or denying an embryo certain worthiness of protection – could be awarded to an embryo following an ongoing process of societal debate. However, I argue that we should be just as cautious *granting* embryos protection as Gordijn is with denying embryos protection.

[265] These are Gordijn's words and he does not explain or elaborate on what constitutes something being "clearly immoral."

I also find Gordijn's claim that embryos should also not be subjected to any procedures which would not be ethically justifiable in adult human beings quite problematic. Using this logic, embryos would no longer be permitted to be frozen for later use, as adult human beings would not be placed in a freezer indefinitely for potential future use. In order to be consistent, this means that *all* embryos must be implanted after *in vitro* fertilisation. This also rules out any type of embryonic stem cell research and, presumably, any stem cell lines derived from embryos, and possibly even the fruits of the research. As a gradualist, I do grant a certain level of protection to embryos, but certainly not the same level afforded to adult persons.

Gordijn is arguing that in order for embryos to be permitted to be destroyed or subjected to any procedures not ethically justifiable in adult human beings, the onus is on the non-conceptionalists to provide compelling arguments that embryos are not, in fact, worthy of equal protection. This is problematic because presumably he (or another conceptionalist) would be the judge of whether or not the arguments put forward are convincing. Whilst it can be agreed upon that an embryo is required to create a human person, there is no agreement as to the moral status of the embryo. Even considering scientific evidence is not sufficient, as the same data could be interpreted in different ways by different people. Considering, for example, what is currently known about the capabilities of an embryo, one could argue that because it has the potential to become a human person, it should be afforded the same protection as a human person. However, another person could just as easily argue that even though an embryo is, in fact, required to create a human person, it is merely a component, and by no means a full-fledged person worthy of full protection. In other words, this is an area in which it is highly unlikely that there will ever be agreement, and a distinct possibility that regardless of the arguments made in favour of a gradualist stance, they may never be found universally convincing.

Furthermore, a flaw in this argument is that it could be easily refuted by simply being reversed; in other words, as long as no compelling arguments have been made *in favour of* granting embryos protection, then it is not required that care is taken to ensure that they are treated in the same way as fully developed human

persons. I accept that his cautious approach was taken because what is known about embryos may change in the future. As a gradualist, I do agree that embryos should be afforded some level of worthiness of protection. However, in cases where the interests of an embryo are in conflict with those of a fully formed and existing human person (such as a pregnant woman), it is illogical to grant moral status to an entity (the embryo) with capabilities that are unknown, and even more illogical to protect the interests of this entity over those of an exiting person. In fact, until something is proven to be deserving of the same worthiness of protection as fully developed adult human beings, it is illogical to grant it such preferential treatment. As a result, this argument also must be rejected.

5.2.2 The non-gradualist non-conceptionalist view

Now that a conceptionalist view has been disqualified, a non-gradualist non-conceptionalist view must also be disqualified in order to accept a gradualist view.

Tooley, a non-gradualist non-conceptionalist, argues that neither abortion nor infanticide (at least during the first few weeks after birth) is morally wrong.[266] He begins by making seven arguments as to why abortion is not immoral: (1) even if a foetus has a serious right to life, there are certain cases when a woman's rights have sufficient weight to render abortion morally permissible, such as in cases where the woman's life is threatened, or when she is pregnant as a result of rape; (2) the fact that the foetus gestating inside a woman is a member of the species *Homo sapiens* is not, in itself, morally significant; (3) the non-potential property that makes an individual a person is the property of being an enduring subject of non-momentary interests; it is not the possession of, or the exercise of the capacity for rational thought, the capacity for free action or the capacity for self-consciousness; (4) the destruction of potential persons is not intrinsically wrong; (5) it is not intrinsically wrong to refrain from producing additional persons, or, more specifically, additional persons who will have certain characteristics; (6) there does not appear to be any property (aside from the property that makes something a person) that makes the destruction of something intrinsically wrong, and that does so independently of the entity's value; and finally (7) it may be the

[266] Tooley, *Abortion and Infanticide*, 419.

case that the property that makes something a person is one that exists to certain degrees, and that the wrongness of destroying something is a matter of the degree to which it possesses the property in question.[267]

Tooley also argues against what he contends are the three main arguments against abortion: (1) that abortion is seriously wrong because it involves the killing of innocent human beings; (2) that abortion is seriously wrong because it involves the destruction of potential persons; and (3) that abortion is seriously wrong because it involves the destruction of persons.[268] He contends that the first two arguments fail because "they appeal to unacceptable moral principles": neither the fact that an organism belongs to the species *Homo sapiens* nor the fact that it is a potential person in itself makes it wrong to destroy it.[269] Moreover, he argues that the third argument is factually incorrect, as it seems unlikely that a fertilised human egg is a person, given its lack of a nervous system and presumably, its capacity to enjoy any mental life whatsoever.[270]

Next, Tooley provides his argument in favour of the permission of infanticide, up until a certain point after birth. He explains that whilst there is considerable disagreement about what makes something a person, one feature that can be agreed upon is one of a psychological nature.[271] He states: "Something is a person by virtue of the sort of mental life that it enjoys, or has enjoyed, or is capable of enjoying. So the problem is arriving at justified conclusions about the mental states and/or capabilities of others."[272] Tooley explains that there are three types of considerations that are relevant to judgments about the mental states of others: (1) their linguistic behaviour; (2) their non-linguistic behaviour; and (3) their neurophysiological states.[273] Whilst our evaluation of adults relies heavily upon their linguistic behaviour and capabilities, when considering foetuses and infants, any conclusions drawn on their mental life and psychological capacities must rest

[267] Ibid., 303-304.
[268] Ibid,. 304.
[269] Ibid.
[270] Ibid., 304-305.
[271] Ibid., 347.
[272] Ibid.
[273] Ibid., 348.

upon observations of non-linguistic behaviour coupled with information about the development of the central nervous system.[274]

More specifically, Tooley argues that being a subject of non-momentary interest is what makes something a person.[275] If this is correct, he explains, three conditions must be met in order for something to be deemed a person: "(1) the entity must be capable of having desires, where desires are construed as states that can be represented in consciousness, rather than merely as states that casually underlie behaviour in a certain way; (2) the entity must be capable of having thoughts about times other than the present; (3) it must possess, and have exercised in relevant ways, the concept of a self as a continuing subject of mental states."[276] In addition to these three, Tooley contends that we should also consider the stage when humans become capable of rational thinking and problem-solving behaviour of various types, as well as when they become agents in a sense that involves deliberation.[277] After an analysis of scientific data, Tooley comes to the conclusion that newborns are not persons.[278] Firstly, he argues that the behaviour of newborn humans provides no grounds for attributing higher mental capacities to them; specifically, it provides no reason for believing that newborns possess a capacity for thought, self-consciousness or rational deliberation.[279] Moreover, the neurophysiological data point to the same conclusion: the neuronal circuitry in the human brain undergoes significant development, but the networks that control higher mental function are not present at birth, and only develop over an extended period of postnatal development.[280]

Tooley also introduces the concept of quasi-persons. He contends that if a person-making property exists that can occur to various degrees and is morally significant even when present to a lesser extent, and an entity possesses this property, but not to the extent required to be considered a person, then it could be considered a

[274] Ibid.
[275] Ibid., 359.
[276] Ibid.
[277] Ibid.
[278] Ibid., 407.
[279] Ibid.
[280] Ibid.

quasi-person.[281] Tooley suggests that if the morally relevant property is a capacity for rational thought or deliberation, it certainly seems possible for these properties to exist on a spectrum, and therefore it is reasonable to accept the concept of quasi-persons. [282] Newborn humans, however, are not quasi-persons, Tooley argues, because whilst newborns do experience *some* thoughts, they are not subjects of non-momentary interests, or have a unification of consciousness over time.[283] So when do humans become quasi-persons? Tooley is unable to provide a definitive answer to that question, but speculates that it occurs around the age of three months.[284]

In summary, Tooley's personhood timeline is as follows. He argues that newborn humans are neither persons nor even quasi-persons; therefore, their destruction is in no way intrinsically wrong.[285] Around the age of three months, babies acquire properties that are morally significant, which makes it, to some extent, intrinsically wrong to destroy them.[286] He continues: "As they develop further, their destruction becomes more and more seriously wrong, until eventually it is comparable in seriousness to the destruction of a normal adult human being."[287] However, Tooley explains that this suggestion is a highly tentative one, and that any serious attempts to determine the point at which a human becomes a person, or a quasi-person, would require scientific information not presently available,[288] along with a more precise account of the properties that make something a person.[289]

Tooley inadvertently accepts a form of gradualism in his own argument, when he describes how, as the baby develops further, its destruction becomes increasingly seriously wrong, until eventually it is comparable to killing a normal adult human being. In other words, Tooley and I agree that worthiness of protection is

[281] Ibid., 407-408.
[282] Ibid., 410.
[283] Ibid.
[284] Ibid., 411. He speculates that this could be the age of quasi-personhood "in part because of the number of striking changes clustering together at around that time, and in part because some of those changes appear to be related in important ways to cognitive developments."
[285] Ibid.
[286] Ibid., 412.
[287] Ibid.
[288] Or at least not available at the time of writing (1983).
[289] Ibid., 421.

accumulated gradually, via stages of development. Whilst for gradualists, external viability is the stage at which full realisation of worthiness of protection occurs, for Tooley, this point comes at some stage a few weeks following birth, and relies upon the acquisition of certain morally significant properties.

The problem with Tooley's "three month" scenario is that this argument has the same flaw that Tooley and other non-gradualists attribute to gradualism: the question of why certain stages of development (such as birth and viability) are chosen as important points of demarcation over others. More specifically, why is worthiness of protection attached to certain stages in the development process and not others; moreover, how are these stages chosen? For gradualists, the most significant stage is external viability. This stage is so significant because it is the point at which the foetus is no longer dependant upon a womb (natural or artificial) and can potentially survive on its own. At the stage of viability, a foetus is its own self-sustaining entity. It is no longer dependant upon another person (or an artificial womb) to survive; no other individual's autonomy is compromised. In other words, the existence of the foetus at viability is not physically benefitting from, harming, or reliant upon another person. It exists as its own independent entity. As such, it makes it far more difficult to argue that its worthiness of protection should in any way be compromised. However, Tooley's potential demarcation point of three months does not represent a similar shift in the infant's self-sustainability. Rather than selecting a specific stage of development, Tooley leaves it up to scientists and psychologists of the future to determine the point at which a human organism comes to believe that it is a continuing subject of experience and other mental states. On balance, gradualism's most important point of demarcation (i.e. external viability) is more morally significant than Tooley's, as it represents a clear shift from the foetus being entirely dependent on a womb (and therefore, another individual or an artificial womb), to being able to survive on its own, as its own self-sustaining entity. Furthermore, the benefit of adopting a gradualist approach is that the embryo/foetus acquires its worthiness of protection in stages, rather than at one loosely defined point of development. As a result, this non-gradualist non-conceptionalist argument must be rejected.

Whilst both Gordijn and Tooley make some strong arguments in favour of conceptionalism and non-gradualist non-conceptionalism respectively, it is not enough to cause me to accept either of their positions. Furthermore, it is impossible to disqualify *all* conceptionalist and non-gradualist non-conceptionalist positions solely based on the analysis of the arguments of these two authors. As mentioned previously, both authors were chosen for their compelling arguments which did not rely upon religion, and because they are strong representations of each stance. However, I believe that I have revealed significant weaknesses of both arguments, which, in both cases, leads to the conclusion that a gradualist view is the strongest, and might be accepted.

5.3 Could (or should) a woman be forced to transfer her foetus to an artificial womb following the abortion of a pregnancy, in order to continue its gestation?

If artificial wombs existed and were used in regular clinical practice, the concept of abortion could change significantly.[290] Currently, an abortion of a pregnancy results in the death of the foetus. The two are inextricably linked.[291] An argument that has been made in favour of abortion in some cases has been that women have the right to make decisions concerning their own bodies. However, if artificial wombs existed, then the woman's decision could be two-fold: whether or not to end the pregnancy, and what should happen to the foetus. When a woman decides to have an abortion, she is seeking an end to her pregnancy, but if artificial wombs existed, there would be another option in addition to terminating the life of the foetus – continuing the gestation of the foetus in an artificial womb. If the option existed to continue the foetus's gestation process in an artificial womb, would requesting the death of the foetus ever be permitted? Singer and Wells, for example, do not believe that should be the case, stating: "Freedom to choose what is to happen to one's body is one thing; freedom to insist on the death of a being that is capable of living outside of one's body is another."[292] Yet, could a woman be forced to place her foetus in an artificial womb following the abortion of the

[290] The discussion of whether artificial wombs are a solution to abortion takes place throughout the literature. For further discussion and analysis on this topic see: Alghrani, "Ectogenesis;" Coleman, Stephen, "Abortion and the Artificial Uterus;" Kaczor, "Abortion Debate".
[291] Singer and Wells, *The Reproductive Revolution*, 135.
[292] Ibid.

pregnancy, in order to continue its gestation? And *should* a woman be forced to place her foetus in an artificial womb following the abortion of the pregnancy in order to continue its gestation? Some view artificial wombs as a "solution" to abortion, meaning that if artificial wombs existed, the termination of pregnancies could occur without ending the life of the foetus, as the foetus could be placed in an artificial womb for the remainder of its gestation. Are artificial wombs a "solution" to abortion, or do they simply provide another option of what to do with the foetus?

5.3.1 The debate

One of the most well-known arguments in favour of abortion rights was put forward in 1971 by Judith Jarvis Thomson.[293] She begins by granting that a foetus is a person from the moment of conception. She then offers her "violinist analogy" as the reasoning behind why abortion should be permissible. In this scenario, you wake up in the hospital to find that you have been kidnapped by the Society of Music Lovers and that a famous, unconscious violinist has been attached to your kidneys. You are the only person that possesses the rare blood type required by the violinist to keep him alive; if he is unplugged, he will die. You must stay in bed in order to support this violinist for nine months, at which stage he will have recovered and can be unplugged. Whilst the director of the hospital is apologetic about the kidnapping, he informs you that as all persons have the right to life and the violinist is a person, you cannot unplug him. Thomson concludes that although it would be a nice gesture to do so, you would not or should not be required to sustain the life of the violinist in most cases.[294]

Indeed, because the person in Thomson's violinist analogy was kidnapped and forced into sustaining the violinist for nine months, it is analogous to situations involving rape, and not representative of all pregnancies. Does this mean that the violinist analogy is only applicable in cases involving rape? Thomson (and I) would argue that this is not the case. Thomson acknowledges that those opposed to abortion rights could make an exception to permit abortions in cases involving

[293] Judith Jarvis Thomson, "A Defense of Abortion," *Philosophy & Public Affairs* 1(1971): 48-49.
[294] For further analysis see: Jarvis Thomson, "A Defense of Abortion."

rape.[295] They could claim that all persons have a right to life, as long as they did not come into existence as a result of rape; or, alternatively, that persons who were born as a result of rape have less of a right to life than those conceived in consensual situations. However, these arguments not only sound unpleasant, but they undermine the primary argument of those opposed to abortion: that everyone has a right to life. Therefore, Thomson contends that someone's right to life – the basis upon which most arguments against abortion rights take place – should not be dependent upon whether or not they were a product of rape.[296] As a result, the violinist scenario, analogous to rape, is, in fact, applicable to any abortion cases, as the right to life (or lack thereof) of the embryo or foetus should not be dependent on how it came into existence.

Thomson later went on to extend her violinist analogy, stating that she is not arguing for the right to secure the death of the foetus:

> *I have argued that you are not morally required to spend nine months in bed, sustaining the life of that violinist; but to say this is by no means to say that if, when you unplug yourself, there is a miracle and he survives, you then have a right to turn round and slit his throat. You may detach yourself even if this costs him his life; you have no right to be guaranteed his death, by some means, if unplugging yourself does not kill him.*[297]

This is the issue at hand when considering abortion if artificial wombs were used in clinical practice. Are women who decide to have an abortion seeking a termination of the pregnancy, of the foetus, or of both? According to Thomson's argument, it would not be permissible to demand the death of a foetus following an abortion. Therefore, if artificial wombs existed and there was a feasible way of keeping the foetus alive following its evacuation from its mother's womb, should women be required to place the foetus in an artificial womb for the remainder of its gestation?

Singer and Wells note that the right of a woman to abort her foetus in a manner which ensures death is different from the usual arguments made in favour of

[295] Ibid., 49.
[296] Ibid.
[297] Ibid., 66.

abortion rights. They claim that this right could only be accepted if the claim that a foetus has a right to life could be disproved, and "even then it is difficult to see why a healthy foetus should die."[298] A mother is not permitted to kill her baby once it is born. Under many current abortion laws, the abortion of the foetus is permitted prior to the stage when it is viable outside of the mother's body. The use of artificial wombs in clinical practice would complicate this significantly by adding a further scenario to those in existence, i.e. that women could request the termination of the foetus along with the pregnancy. In other words, when artificial wombs are used in clinical practice, the end of the woman's pregnancy does not necessarily mean an end of the life of her foetus. The existence and use of artificial wombs in clinical practice would force this issue, raised by Singer and Wells – regarding whether or not a woman can request the death of her foetus – to be discussed. This is not an issue currently, as the end of a pregnancy and the death of the foetus are inextricably linked, but must be addressed before artificial wombs are used in clinical practice to ensure that an ethical framework is in place.

Singer and Wells suggest that artificial wombs would be welcomed by those who oppose abortion.[299] Those opposed to abortion are also typically opposed to any sort of experimentation on the human embryo which may result in its death or destruction.[300] However, Singer and Wells argue that because artificial wombs also have the potential of saving the lives of premature babies that would have otherwise died, they will be acceptable to those who oppose abortion.[301] Furthermore, as explained in the previous chapter, even though initial uses of the artificial womb would be considered experimental treatment, those opposed to abortion would likely welcome the treatment, as it would give the infant a better chance at survival than it would have had otherwise.[302]

Similarly, it is likely that those who oppose abortion oppose the resulting death of the foetus, rather than a process that would result in the end of a pregnancy (if there was some way to ensure that the end of the pregnancy did not mean the

[298] Singer and Wells, *The Reproductive Revolution*, 135.
[299] Ibid., 134.
[300] Ibid.
[301] Ibid.
[302] Singer and Wells, *The Reproductive Revolution*, 134.

death of the foetus). Indeed, it is the fact that the current abortion procedures are synonymous with the death of the foetus that causes people to oppose the current practice of abortion.[303] Therefore, they would likely be in favour of using artificial wombs to keep the foetus alive outside of the mother's body, following a foetal evacuation procedure. It should also be noted that some organisations that oppose abortion, such as the Catholic Church, could be in favour of using artificial wombs as a means to "rescue" foetuses from an abortion procedure or to assist in keeping premature babies alive, but would not be in favour of using artificial wombs as a fertility treatment.[304]

The two aspects of having an abortion procedure – ending the pregnancy and terminating the life of the foetus – result in two distinct outcomes for the woman: no longer being pregnant, and not becoming a genetic mother. Some women do not seek abortions exclusively to end pregnancies; women may also decide to have an abortion because they do not want to be a mother in any context: not only not to be the person who raises the child (a social mother) or gestates and bears the child (a biological mother), but also not to be a genetic mother.[305] In cases involving the latter scenario, ending the pregnancy is a means to an end – not becoming a genetic mother. Whilst it is a possibility to put the child up for adoption, some women would simply prefer not to have any of their genetic offspring in existence.

This is reflected in the findings of the only published qualitative research (to my knowledge) on women's responses to artificial wombs, by Leslie Cannold. It should be noted that this study was published in 1995 and has a limited scope of 45 women in Australia, but has been widely cited in the literature and influential

[303] Ibid., 135.
[304] See Kaczor, "Abortion Debate," 290-291.
[305] For the purpose of this dissertation, there are three types of mothers: genetic mothers (those who provide the egg for the creation of the embryo who, in turn, is genetically related to her offspring); biological mothers (those who gestate and give birth to the child); and social mothers (those who raise the child). Indeed, these three roles are frequently undertaken by one woman. However, it is possible that one child could have two or three different types of mothers, according to this definition. For example, an egg could be obtained from one woman, which is used to create an embryo that is gestated by another woman, which produces a child that is raised by a third woman. Similarly, there are two types of fathers: genetic fathers and social fathers. For further discussion on this aspect of the debate, see Langford, "An End to Abortion."

on the debate surrounding whether artificial wombs are a solution to abortion.[306] The response of the participants as to whether artificial womb technology is a solution to abortion was overwhelmingly negative – both from those for and against the right to have an abortion.[307] The participants[308] were asked to respond to two scenarios: 1) If you became pregnant with a child you could not keep, would you abort it or give it up for adoption?; and 2) If you were two months pregnant and were unable to raise the child, would you abort it, give it up for adoption, or undergo a foetal extraction and place the foetus in an artificial womb?[309]

Women in the group in favour of abortion rights believe that if a woman becomes pregnant, she has the responsibility either to gestate, bear and raise the foetus and resulting child, or, in the event that she is unable to do so, abort the foetus and prevent its further development and "the consequent creation of a child to which she has wide-ranging and inescapable responsibilities."[310] The participants in this group expressed concern over the fact that women have a duty to protect their foetus from physical, emotional or social harm – both inside and outside of their womb.[311] However, they believe that if a woman is unable to undertake the significant responsibilities of being a good mother, then it is morally acceptable (and in some cases morally laudable) for her to end the pregnancy and terminate the life of the foetus.[312] This responsibility for the foetus extends past its gestation and to the fact that the foetus, if gestated in an artificial womb, would still one day be born, and be the woman's child, and she would feel obliged to raise it and be morally responsible for it.[313] In other words, this group believes that if a woman makes the decision to bring a child into the world, then she is responsible for its wellbeing.[314] If a "good mother" raises her own children, then the only way

[306] Cannold's study has been cited in numerous works, including: Coleman, "Abortion and the Artificial Uterus"; Jackson, "Degendering Reproduction"; Langford, "An End to Abortion."
[307] Cannold, "Women, Ectogenesis and Ethical Theory."
[308] Although Cannold notes that there were 45 participants in the study, she does not provide any further figures regarding the breakdown of the participants into pro-abortion rights or anti-abortion rights groups, or numerical data on how the women answered the questions.
[309] Ibid., 57-58.
[310] Ibid., 58.
[311] Ibid., 59.
[312] Ibid.
[313] Ibid.
[314] Ibid., 60.

around this for women who are unwilling or unable to do so would be to ensure that the child does not come into existence in the first place.[315] Based on these beliefs, the participants did not find that artificial wombs would be the "solution" to abortion, or even an acceptable replacement for someone seeking an abortion, as it results in the creation of a child towards which the woman feels some maternal sense of responsibility.[316] As a result, the women in favour of abortion rights reject artificial wombs in lieu of abortion, because as genetic mothers, they would be confronted with situations requiring a duty of care for their foetus/baby that they did not accept.[317]

For women in the group that opposes abortion rights, the preservation of the life of the foetus is not the only reason they find abortion morally unacceptable.[318] Rather, similar to the group of women in favour of abortion rights, this group contends that a "good mother" is one who accepts responsibility for the care of her foetus/child. However, as this group finds abortion morally unacceptable, the only viable option for them is for the mother to gestate, bear and raise the child.[319] Consequently, the women in the group opposed to abortion rights rejected the use of artificial wombs, despite the fact that they would have the ability to preserve the life of the foetus following an abortion procedure.[320] Because this group holds the view that good mothers always gestate, bear and raise their own children, they believe that the use of an artificial womb is essentially an abandonment of their maternal responsibilities. [321] Furthermore, this group specifies that a foetal evacuation – even one that does not result in the death of the foetus through the use of an artificial womb – constitutes the same maternal abandonment as abortion, and is therefore unacceptable.[322]

The women in both groups of the study reject the use of artificial wombs as a method of foetal preservation following an abortion, but each for different

[315] Ibid.
[316] Ibid., 61.
[317] Ibid.
[318] Ibid.
[319] Ibid., 62.
[320] Ibid.
[321] Ibid.
[322] Ibid.

reasons. Artificial wombs are an unacceptable "solution" to abortion for the women in favour of abortion rights because it preserves the life of the foetus and, as a result, the woman's maternal responsibilities.[323] The women opposed to abortion rights also reject artificial wombs because they enable women to disregard their responsibility to gestate, bear and raise the children that they conceive.[324] Cannold contends that there is a disjuncture between women's moral framework on abortion and the moral framework dominating formal ethical discourse which needs to be altered, "because of the irrelevance of moral theory to women's moral needs."[325] She states that women's actual moral views on abortion should be taken into consideration in the formal ethical debate on surrounding issues, in order to make it more meaningful.[326] Whilst Cannold does not elaborate further on how the ethical debate could be made more meaningful, my interpretation of her comment is that if women's actual moral views were taken into consideration, then both the abortion debate and any resulting regulation would more accurately reflect their positions. Furthermore, Cannold contends that an analysis of the women's words reveals that the discrepancies between the attitudes of the women and those of some ethicists are grounded in the inadequate understanding of the framework within which women consider the morality of abortion (primarily, the belief that if a woman becomes pregnant, she has the responsibility either to gestate, bear and raise the foetus and resulting child, or terminate the pregnancy).[327] This framework enables women who disagree on the morality of abortion to agree on the moral unacceptability of using artificial wombs as a "solution" to abortion.[328]

Perhaps the most vocal organisation opposed to abortion is the Catholic Church. Christopher Kaczor writes from a Catholic perspective, and offers eight potential objections that the Catholic Church would have[329] to artificial wombs.[330] These

[323] Ibid., 63.
[324] Ibid.
[325] Ibid.
[326] Ibid.
[327] Ibid., 58.
[328] Ibid.
[329] To my knowledge, the Catholic Church has not taken an official position on artificial wombs. Kaczor draws from statements the Catholic Church has made on various reproductive technologies to determine what he thinks the Catholic Church's position on artificial wombs may be.
[330] Kaczor, "Abortion Debate," 289.

objections include (1) the artificiality objection; (2) the IVF objection; (3) the embryo transfer objection; (4) the deprivation of maternal shelter objection; (5) the birth-within-marriage objection; (6) the integrative parenthood objection; (7) the surrogate motherhood objection; and (8) the wrongful experimentation objection.[331] However, he states that if the development of artificial wombs took place in the context of saving premature neonates that would otherwise die, then the experimental treatment required for the development of artificial wombs should be seen as permissible.[332] Moreover, having examined each of the potential objections the Catholic Church may have to artificial wombs, he could find no basis in Catholic magisterial teaching as currently articulated, for the condemnation of the use of artificial wombs to save the life of a foetus following the abortion of a pregnancy.[333] Kaczor claims that even if the Catholic Church would someday declare artificial wombs to be morally impermissible, partial ectogenesis – or continuing the gestation of a foetus that would have otherwise been aborted – might still be viewed as the lesser of two evils in situations involving abortion.[334] It would be the difference between a foetal extraction and a termination of the foetus, and given both options, the Catholic Church would view the killing of the foetus via abortion as the more serious evil.[335]

The existing debate over artificial wombs amongst those in the Catholic Church is still in its infancy. Without the Catholic Church providing an official opinion specifically on the use of artificial wombs, scholars and members of the Church are left to attempt to discern what the Catholic Church's position on artificial womb technology might be. However, unlike Kaczor, who analysed existing Catholic Church positions and ultimately found that the use of artificial wombs would be acceptable in cases where it would save the life of a foetus or premature neonate, others may argue that certain teachings of the Catholic Church – such as its position against IVF – would result in the Catholic Church taking a stance against artificial wombs. Until the Catholic Church specifically addresses its

[331] Ibid., 289-297.
[332] Ibid., 298.
[333] Ibid.
[334] Ibid.
[335] Ibid.

stance on artificial wombs, Catholics must form their own opinions on the emerging technology.

5.3.2 Assessment

The ethical problem of whether women could or should be forced to place their foetus in an artificial womb to continue its gestation process following the termination of a pregnancy will be discussed in terms of autonomy, human dignity and human rights, consent and cost.

5.3.2.1 Autonomy

Claiming that artificial wombs would be a "solution" to abortion is implying that all women seeking to abort their pregnancy would either choose or be required to transfer their foetuses to an artificial womb, rather than undergo the current abortion procedures of either a medication-induced abortion, or the vacuum aspiration technique, used later in the pregnancy. Forcing women to place their foetus in an artificial womb following the termination of a pregnancy is ethically problematic.

Essentially, if women were forced to place their embryo or foetus in an artificial womb to continue its gestation against their will, they would be faced with a choice of two options: gestating their genetic children themselves, or placing their embryo or foetus in an artificial womb for the remainder of its gestation.[336] This means that their right to have an abortion which results in the termination of the foetus – a right which, in some countries, has been in existence for decades – would be revoked. Women would no longer have the option to both end their pregnancy *and* not become a genetic mother. The right to end their pregnancy would remain, but rather than taking place in a traditional procedure, it would occur via a foetal transplant, whereupon the foetus would be transferred from the woman's uterus to an artificial womb for the remainder of its gestation. Women would no longer have the option of choosing not to become a genetic mother. By choosing not to become a genetic mother, a woman is making the decision not to have her own genetic offspring come into existence, and therefore not have

[336] Langford, "An End to Abortion," 267.

biological and genetic ties to her child for the rest of her life (even if she never has contact with the baby again after its birth).

At this stage in the development of artificial womb technology, is it impossible to determine the type of procedure through which a foetus would be transferred from a woman's uterus to an artificial womb.[337] It is impossible to tell how invasive it would be, or what, specifically, the procedure would entail, as neither the procedure, nor the artificial wombs capable of finishing the foetal gestation process, currently exist. However, as the goal of the procedure would be to evacuate the foetus from the woman's womb alive and intact, it is a fair hypothesis that it may be more invasive than current vacuum aspiration abortions, which are not required to remove the foetus alive nor intact.[338] Regardless of the specifics of the procedure, the right to autonomy ensures that not only do women have the right to select the procedure that they believe is in their best interest, they also have the right to make the decision whether or not to undergo the procedure – whether that is abortion or a foetal transplant – at all.[339] This means that the women would not only have the right to choose or reject their own medical treatment, but also to choose a less risky and invasive abortion procedure over one that is more risky and invasive.[340] This is an infringement of a woman's right to autonomy and individual responsibility – one of the UNESCO Principles. The principle states that the autonomy of persons – in this case, pregnant women – to make decisions, whilst taking responsibility for those decisions and respecting the autonomy of others, must be respected.[341] It could be argued that in this situation, the "other" being referred to is the foetus. However, nowhere in the UNESCO Principles does it say that the right to autonomy applies to foetuses. Whilst human rights and human dignity could potentially be applied to foetuses (although to a lesser extent than born infants, children, et cetera) if taken as part of their increasing worthiness of protection, autonomy should be reserved for existing, self-sustaining, fully formed, born persons.

[337] James "Ectogenesis: a Reply to Singer and Wells," 87; Wells, "Ectogenesis, Justice and Utility," 377-378.
[338] James, "Ectogenesis: a Reply to Singer and Wells," 87.
[339] Ibid.
[340] Ibid.
[341] Universal Declaration on Bioethics and Human Rights, 2005, Art. 5.

To force, or in any way coerce, women into having a foetal transplant (rather than a foetal evacuation procedure) would violate their autonomy.[342] Therefore, in situations when an artificial womb is available to continue the gestation of a foetus following the abortion of a pregnancy, the woman's right to autonomy must be balanced against the interests of the foetus – namely, to remain alive. The potential human dignity and human rights afforded to embryos/foetuses will be discussed in the following section. This, of course, goes back to the debate over the worthiness of protection of the embryo/foetus. Whilst late-stage foetuses in particular, are, in fact, worthy of some level of protection, this must be weighed against the violation of autonomy that would occur if a woman was forced to undergo a medical procedure against her will. Yet, does the woman's autonomy take precedence over the life of the foetus on every occasion? Although forcing someone to have *any* medical procedure against his or her will – regardless of invasiveness – is a violation of his or her autonomy, the level of invasiveness in this particular situation (forcing a woman to undergo foetal transplant surgery rather than a foetal evacuation procedure) should be taken into consideration. Forcing a woman to have a more invasive surgery than the one she would choose for herself should not be permitted, and should, under most circumstances, take precedence over the worthiness of protection of the foetus. I am specifying that a woman's autonomy to determine not to undergo a procedure should take precedence *under most circumstances*, because if the foetal transplant procedure ends up being only slightly more invasive than a foetal evacuation procedure this must be taken into account when weighing the woman's autonomy against the human dignity and human rights of the foetus. Again, this is a case of balancing principles. By "under most circumstances" I mean that only under some extreme

[342] Whilst I am aware of the significant ongoing debate surrounding the various types of autonomy, in this dissertation I used the concept of autonomy put forward by John Stuart Mill, involving personal autonomy and freedom of choice. (See: John Stuart Mill, *On Liberty* New York: Norton, 1859/1975.) Conversely, Immanuel Kant contended that autonomy should be based on rational choice, rather than Mill's emphasis on preferences and desires. (See: Immanuel Kant, *Groundwork of the Metaphysics of Morals*, edited by H.J. Paton, London: Hutchinson, 1948.) Furthermore, I have opted for Mills' version of autonomy over a concept of relational autonomy, which puts emphasis on the role that relatedness (to other individuals, families, society, et cetera) and interpersonal dynamics play in the notion of autonomy. (See, for example: Trudy Grovier, "Self-Trust, Autonomy and Self-Esteem," *Hypatia*, 8 (1993): 99-119; Catriona Mackenzie and Natalie Stoljar, eds. *Relational Autonomy: Feminist Perspectives on Autonomy, Agency and the Social Self*, New York: Oxford University Press, 2000; Catriona Mackenzie, "Relational Autonomy, Normative Authority and Perfectionism," *Journal of Social Philosophy*, 39 (2008): 512-533; Marina Oshana, *Personal Autonomy in Society*, Hampshire: Ashgate, 2006.)

circumstances in which the foetus is at a very late stage and on the verge of being born, could the interests of the foetus (soon-to-be baby) take precedence over the wishes of the woman, in cases when the foetal transplant procedure is equally or less invasive than a foetal evacuation procedure. However, as the foetal transplant procedure would, in all likelihood, take place at a much earlier stage of the pregnancy (as opposed to a very late stage, very close to birth), it is unlikely that there would be frequent scenarios involving a women having to undergo a foetal transplant or evacuation procedure at that late stage in the gestation process.

However, if the foetal transplant procedure is equally or less invasive than a foetal evacuation procedure, the situation becomes more complex. Essentially, if this were the case, then the woman would not be forced into a procedure that was more invasive, painful or uncomfortable: she would experience either an equally or less invasive procedure. Whilst it is not difficult to argue that a woman should not be subjected to a more invasive procedure against her will as it will likely be more painful and uncomfortable with potentially a longer recovery process, it is far more difficult to make the argument that a woman should not be forced into having a procedure that is equally or less invasive than the one she has already consented to undergo, if the proposed equally or less invasive procedure (in this case, a foetal transplant) could result in a positive outcome (the preservation of the life of the embryo/foetus). This is particularly true in the case of a foetal transplant versus a foetal evacuation procedure, because rather than simply being about the procedure itself and the recovery process afterward, it also involves the embryo/foetus, which, as stated previously, is worthy of some level of protection.

In this scenario, rather than weighing whether a woman should be forced into a more invasive procedure and thus have her autonomy infringed versus the worthiness of protection of the foetus, we instead must weigh a woman's desire not to be a genetic mother with the worthiness of protection of the foetus.[343] This is not as straightforward. Despite the fact that forcing a woman into *any* unwanted medical procedure is a violation of her autonomy, it is more difficult to argue that

[343] In this scenario, it could also be asked what the responsibilities of the mother are towards the foetus, as if the foetus already exists. As I have argued earlier in this chapter, if the foetus is not externally viable, it is not entitled to full worthiness of protection. Therefore, it is up to the mother and her intentions to determine the extent of her responsibilities.

– should the foetal transplant surgery be equally or less invasive than a foetal evacuation procedure – she has the right to insist upon her foetus being terminated, rather than being placed in an artificial womb, as explained in the previous paragraph. However, forcing anyone into *any* unwanted medical procedure sets a dangerous precedent.

5.3.2.2 Human dignity and human rights

As explained previously in this chapter, I have taken a gradualist position in the debate over the moral status of the embryo. I have argued that embryos (and eventually foetuses) become increasingly worthy of protection as they reach various stages of development, the most significant stage being viability outside of any womb – natural or artificial. This concept of "protection" refers to the human dignity and human rights of the embryo, foetus or neonate; meaning that as the embryo develops, it becomes increasingly worthy of the protection of its human dignity and human rights. Eventually, the foetus reaches a stage when it becomes externally viable (meaning that it is able to survive outside of a natural or artificial womb) and is afforded the same worthiness of protection as a fully developed adult person. Having said that, in situations when the embryo/foetus is still developing inside of a woman, then the woman's human dignity, human rights and autonomy must also be taken into consideration. In situations where there are competing interests between the woman's decision to end a pregnancy, and the embryo/foetus's right to protection as a result of its human dignity and human rights, then the interests of the two parties must be weighed, and the principles of autonomy and human dignity and human rights balanced.[344]

Human dignity and human rights are referred to in the first of the UNESCO Principles, which states that "human dignity, human rights and fundamental freedoms are to be fully respected," and "the interests and welfare of the individual should have priority over the sole interest of science or society."[345] The

[344] This ethical scenario is very similar to the one that arises when a woman would prefer not to undergo a Caesarean section, despite the fact that doctors have advised her that the procedure could save the life of her baby and potentially, herself. Both cases involve a late-stage foetus at the very last stage of *in utero* development prior to birth, the human rights and human dignity of which must be balanced with the woman's right to autonomy – that being, choosing how to give birth.

[345] Universal Declaration on Bioethics and Human Rights, 2005, Art. 3.

difficulty with this principle is that nowhere in the UNESCO Universal Declaration on Bioethics and Human Rights is it specified whether this principle applies to embryos and foetuses. Whilst this makes the instrument more widely acceptable to those with varying viewpoints, it also makes it very difficult to both successfully apply or deny its application to embryos and foetuses. For instance, conceptionalists would argue that this principle does, in fact, apply to embryos and foetuses – as they believe they are worthy of full protection from the point of conception – and therefore, their human dignity and human rights must be respected at all stages of development. On the other hand, non-gradualist non-conceptionalists would argue that the first UNESCO Principle does not apply to embryos or foetuses under any circumstances, as they do not believe that embryos and foetuses are worthy of protection until some stage after birth.

Consequently, conceptionalists, who argue that an embryo/foetus has a right to life, are typically those who argue that artificial wombs are a solution to abortion. To them, preserving the life of the embryo/foetus is typically the most important issue, and if artificial wombs existed, then women who sought abortions could have a foetal transplant and the pregnancy could be completed in an artificial womb. They argue that, according to the UNESCO Principles, the interest and welfare of the individual – in this case, the embryo/foetus – should have priority over the "sole interest in science or society;" in this case, the wishes of the woman. In other words, conceptionalists seek to ensure that the embryo/foetus's human dignity and human rights are fully respected, in accordance with the first UNESCO Principle.

Whilst embryos and pre-viable foetuses are deserving of some level of worthiness of protection, they still do not have the same worthiness of protection as a born human person. Furthermore, gametes technically also have the *potential* to become persons, yet no argument is put forth claiming that they should have any set of rights or, in fact, not be outright discarded if unneeded.[346] As explained previously, a gradualist approach should be adopted, recognising that

[346] For further information on the status of embryos, see Helga Kuhse and Peter Singer, "The Moral Status of the Embryo," in *Unsanctifying Human Life*, ed. Peter Singer (Oxford: Blackwell Publishers Limited, 2002).

embryos/foetuses do not have the same rights as a full-fledged post-birth person until they are externally viable – meaning that they are capable of survival outside of any womb, natural or artificial. It is not clear when, precisely, an embryo/foetus becomes deserving of the same worthiness of protection as a fully developed human person, as viability, as discussed previously, is a fluid concept, meaning that there is not one specific temporal stage of development (for example, 22 weeks) at which point *all* foetuses are capable of surviving outside of any womb, natural or artificial. The ability to survive outside of a womb differs from foetus to foetus. As a result, it is impossible to provide a specific timeframe for worthiness of protection, and these scenarios should be dealt with on a case-by-case basis.

Moreover, if artificial wombs were to become viewed as a solution to abortion, and all women seeking abortions would be ordered to have foetal transplants, it would constitute a violation of the woman's human dignity and human rights, as guaranteed by the first UNESCO Principle, because forcing a woman to undergo a medical procedure – in this case, a foetal transplant – against her will is a violation of her human dignity and human rights. Indeed, as explained previously in this section, the autonomy, human dignity and human rights of the woman must be considered alongside the worthiness of the protection of the human dignity and human rights of the embryo/foetus she is gestating, in order to determine which course of action should (or should not) be taken. In other words, the woman's human dignity and human rights in the context of not forcing her to undergo an unwanted medical procedure must be weighed against the human dignity and human rights of her embryo/foetus, taking into account its stage of development.

5.3.2.3 Benefit and harm

Furthermore, requiring all women who wish to have an abortion to have a foetal transplant could also potentially violate the second UNESCO Principle of benefit and harm. This principle states that in medical practice, the direct and indirect benefits to the patients should be maximised, whilst any possible harm to them should be minimised.[347] In this case, some would argue that performing foetal transplant surgery against the woman's will would result in the benefit of her

[347] Universal Declaration on Bioethics and Human Rights, 2005, Art. 4.

foetus being placed in an artificial womb to continue its gestation process and being born alive. In addition, they may also argue that the harm – having the patient (the woman) be an unwilling participant in the foetal transplant surgery – would be outweighed by the benefit of keeping the foetus alive. However, this would not always be the case. In fact, the opposite is true under many circumstances. Realistically, if artificial wombs were used in clinical practice and a woman still opted to have a traditional abortion as opposed to a foetal transplant, then she would have made the decision not to become a mother in any context. She had the option of using an artificial womb to continue to gestate the child, but would have decided against it. As a result, the fact that her foetus would be removed from her body, gestated in an artificial womb and then born would not be a benefit for her. In fact, to her, it would be considered harmful as it would force her to become a genetic mother against her will. Therefore, each situation involving the human dignity and human rights of both a woman and her embryo or foetus should be considered on a case-by-case basis, weighing the harms and benefits of both parties.

5.3.2.4 Consent

Forcing a woman to undergo a foetal transplant procedure against her will would violate the UNESCO Principle of consent.[348] This principle states that "any preventative, diagnostic and therapeutic medical intervention is only to be carried out with the prior, free and informed consent of the person concerned, based on adequate information."[349] The foetal transplant procedure is conducted on behalf of the foetus – not the woman. As the foetus clearly cannot consent,[350] and the procedure itself is being performed on the woman, the woman's informed consent should be required in order for the procedure to take place.

It must be noted that if a woman has, in fact, granted her consent for a foetal transplant, then she is simply exercising her right to reproductive autonomy and choosing to end her pregnancy whilst preserving the life of her foetus. However, that scenario is not the one being dealt with in this chapter. This chapter

[348] Ibid., Art. 6.
[349] Universal Declaration on Bioethics and Human Rights, 2005, Art. 6.
[350] This issue will be discussed further below.

specifically deals with the situations in which a woman would be forced to undergo a foetal transplant and place her embryo or foetus in an artificial womb for the remainder of its gestation. In that scenario, if a woman would prefer to have a traditional abortion – including the termination of the foetus – but is forced to have a foetal transplant instead, then clearly she did not consent to the procedure; this is in violation of the fourth UNESCO Principle of consent.

Moreover, the fifth UNESCO Principle relating to persons without the capacity to consent must also be taken into consideration. As discussed throughout this chapter, there is no consensus as to whether or not an embryo or foetus constitutes a "person" – meaning that it is worthy of the same protection as a fully developed adult. This principle states that "authorisation for research and medical practice should be obtained in accordance with the best interest of the person concerned and in accordance with domestic law. However, the person concerned should be involved to the greatest extent possible in the decision-making process of consent, as well as that of withdrawing consent." Embryos, foetuses and neonates each fit under this category as none are able to grant their consent or participate in the decision-making process to any extent. It also means that – for those who consider these entities to be "persons" – any medical practice should be done in accordance with the patient's best interest. As explained in the previous section, taking the gradualist approach, embryos and foetuses are granted increasing levels of protection as they develop. As a result of that, and the fact that they do not have the capacity to consent, their best interests – namely, being kept alive – should be taken into consideration. However, in situations involving the termination of a pregnancy, the interests of the embryo/foetus is often in competition with the interests of the woman, which could include her ability to decide what type of procedure she will undergo, and her decision of whether or not she would like to become a genetic mother. There is certainly a potential conflict of interest in these situations, as the woman is the one who wants to end the life of the foetus, as well as the one who is able to make decisions on behalf of the foetus. This represents a unique situation in that the person making the decision for the entity without the capacity to consent must balance acting in own best interests (i.e. ending the life of the foetus) and the foetus's best interests (i.e. remaining alive). Again, these situations should be considered on a case-by-case basis, but more often than not,

the interests of the woman – a fully developed person with full rights and protections – should be respected.

5.3.2.5 Cost

Another aspect of viewing artificial wombs as a "solution" to abortion is the potential cost of not only the procedure itself, but also of the babies once they are born.[351] These costs include food, shelter, health care, childcare, education, and transportation, among others. Firstly, the cost of the foetal transplant, followed by the operation of the artificial womb for the remainder of the foetus's gestation must be considered. As the technology does not yet exist, it is impossible to place an exact figure on how much operating an artificial womb would cost. However, there will be some sort of cost attached to the foetal transplant surgery, the materials necessary for the operation of the artificial womb (for example, providing the nutrients and oxygenated liquid for the foetus), as well as the cost of technicians and physicians who oversee the gestation process in the artificial womb. The woman's recovery following the foetal transplant surgery may also be costly, as it may resemble the procedure currently used for Caesarean section births, which have significantly longer recovery periods and more potential complications than a current abortion procedure or a vaginal birth.

Secondly, the cost of the babies once they are finished gestating in the artificial wombs must be considered. Whilst some argue that the babies that would have been aborted but were placed into artificial wombs could satisfy the demand for babies to adopt, the number of babies resulting from this could potentially far exceed the demand for adoptive babies.[352] This could potentially leave countless babies without parents to care for them, which may result in them being cared for by the State. If this were the case, then orphanages and other services would have to be provided for these children.[353] This may be a greater problem in the developing world, in places where abortion and poverty rates are high, and the State also may not be able to afford to care for these children.[354]

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[351] Several articles discuss this issue. Compare: Alghrani, "Ectogenesis," 199-200; Coleman, "Abortion and the Artificial Uterus," 14-15.
[352] James, "Ectogenesis: a Reply to Singer and Wells," 87.
[353] Ibid.
[354] Ibid.

5.3.2.6 Artificial wombs are not a solution to abortion

Much of the existing literature claims that artificial wombs will be a solution to abortion. In fact, suggesting that artificial wombs are a solution to abortion is ethically problematic because it presupposes that *all* potential abortions would, with the assistance of artificial wombs, become foetal transplants. However, a woman should not, under most circumstances, be forced into undergoing a medical procedure – in this case, a foetal transplant – against her will.

There are six reasons why artificial wombs are not, in fact, a solution to abortion: (1) this presupposes that abortion is an existing problem; (2) abortion will continue whether or not it is legal; (3) some women have abortions in order not to become genetic mothers; (4) there are scenarios in which the foetus is incompatible with life in which the mother specifically seeks to end its life; (5) the existence of artificial wombs will ignite the abortion debate, rather than solve or end it; and (6) artificial wombs should be viewed as another reproductive option, rather than a solution to abortion.

Firstly, offering artificial wombs as a "solution" to abortion presupposes that abortion itself is a problem. For many – including myself – abortion is a method of exercising autonomy for women who do not wish to be pregnant or become a mother. A substantial portion of society, however, would disagree, and would argue that abortion is, in fact, a problem, as it results in the death of the embryo or foetus. For people of this opinion, artificial wombs would be viewed as a solution to abortion, as it would solve the problem of the certain death of the embryo or foetus resulting from abortion, as the embryo/foetus could be transplanted in an artificial womb to continue its gestation process. This would mean that women could make the decision to end their pregnancy without terminating the embryo/foetus. For those who suggest that artificial wombs are a solution to abortion, the morally problematic part of an abortion is the termination of the embryo/foetus. Therefore, if artificial wombs existed, hypothetically, each abortion procedure could potentially involve a foetal transplant, where the embryo/foetus is placed in an artificial womb to continue its gestation process.

Whilst abortion is, of course, a serious decision for a woman that should not be taken lightly, and ideally, would never *have* to occur, it remains an integral, legal part of many societies. In an ideal world, abortions would not have to take place, as all babies conceived would be planned and wanted. However, as that is not the case, and a wide range of circumstances exist that may result in women seeking abortions, it is important for abortion to remain safe and legal. Therefore, viewing abortion itself as a problem is inaccurate.

Secondly, the technology necessary to perform abortions safely and effectively is widely practiced and is likely to continue to be performed regardless of whether or not it is made illegal, or whether or not artificial wombs are used in clinical practice.[355] Abortion as a practice is so heavily ingrained in many societies that even if abortions were to be criminalised, they would most likely still take place. Indeed, abortions also take place in countries where it is illegal.[356] However, rather than abortions occurring in a safe and regulated atmosphere, they would be performed in unregulated and potentially unsafe conditions.[357] This could result in not only the termination of the embryo/foetus, but could also cause serious health risks for the mother.[358] As a result, it would be more accurate to view artificial wombs as a possible *alternative*, rather than a *solution* to abortion.

Singer and Wells claim that once artificial wombs are used in clinical practice "pro-choice feminists and pro-foetus right-to-lifers can then embrace in happy harmony."[359] This is an oversimplification of an extremely intricate issue. Whilst

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[355] Highly restrictive abortion laws do not necessarily result in lower abortion rates. For example, the abortion rate is 29 per 1,000 women of childbearing age in Africa and 32 per 1,000 in Latin America – regions where abortion is illegal in most circumstances in most countries. In Western Europe, where most countries are permissive of abortion, the abortion rate is 12 per 1,000 women of childbearing age. The Guttmacher Institute, "Facts on Inducted Abortion Worldwide," last modified January 2012, last accessed 9 May 2012, available from http://www.guttmacher.org/pubs/fb_IAW.html#1.

[356] For instance, the overall abortion rate in Africa (where the vast majority of abortions are illegal) was approximately 29 abortions per 1,000 women of childbearing age between 2003 and 2008. The Guttmacher Institute, "Facts on Inducted Abortion Worldwide," http://www.guttmacher.org/pubs/fb_IAW.html#1.

[357] The Guttmacher Institute, "Facts on Inducted Abortion Worldwide," http://www.guttmacher.org/pubs/fb_IAW.html#1.

[358] For example, in South Africa, the annual number of abortion-related deaths fell by 91% following the liberalisation of the abortion law. The Guttmacher Institute, "Facts on Inducted Abortion Worldwide," http://www.guttmacher.org/pubs/fb_IAW.html#1.

[359] Singer and Wells, *The Reproductive Revolution*, 135.

yes, some women who decide to have an abortion would choose to have a foetal transplant and consent to the foetus being transferred to an artificial womb, it is naïve to expect *every* woman seeking an abortion to make the same decision, or to think that artificial wombs will "solve" abortion. What it does do, however, is provide women with another option, thereby expanding their reproductive autonomy.

Thirdly, suggesting that artificial wombs are a solution to abortion presupposes that all women who seek abortions are doing so solely to end the pregnancy, giving more consideration to the life of the embryo/foetus than to the wishes of women also seeking to prevent motherhood. Consequently, Thomson's violinist analogy is not particularly applicable to scenarios where women decide to have an abortion and not use an artificial womb because they do not want to be a mother in any context (biologically, socially or genetically). Whilst it may be true that you would not have the right to slit the throat of the violinist once he is unhooked from your kidneys, it is also important to take into consideration the fact that you would have no responsibility towards the violinist whatsoever. If, for example, there were artificial kidneys available for the violinist that would allow him to complete his nine months of treatment, you would still have no connection – biological, emotional, physical – to the violinist following his unhooking from your kidneys. That is not the case with children, who retain at minimum, a genetic relationship with their mothers. Even if a woman decides to transfer her foetus to an artificial womb and never sees it again following the foetal evacuation procedure, she is still aware that she has genetic offspring somewhere in the world. The person hooked up to the violinist in the scenario would have no analogous familial relationship with the violinist, following his unhooking from the person's kidneys. This is not to say that someone can slit the throat of any genetic relative that they would want to be rid of; obviously, this example only applies in the scenario of a pregnancy and embryo/foetus that a woman would like to terminate. In other words, whilst the worthiness of protection of the embryo/foetus should be considered, it should not automatically override a woman's decision not to become a genetic mother.

To view artificial wombs as a solution to abortion would be to espouse the view that foetuses "can simply be transferred from one incubator (a woman) to another (a fake[360] womb)" without taking the decisions of the woman – such as whether or not she wants to be a genetic mother or have potentially invasive foetal transplant surgery – into consideration.[361] The notion that artificial wombs are a solution to abortion *always* places primacy on the wellbeing of the foetus, not on the health or experiences of the woman,[362] and does not allow for the consideration of both parties' interests. This does not respect women's autonomy or human dignity and human rights.

As the women in Cannold's survey revealed, the mothers would always feel some sense of responsibility or obligation towards their children – even if they were put up for adoption. In the view of the women opposed to abortion rights, the only solution would be for the mother to gestate, bear and raise the child herself. In the view of the women in favour of abortion rights, having an abortion was preferable to gestating and bearing a child that would then be put up for adoption, as they were making an active decision not to become a genetic mother. In this case, Thomson's analogy is not applicable as it does not take into account the fact that women may have abortions in order not to become genetic mothers, and furthermore, view this as the most responsible option. Rather than feeling any sort of obligation towards their children, these women contend that aborting the child, even if artificial wombs existed, would be the preferable option. In this scenario, from my understanding, these women are balancing the principles of their autonomy and human dignity and human rights with the human dignity and human rights of their foetus. I agree with their belief that an integral part of their human dignity and human rights is that their decision not to become a genetic mother be respected.

In Thomson's analogy, she specifies that if a "miracle" occurs and the violinist survives, then you do not have the right to "turn round and slit his throat."[363] If artificial wombs existed, then placing a foetus inside the device would, at that

[360] "Fake womb" is Langford's terminology. She is referring to an artificial womb.
[361] Langford, "An end to abortion," 267.
[362] Ibid.
[363] Jarvis Thomas, "A Defense of Abortion," 66.

stage, not be considered a "miracle" – it would be regular clinical practice and therefore would not be an exception to the rule. Moreover, in Thomson's analogy, you would have no responsibility or obligation towards the violinist after he has been unplugged, if a miracle did happen, and he happened to survive. You would not have the same biological and genetic connection to the violinist that a mother would have to her child, meaning that once the violinist is unhooked, you are in no way connected or related to the violinist, nor have any obligation towards him. The mother would have a genetic connection to her child for the rest of her life – simply by the child's existence – even if she decided to give it up for adoption and never saw him or her again after the day she gave birth. In this sense, Thomson's analogy removes one extremely important component of motherhood – the existence of a genetic child to which she will always have, at minimum, genetic ties. This would simply not occur with the violinist. Whilst you may not have the right to slit the violinist's throat, you also would not have any sort of genetic connection or obligation to the violinist once he has been unplugged. In any event, the wishes of the woman not to become a genetic mother must be balanced against the worthiness of protection of the embryo/foetus. However, the fact that some women would make the decision not to become a biological mother means that artificial wombs cannot be considered a solution to abortion, as doing so would simply place the worthiness of protection of the embryo/foetus over the rights of the woman in every circumstance.

Fourthly, there are some cases, such as when foetal defects are detected or when the foetus is deemed to be incompatible with life, when the specific desired outcome of the abortion is to end the life of the foetus. In these cases, the mother does not necessarily *not* want to be pregnant – in fact, there is a fair chance that the pregnancy was intentional – but, following prenatal testing, has decided that the child would have such a difficult life full of suffering and disability that the most humane thing to do is to end the pregnancy and secure the death of the foetus.[364] In these cases, the desired outcome is to end the life of the foetus; it does not necessarily mean that the woman would have sought to end her pregnancy, should she have been gestating a healthy foetus. Moreover, the woman

[364] For further discussion see: Coleman, "Abortion and the Artificial Uterus," 13-14.

may want to become a mother as well, but would make the decision to end the life of the foetus if it was severely disabled or incompatible with life, in order to save her child from a life of suffering. In these scenarios, the women are having an abortion in order to end the life of her foetus in order to prevent a life of suffering or a stillbirth – not necessarily to end the pregnancy. Therefore, in these cases, artificial wombs could not be viewed as a solution to abortion, as artificial wombs would only prolong the foetus's life of suffering, when the intended consequence of ending the pregnancy is to end the life of the foetus.

Fifthly, acknowledging the mere existence of artificial wombs will not end the abortion debate, nor serve as a "solution" to the abortion "problem." Instead, it will merely shift and add to the ongoing the abortion debate, particularly on topics such as the moral status of embryos and foetuses. The emergence of artificial womb technology will bring these issues to the forefront of public and political discourse. Despite numerous other advances in reproductive technology – such as PGD – the last major advancement in reproductive medicine occurred in the 1970s with the advent of IVF. The IVF process and technology radically changed the way that human beings were capable of reproducing. If artificial wombs existed, another – arguably more significant and controversial – method of human reproduction would be available; with it would come an extensive debate on what it means to be a human person, and the moral status of embryos and foetuses. These topics are, naturally, inextricably linked with the abortion debate. So, far from ending the abortion debate, the emergence of artificial womb technology will make abortion and its related issues even more controversial and in need of discussion.

Sixthly, artificial wombs should be viewed as another reproductive option for women, rather than as a solution for abortion. If artificial wombs existed, women would have the option of ending their pregnancy without terminating their foetus. In this sense, the existence of artificial wombs would lower the threshold of who would undergo an abortion (of the pregnancy) procedure, thus expanding the existing scope of who would choose to have an abortion (of the pregnancy), meaning that people who would have never otherwise considered having an

abortion (on the grounds that morally, they could not end the life of the foetus, even though they did not want to be pregnant) could now choose to do so.

Lastly, it is important to note that stating that a woman should not be forced to undergo a foetal transplant and have her foetus placed in an artificial womb for the remainder of its gestation is not to say that women should, under every circumstance, have the opportunity to terminate the foetus as well as the pregnancy. That is an important issue – and the source of many debates – but not one that will be discussed in depth in this dissertation.

5.4 Would it be ethically permissible to terminate an artificial gestation process?

Whilst some women seek abortions as a result of an unplanned, unwanted and/or dangerous pregnancy, there are also circumstances under which a woman (or both parents) first decides to get pregnant and have a baby, but later chances her/their mind(s). As long as the abortion takes place within the acceptable legal timeframe – and that abortion is legal in the State in which she resides[365] and provided all sufficient grounds are satisfied – the termination of the pregnancy and foetus is a legal, routine procedure. However, if a person or set of parents decided to create an embryo via IVF and then implant it directly into an artificial womb, thereby facilitating the entire gestation process outside of the human body, could the embryo or foetus growing in the artificial womb be aborted?[366] Would there be a specific stage of the gestation process that would serve as a demarcation between when it would and would not be acceptable to abort? Would external viability be a determining factor? Should the mother still have more of a say than the father?

5.4.1 The debate

If artificial wombs are used in clinical practice for the entire gestation process, inevitably, situations will arise where one or both of the persons involved with the creation of the embryo would have second thoughts about gestating it, and would request an abortion of the embryo or foetus growing inside the artificial womb.

[365] Or that she has the ability and/or resources to procure an abortion elsewhere.
[366] Compare: Alghrani, "Ectogenesis," 200-203; Jackson, "Degendering Reproduction," 364-365; Brassington, "The Glass Womb," 203-207.

For example, one or both of the parents could die whilst the embryo/foetus is being gestated, or the parents could determine that they are no longer in a financial position that would permit them to raise a child, or one or both of the parents could become seriously ill and incapable of raising a child. In each of these circumstances, one or both of the parents could request that the artificial womb be switched off and the embryo or foetus inside aborted. The debate is surrounding whether or not this would ever be ethically permissible.

Moreover, if there is disagreement amongst the parents over whether or not the artificial womb should be switched off and the embryo/foetus aborted, whose request should prevail? Traditionally, the woman has the final say over whether or not a foetus developing inside of her will be aborted, as it is a decision she is entitled to make based on autonomy.[367] However, if an artificial womb is used for the entire gestation process, both parents have contributed equally the process – both in the form of being gamete donors. Despite the fact that obtaining gametes from a woman is a far more invasive and difficult procedure than obtaining gametes from a man, the gamete-procuring process aside, both parents each contribute the necessary components to create an embryo. Autonomy is no longer an issue, as neither parent is internally gestating the embryo/foetus.

Miscarriages are another issue that should be taken into consideration when discussing the artificial gestation process. Foetuses gestating *in utero* that have severe genetic or developmental abnormalities may result in a miscarriage. It is unclear how this would translate to an artificial womb. If foetal abnormalities are detected through an equivalent of amniocentesis, would the parents be allowed to abort the foetus, as they may have done if it was gestating in a woman's womb? Perhaps this might not even be an issue, as the embryos used may have first undergone PGD in order to determine which embryos would be best to implant in the artificial womb. Moreover, artificial wombs may be designed in a way that would enable them to detect genetic or developmental abnormalities and would automatically abort the foetus. However, as the technology does not yet exist, it is impossible to know whether or not that even could be possible.

[367] See also Alghrani, "Ectogenesis," 202.

Simonstein argues that if errors occur in the laboratory or during the artificial gestation process, then switching off the artificial womb could be considered euthanasia.[368] This would be problematic, she contends, as euthanasia is illegal in most countries.[369] Reiber also questions whether artificial wombs could ever be switched off in cases when the foetus would have been miscarried naturally due to a foetal anomaly.[370] He suggests using the principle of proportionality "to distinguish ordinary from extraordinary care," as well as to evaluate the burdens that would be imposed by the outcomes.[371] He also suggests consultations with medical experts, bioethicists and parents prior to the decision making.[372]

Schultz contends that if an embryo is conceived via IVF and implanted in an artificial womb, then neither the mother nor the father should have a right to terminate the artificial gestation process.[373] Alghrani hypothesises that once artificial wombs are used in clinical practice, new legislation must be drafted to reflect the new concept of viability in order to specify under which circumstances – if any – the artificial womb can be switched off.[374]

Steiger argues that from a legal point of view, there are no circumstances under which an artificial gestation process can be terminated.[375] He states that because the foetus exists outside its mother's body, then the State could be justified in forcing a parent (or parents) to bring a foetus gestated in an artificial womb to term, whilst a foetus at the same stage *in utero* may still be subject to an abortion.[376] This would then result in the weighing of the State's interest in foetal health and life against the parents' negative reproductive interests (i.e. their desire not to become genetic parents), rather than against a woman's right to privacy in her own body.[377] Steiger hypothesises that this may very well result in the State's

[368] Simonstein, "Artificial Reproduction Technologies," 362-363.
[369] Ibid., 263.
[370] Reiber, "Morality," 519-520.
[371] Ibid., 520.
[372] Ibid.
[373] Schultz, "Development of Ectogenesis," 4.
[374] Alghrani, "Ectogenesis," 201-202.
[375] Steiger, "Not of Woman Born," 155.
[376] Ibid.
[377] Ibid., 155-156.

interests dominating and the foetus being brought to term.[378] However, he notes that if this were to be the case, it would be necessary to determine who is financially responsible for the foetus's development, as well as the resulting child.[379]

5.4.2 Assessment

Ultimately, there do not appear to be any circumstances (aside from the detection of abnormalities that would have resulted in natural miscarriage)[380] under which the artificial womb could be switched off and the embryo/foetus allowed to perish. Unlike a pregnancy *in utero*, the gestation process in an artificial womb cannot happen unintentionally. When parents make the deliberate decision to gestate their child in an artificial womb, they should agree on areas of potential controversy via a contract, such as what happens if one or both of them die or become seriously ill, or if one or both simply do not want to continue their child's artificial gestation process. Of course, there will be scenarios that may arise outside of the scope of the contract, but those would be the exception rather than the norm.

Switching off an artificial womb and allowing the embryo/foetus inside to perish would be contrary to the first UNESCO Principle calling for human dignity and human rights to be respected. Whilst the first UNESCO Principle does not specifically extend protection to embryos and foetuses, as explained previously, they should be afforded gradually increasing worthiness of protection as they develop. As explained previously, in situations where a mother's autonomy is in conflict with the human rights and human dignity of her embryo of foetus, then the principles must be balanced in order to determine the most appropriate course of action. However, in situations involving artificial wombs, as the embryo/foetus is not developing inside of a woman, it is not a case of competing physical interests (i.e. the woman's body versus the developing embryo/foetus). However, non-physical interests of the parents – such as deciding that they do not want to become genetic parents, as discussed above – should not take precedence over the

[378] Ibid.
[379] Ibid.
[380] However, this is unlikely to happen. This will be discussed in this section.

developing embryo or foetus's right to human dignity and human rights in this scenario. This is because the parents deliberately made the decision to create this embryo and gestate it in an artificial womb. This is not something that can happen accidentally or without giving it much thought, as the process to gain access to an artificial womb is likely to be complex and full of various safeguards and steps including consent forms and conversations with doctors and counsellors. Deliberately creating an embryo and gestating it in artificial womb, and then intentionally turning off the artificial womb and allowing the embryo/foetus to perish, undermines the embryo/foetus's dignity and its worthiness of protection. To intentionally create a human life is one thing, but to end the process before completion is another. If this were permitted, it would appear that embryos/foetuses are merely a commodity[381] – something that can simply be created and/or destroyed, which does not respect their human dignity and human rights.

This particular scenario is different than one involving a woman's pregnancy. Firstly, any artificial pregnancies are deliberately created. There are no cases of rape or unintentional pregnancies, which may be the case when women become pregnant. There are no situations involving cases where the woman is unwilling or unable to either gestate or bear the child. Secondly, and most importantly, because a woman is not directly involved in the artificial pregnancy, there are no issues surrounding her autonomy. In situations involving an *in vivo* pregnancy, whilst it may be argued that the embryo/foetus is deserving of some worthiness of protection, the woman's right to autonomy – in this case, deciding what happens to her body and determining which medical procedures to undergo – should usually be given priority. However, in situations involving the pregnancy taking place in an artificial womb, there is no issue of autonomy. As a result, the interests of the embryo/foetus (to continue developing and remain alive) are not in conflict with a woman's autonomy and consent, and the embryo/foetus's dignity should be recognised. In both scenarios – a woman's pregnancy and an artificial pregnancy – the embryo/foetus is deserving of some respect and worthiness of protection, as it has the potential to become a human life. However, with natural pregnancies,

[381] The potential commodification and commercialisation of embryos and foetuses will be discussed in Chapter VI.

the woman's autonomy and right to make decisions regarding her own body and medical care outweigh those of the unborn embryo/foetus. As that is not an issue with artificial pregnancies, the dignity and worthiness of protection of the embryo/foetus must be respected. That is, however, not to say that an embryo/foetus is a fully developed human being deserving of the same worthiness of protection as a born human person. Whilst it does have the potential to become one and is therefore deserving of more respect than other bodily material, it is merely on the way to becoming a human person, but is not quite there yet.

The only scenario in which it *could* potentially be acceptable to switch off the artificial womb would be if serious foetal abnormalities or illnesses were detected, which would have resulted in a natural miscarriage (had the pregnancy been *in vivo*). However, when artificial womb technology is advanced enough to be used in clinical practice, it is likely that steps have been taken to ensure that the machine is advanced enough to also simulate a miscarriage, if appropriate, or correct the problems. Furthermore, the embryos placed in an artificial womb are likely to be screened prior to implantation, so they are less likely to develop abnormalities and diseases than naturally conceived embryos/foetuses. The reason that the detection of serious foetal abnormalities could potentially justify switching off the artificial womb is because it could be viewed as respecting the foetus's human dignity and human rights to let it perish over allowing it to be born with abnormalities that could result in it being disabled, seriously ill, or incompatible with life. If the medical staff overseeing the artificial gestation process has reason to believe that the foetus has serious abnormalities or developmental problems, they could recommend that the most humane course of action would be switching off the artificial womb. However, there do not appear to be any other circumstances (aside from the detection of abnormalities that would have resulted in natural miscarriage) under which an artificial womb could be switched off and the embryo/foetus allowed to perish.[382]

[382] Despite the fact that when a woman is pregnant, she has the right to decide whether or not to become a genetic or biological mother, the situation is slightly different during an artificial gestation process. In an artificial gestation process (as explained in this chapter), parents would have to go through a lengthy, complex process in order to deliberately create a child. In most circumstances when a woman is pregnant and decides she does not want to become a biological or genetic mother, she has most likely not made the deliberate, conscious decision to become pregnant.

Whilst the ending of an artificial gestation process has the potential to be ethically problematic, steps can be taken prior to the start of the artificial gestation process that would eliminate most, if not all, of the problems likely to arise. Firstly, like many medical procedures, including fertility treatments, the parents[383] will have to undergo conversations with doctors, fertility specialists, and possibly counsellors, prior to gaining access to and using an artificial womb. This should include a binding contract of some variety that stipulates that they fully intend to complete the entire gestation process taking place in the artificial womb. The contract could include a clause, for example, that stipulates that if the parents decided to separate or no longer wanted the child, then one or both parties would still remain legally responsible for the child, upon the completion of its gestation. As artificial wombs are likely to be quite costly, using one is not a decision that the parents will, in all likelihood, take lightly. There is no guarantee, of course, that such contracts will be effective. However, contracts could be viewed as the most basic form of regulation, and ideally, would be based on ethical guidelines to ensure that the best interests of all parties involved are protected. Whilst the existence of contracts certainly will not solve all problems that may arise in relation to artificial wombs, they are an explicit commitment and agreement to a specific set of rules and guidelines in relation to what occurs before, during and after the artificial gestation process, and presumably better than permitting people to create other persons without being held in any way accountable, legally.

As discussed above, there are, however, situations in which one or both parents die or become seriously ill and would therefore be unable to be parents to the child gestated in the artificial womb. It is also likely that situations like these would be covered in the contract agreed prior to the implantation of the embryo in the artificial womb. For example, a clause could be included that would stipulate who the child's guardian(s) would be, should anything happen to the parents during the artificial gestation process. This is a decision that the parents would

[383] Whilst it will be possible to have one parent responsible for the growth of their child in an artificial womb (as he or she has received the other necessary gametes from a donor), this chapter will refer to those using an artificial womb to gestate a child as "parents."

have to make once the child is born regardless of the method of its gestation – it just would be in effect from an earlier stage.

Similarly, situations in which the parents decide that they can no longer afford to have the child and become parents are also likely to be rare, as the technology – like most current forms of artificial reproductive technology – will only be available to those who can afford it, at least initially. Whilst there is a chance that artificial wombs potentially could be covered by some insurance providers if it is viewed as a fertility treatment or as being safer than pregnancy, it is likely to be used as a method of last resort – at least at first – when all other fertility treatment options are deemed unsuitable. In these situations, the parents so desperately want a child that they are using the artificial womb as a fertility treatment. Insurance providers would likely only cover the use of artificial wombs in situations where it is used as a fertility treatment (rather than simply because the woman does not want to be pregnant); therefore, the parents made a premeditated, serious decision to have a child, and are unlikely to change their mind about wanting to have the child.

Moreover, a currently existing problem with both IVF and surrogates is that sometimes multiple embryos are implanted in the woman to increase the chances of pregnancy – a system which has the potential to result in multiple births, even if the parents were only seeking to have one child. Whilst this is not the case in all instances of IVF and surrogates – and parents are likely to have the option of implanting one embryo at a time – it is often done as a cost-saving measure and to reduce the number of times that the implantation of the embryo is attempted. It is also done to decrease the number of times the woman has to have the invasive IVF procedure (which involves stimulating the ovaries for egg production, retrieving the eggs via a transvaginal needle, and transferring the fertilised egg(s) into a woman's uterus via catheter). If artificial wombs were used in clinical practice, this would not be an issue, as it is likely that the number of embryos implanted would result in the same number of children.

Another concern about the artificial gestation process is in regards to what would happen to foetuses that would have been naturally miscarried in a woman's

womb. Chances are that when artificial womb technology is used in clinical practice, it will be required to be so advanced that it mimics a woman's womb in virtually every way possible. This would include naturally aborting the foetus in situations where it would have occurred in a woman's womb. Furthermore, as discussed above, it is likely that PGD will be used on embryos gestated in an artificial womb, therefore decreasing the risk of having foetuses that would have been miscarried. If a fertility treatment as advanced as artificial wombs is being used, it is likely that only embryos deemed to be healthy would reach the implantation stage.

In addition, both parents would have an equal say in the gestation process of the embryo/foetus. As described above, because both parents have equal roles in the process as gamete donors and the woman is not gestating the child *in utero*, then both parents have contributed equally[384] to the process and therefore are granted equal say in what happens to the embryo/foetus/baby. Equal contribution from the parents is important because they are both the child's genetic parents, yet neither parent has had to spend nine months of his or her life gestating the child. The fact that the woman is currently and always has been the sole parent responsible for gestating and bearing the child means that she may, in some circumstances, have more of a say in what happens during the gestating and birthing processes (as it is taking place in her body). However, if artificial wombs were used, then both parents would contribute their gametes (or, in some cases, obtain them from donors) and, in theory, should have an equal say in the baby's gestation and birthing processes. The potential for differing wishes of the parents is also something that would be dealt with in the contract agreed prior to the implantation in the artificial womb.

5.5 Could the existence and use of artificial wombs result in an ethically undesirable erosion of abortion rights?

When the clinical use of artificial wombs commences, there are two possible options for abortion legislation: it could change to reflect the existence of artificial

[384] Bearing in mind, of course, that the retrieval process for obtaining gametes is far more intrusive and difficult for women than for men.

wombs, or it could remain the same. Both of these scenarios present distinct ethical problems related to currently existing abortion rights.

Firstly, if abortion regulations were to be overhauled in order to take artificial wombs into account, a debate on abortion rights and practices would have to occur, and there is a possibility that there would be an erosion of existing abortion rights[385] if the laws became more conservative. As most States in which abortion is legal have laws to this effect, abortion has been a right and used in regular practice for decades. Law-making bodies or courts in these countries have determined that a woman has the right to undergo an abortion procedure under certain circumstances, provided sufficient grounds are satisfied. Any steps taken via changes in abortion regulation that would in any way diminish these rights could and should be viewed as a threat to women's autonomy. Furthermore, deeming abortion to be illegal and/or morally wrong will not alter everyone's point of view on abortion. Many people will continue to view it as their right and not something that is in any way morally wrong. As a result, this would inevitably lead to the return of performing illegal "back-alley" abortions by doctors in clinics that are not regulated. People will not stop having abortions, but the conditions under which they occur may be made unsafe, therefore posing a risk to the patients' health and wellbeing.

On the other hand, in States where abortion is already illegal, such as Ireland, the existence of artificial wombs may spark an abortion debate which may lead to the granting of abortion rights. In this situation, a societal debate that could possibly lead to the granting of certain abortion rights could be viewed as being ethically desirable. Indeed, there is no guarantee that having such a debate would lead to the granting or extension of abortion rights; the debate could just as easily result in regulations that are just as strict as or possibly stricter than the existing legislation. The latter scenario would be seen as being ethically problematic, as it represents either the erosion or lack of existing abortion rights.

[385] In States that do, in fact, have existing abortion rights. Abortion is not an existing right in Ireland, for example.

Secondly, if countries or regions opt not to alter their abortion regulation in light of artificial wombs, then the practice of abortion would be illegal in most jurisdictions which use viability outside of a woman's uterus as the demarcation of when an abortion is permitted to take place. In other words, the main criterion for whether or not an abortion can take place is whether or not it is considered viable outside of a womb. Indeed, when existing abortion regulations were enacted, the womb being referred to is obviously one located in a woman, and not an artificial womb. However, if artificial wombs existed, embryos, foetuses and neonates would always be capable of meaningful life outside the mother's womb, as it would have the opportunity to finish the gestation process in an artificial womb. This would mean that abortion may no longer be permitted, as all embryos, foetuses and neonates could finish their gestation process in an artificial womb.

5.5.1 The debate

Most existing abortion regulations – whether in the form of legislation or court decisions – use some concept of viability to determine the stage of development up until which a foetus can be aborted. As explained in the previous chapter, viability is a fluid concept that is dependent upon numerous factors, including the available technology. For example, when the Abortion Act (1967) was passed in the United Kingdom, an abortion could take place up until the 28th week of pregnancy. However, with advancements in technology which allow even more prematurely born babies to survive, the limit was changed to the 24th week in 1990.[386]

As discussed in the previous chapter, one concept of viability suggests that it is the point at which a baby is born alive,[387] whilst another concept, put forth by two landmark court rulings, indicates that viability occurs when the foetus has the capability of meaningful life outside the mother's womb.[388] However, if artificial wombs are used in clinical practice, it will add a further dimension to the concept of viability: scenarios in which the embryo/foetus/neonate is, in fact, viable

[386] Human Fertilisation and Embryology Act, 1990, Art. 37.
[387] Rance v Mid-Downs HA [1991] 1 QB 587, [1991] 1 All ER 801 (QBD).
[388] See Roe v Wade 410 US 113 at 163 (1973) and C v S [1988] QB 135, [1987] 1 All ER 1230.

outside of the mother's womb – because it is in an artificial womb – but is unable to exist outside of some sort of womb, artificial or natural.

The existing literature recognises that the existence of artificial wombs would, in fact, alter the concept of viability – something that must be addressed in the legislation. Whilst some authors simply acknowledge that the existence of artificial wombs will have implications on existing abortion legislation, others suggest ways to change the legislation to reflect the emerging technology. In other words, the debate is not whether artificial wombs will affect existing abortion legislation, but rather, how the changes to existing legislation should be handled.[389]

Simonstein argues that the existence of artificial wombs could have significant consequences on current abortion legislation; namely, that existing abortion rights could be eroded, as they are currently rooted in a woman's right to make decisions concerning her own body until the point when her foetus is viable.[390] Similarly, Murphy analyses how the existence of artificial wombs would make it more difficult to justify elective abortions for pregnant women as a result of the technical viability of all foetuses outside of a woman's womb.[391] Buckley contends that artificial wombs would push back the period of viability, possibly negatively impacting upon a woman's right to privacy.[392] He suggests that viability should be defined as the ability to exist outside a woman's womb without artificial aid.[393] Reiber, who writes from a Roman Catholic perspective, also acknowledges that the existence of artificial wombs would result in the concept of viability as a boundary being eliminated, adding that governments that rely on the concept of viability in their laws would then have to either outlaw abortion or change their legislation.[394]

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[389] Although it should be noted that most authors who acknowledge that artificial wombs will require a revisiting of the abortion debate and a change in the legislation do not provide any suggestions on what changes should be made. The authors that do provide such suggestions will be discussed.
[390] Simonstein, "Artificial Reproductive Technologies," (2009), 182.
[391] Murphy, "Is Pregnancy Necessary," 78.
[392] Michael Buckley "Current Technology Affecting Supreme Court Abortion Jurisprudence," *New York Law School Review* 27 (1982): 1257.
[393] Ibid.
[394] Reiber, "Morality," 523.

Son also agrees that the existence of artificial wombs would require States to revisit and revise their existing abortion legislation.[395] Son argues that the woman's interests and rights are in conflict with the State's interest to keep the foetus alive.[396] Son advocates a gradualist approach, whereby the interests of the woman are paramount early in the pregnancy and are eventually outweighed by the interests of the State/developing foetus as the foetus develops.[397] Son suggests that the concept of viability should be altered to mean the stage of advanced foetal development, rather than the point of foetal independence from a woman's womb.[398] Similarly, Martyn contends that the adoption of a standard based on the extent of foetal development (specifically, one based on foetal brain development) rather than a standard based on viability, will reduce the impact of artificial womb technology on women's privacy rights.[399]

Goldstein discusses the impact that the existence of artificial wombs will have on existing abortion regulation at length.[400] He contends that States may proscribe first trimester abortions that result in the death of the foetus, as long as none of the women's fundamental rights[401] are infringed.[402] Goldstein clarifies this stance further, stating that a woman's right not to bear and beget children does not encompass a right not to abort a pregnancy foeticidally, past the point of viability.[403] He suggests that States could define viability as "natural" or "artificial," and could demand that any woman ending her pregnancy be required to place her foetus in an artificial womb for the remainder of its gestation, so long as the procedure to do so is no more hazardous to the woman than a foeticidal abortion.[404] Lastly, Goldstein argues that States requiring women to place their

[395] Hyun Jee Son, "Artificial Wombs, Frozen Embryos and Abortion: Reconciling Viability's Doctrinal Ambiguity," *UCLA Women's Law Journal* 14 (2005).
[396] Ibid., 225.
[397] Ibid.
[398] Ibid., 225-226.
[399] Ken Martyn, "Technological Advances and *Roe v. Wade*: The Need to Rethink Abortion Law," *UCLA Law Review* 29 (1982): 1214-1215.
[400] Mark A. Goldstein, "Choice Rights and Abortion: The Begetting Choice Right and State Obstacles to Choice in Light of Artificial Womb Technology," *Southern California Law Review* 51 (1977): 882.
[401] Goldstein discusses a woman's right to privacy: Ibid., 885.
[402] Ibid.
[403] Ibid.
[404] Ibid.

foetus in an artificial womb following an evacuation procedure would be responsible for dealing with the resulting children.[405]

Whilst no clear consensus emerged in the literature as to how to adequately legislate for abortion in light of the existence of artificial wombs, it is quite clear that the existence of artificial wombs will, in fact, fan the flames of the ongoing the abortion debate, and will require the rethinking of the concept of viability and worthiness of protection.

5.5.2 Assessment

Abortion regulation will have to change in order to reflect the new concept of viability. A distinction must be made between viability outside of a women's uterus, and viability outside of *any* womb. Whilst this change can take place in several different ways – amending existing laws by the legislature, a new court decision, or a referendum – it is highly likely to spark a contentious debate in many countries. Even in countries where abortion is legal – such as the United States of America – there are still very strong anti-abortion rights lobby groups and organisations. Given the opportunity to potentially influence the making or amending of a new abortion law, both anti-abortion rights and pro-abortion rights groups will make every attempt to have their voices heard and included in the updated legislation.

Regardless of the method in which abortion regulation is altered, a few issues must be addressed. Firstly, and perhaps most divisively, the issue of the moral status of the embryo must be addressed. This is a question that may never be answered in a way that is agreeable to everyone, and may make it very difficult to reach any agreement amongst lawmakers. In fact, in countries such as Ireland, the issue of the moral status of the embryo may be so contentious that lawmakers may intentionally avoid raising or discussing the issue, therefore potentially making it very difficult to pass legislation that protects or provides abortion rights.

[405] Ibid.

Secondly, whether women seeking an abortion should be able to request not only an end to their pregnancy, but also a termination of the life of their foetus must also be addressed. Currently, prior to the existence of artificial wombs, the question of when an embryo/foetus/infant is worthy of protection is divisive, but existing legal frameworks regarding abortion and infanticide dictate when, and under what circumstances, a foetus could be aborted. Naturally, those opposed to abortion rights who view an embryo as having the same worthiness of protection as a fully developed human person, disagree with existing laws permitting abortion. Regardless of whether or not abortion is universally accepted, it is legally in operation in many parts of the world. Furthermore, many countries that permit abortion only do so until a particular point in the pregnancy – the ever-shrinking "age of viability." If artificial wombs were used in clinical practice, this would all change. The point at which a foetus could be aborted – if they could be aborted at all, given the fact that they could potentially complete their gestation in an artificial womb – would have to be determined and then stipulated in the regulation.

Thirdly, the issue of whether women seeking an abortion could or should be required to transfer the foetus to an artificial womb must be addressed. If abortion regulation was altered, there is a possibility that a compulsory part of an abortion procedure would be transferring the embryo/foetus to an artificial womb. As discussed earlier in this chapter, this raises the issues of autonomy, consent, and respect for human dignity and human rights. As the foetus is growing inside of a woman and any medical procedures or treatments would take place in or on her body, she should have the right to determine what type of medical intervention to accept, and whether or not to accept it, under most circumstances. There are some, however, that argue that the foetus has a right to life – particularly because it could be kept alive outside of the mother's womb if artificial wombs existed – which should override a woman's claim to autonomy. If women were legally required to transfer their foetus to an artificial womb in the event that they would like to have an abortion, then having a "traditional" abortion that would result in the certain death of the foetus could be considered a crime. If this were the case, it could also lead to the proliferation of illegal abortion clinics that would persist in performing "traditional" abortions that resulted in the death of the foetus. Forcing

these establishments underground, as they are in some countries, would be unsafe as they would no longer be regulated for health and safety and could put the mother's life in danger. Any updated regulation on abortion must address these issues.

Fourthly, the concept of viability must be addressed. If artificial wombs were used in clinical practice and the age of viability outside the mother's womb vanishes, then technically all existing embryos – frozen or otherwise – would be considered viable.[406] Would this mean that frozen embryos could no longer be destroyed, even if that is the wish of the parents and/or donors? What would happen in circumstances where embryos were frozen many years ago and the parents and/or donors no longer have any interest (or perhaps biological capability) in using them, but do not want to see their embryos gestated, resulting in their genetic offspring coming into existence? Again, this must all be addressed by legislators when amending or drafting new abortion regulation. As discussed above, this problem relating to the viability of embryos can be avoided by stipulating that external viability means that the foetus would have to be able to survive outside of both a woman's womb *and* an artificial womb. If this were the case, then frozen embryos would not be considered viable.

Lastly, as discussed in the previous section, abortion regulation must address whether parents would be permitted to abort the foetus in an artificial womb. If this is deemed to be illegal, switching off an artificial womb and ending the artificial gestation process could potentially be viewed as murder. If a foetal abnormality was detected that would have been aborted in an *in utero* pregnancy, it could potentially be considered euthanasia to abort it in an artificial womb. Furthermore, issues surrounding liability – who is liable if something were to happen to the artificial womb, such as it becoming disconnected from its power source – should also be considered.[407] With so many complex and potentially problematic scenarios, it is imperative that these issues are taken into consideration during the drafting process of any abortion regulation.

[406] See also Alghrani, "Ectogenesis," 200.
[407] See also Alghrani, "Ectogenesis," 203.

It should also be noted that like other emerging technologies that are subject to regulation, any necessary changes to abortion regulation should take place prior to the use of artificial wombs in clinical practice. If, as explained earlier, artificial wombs render viability qualifications obsolete, it is important to have the appropriate regulation in place prior to that occurring; otherwise formerly legal abortion procedures may be considered a crime. However, as explained in the previous chapter, there will be a significant period where artificial wombs are only used as experimental treatments, which could provide a window of opportunity for creating or altering existing abortion regulation, according to the newly emerging technology.

In order for laws requiring women seeking abortions to transfer their foetuses to artificial wombs, abortion and all of its ethical components (i.e. the moral status of the embryo and foetus, as well as the concept of viability) must be debated by law-making bodies. During the course of such a debate, objections to this will, in all likelihood, be raised. To discount artificial wombs as a technological advancement based on the fact that laws *may* be passed sometime in the future requiring women to use artificial wombs following an abortion procedure would be illogical as it is based on pure speculation. Indeed, any emerging technology could potentially raise ethical concerns if specific regulation involving this technology is or is not enacted. If no regulation is enacted, then, based on the existing regulation currently in place, abortion would be illegal in many jurisdictions, as embryos and foetuses would always be externally viable if artificial wombs existed.

However, if regulation is adopted, abortion in general, as well as in the context of artificial wombs, must be debated by law-making bodies. If this is the case, there is a chance that conservative lawmakers would have the opportunity and ability to erode current abortion rights. This would have less to do with the actual moral and ethical implications of the regulation, and more to do with the fact that they would be able to push forward a conservative agenda if they are the party in power. Conversely, regulation that ensures that artificial wombs are used in a way that is ethically responsible and maximises the benefits not only for women, but any person looking to use artificial wombs as a fertility treatment, could also be

adopted. The existence of artificial wombs will, undeniably, alter the concept of viability and this must, in no uncertain terms, be dealt with in terms of existing abortion regulation. The possibility that existing abortion rights and protections could be eroded as a result of the updating of abortion legislation is, in fact, ethically problematic. Abortion, as a practice, will never cease to exist. However, if it was made illegal, then women would be forced to seek unregulated and potentially dangerous abortions in other jurisdictions. Moreover, the potential erosion of abortion rights would essentially be an erosion of a woman's autonomy, as women would then be further restricted with what they could (or could not) do with their own body. However, at this stage it is impossible to predict the type and scope of regulation that will be enacted in the future. As a result, the ethical problem of the potential erosion of abortion rights is not, in fact, insurmountable, as there is also the possibility that abortion rights could be protected, or even enhanced.

5.6 Conclusion

Regardless of the advances made in the area of artificial wombs and their impact on abortion, there will always be a deep-seated debate regarding the moral, political, philosophical and theological questions that arise from abortion. Whilst the existence of artificial womb technology may alleviate some of the controversy by providing another option for women seeking to end a pregnancy, it most certainly will not answer questions such as when certain rights can be invoked, or result in any sort of consensus amongst those who disagree on the issue.[408] Ultimately, advances in neonatal intensive care will lead to similar problems regarding the concept of viability; as the technology progresses, the age of viability decreases. As this is likely to occur prior to artificial wombs being used in clinical practice, issues surrounding the moral status of the embryo and foetus will arise anyway.[409]

I have taken a gradualist stance in relation to the moral status of the embryo and foetus, meaning that their worthiness of protection increases with development. This means that in situations determining the fate of the embryo/foetus, its

[408] See also Alghrani, "Ectogenesis," 199.
[409] Takala, "Human Before Sex?," 193.

varying levels of worthiness of protection must be balanced with the interests of the mother.

This chapter has analysed three ethical problems: (1) whether women could (or should) be forced to transfer their foetus to an artificial womb following an abortion of a pregnancy; (2) whether the artificial gestation process can be terminated; and (3) whether the existence of artificial wombs will result in an erosion of existing abortion rights.

Under most circumstances, I have argued, it is impermissible to force a woman to undergo a foetal transplant procedure and place her foetus in an artificial womb to finish its gestation. Indeed, whether or not this procedure could or should be compulsory in cases where women seek abortions must be considered via balancing the ethical principles of autonomy, human dignity and human rights, benefit and harm, and consent, taking in account both the woman and the embryo/foetus. If the foetal transplant procedure is more invasive than the foetal evacuation procedure which results in the termination of the foetus, then is it a violation of a woman's autonomy to force her to undergo an unwanted medical procedure without her consent. As explained previously, the situation becomes more complex if the foetal transplant procedure is equally or less invasive than the foetal evacuation procedure, as this does not constitute as severe a violation of the woman's autonomy. Under any circumstance, the interests of the woman must be balanced against the interests of the embryo/foetus which, as a gradualist, I argue become more relevant as the embryo/foetus develops, as it becomes increasingly worthy of protection. As artificial womb technology does not yet exist, it is impossible to know what the foetal transplantation procedure will entail and precisely how invasive it will be. As a result, each situation should be taken on a case-by-case basis, balancing the interests of the women with those of the embryo/foetus. When regulation is developed that addresses whether women should be forced to place their foetus in an artificial womb is drafted, a serious debate on abortion must take place. There is a possibility that legislation will be enacted that would force women to transfer their foetuses to artificial wombs following abortions, as well as a possibility that such legislation would not be enacted. It is impossible to predict how governments and legislatures around the

world will handle this issue. However, as there is a possibility that legislation will be enacted that preserves a woman's autonomy and does not force her into (at least) a more invasive procedure in order to save the life of the foetus, this ethical problem is, in fact, surmountable.

As for the ending of an artificial gestation process, as discussed earlier in this chapter, some of the potential ethical problems arising from this scenario can be dealt with by requiring the parent(s) to sign a compulsory binding contract prior to the beginning of the artificial gestation process. This would ensure that they fully intend to gestate the child in its entirety and that they have stipulated what should happen to the child in the event that one or both parents are unable to care for it. The issue of liability would also be dealt with in this contract, possibly placing the responsibility with the doctors or technicians responsible for the artificial womb. The requirement for such a contract should be included in the updated abortion regulation. Moreover, it is unlikely that deciding to end an artificial gestation process if foetal abnormalities are detected would be considered euthanasia. As discussed above, once artificial wombs are used in clinical practice, they are likely to be advanced enough to mimic a woman's womb in every way possible – including having miscarriages when it would have happened naturally. Furthermore, as PGD would most likely take place on the embryos prior to implantation in an artificial womb, the embryos will have already been tested for many potential abnormalities. As a result, this ethical problem is also surmountable.

The existence of artificial wombs would mean that technically, all embryos and foetuses are always viable outside of a woman's womb. As viability is the basis of most existing abortion legislation, all current regulations should be amended to reflect the changes to reproductive technology. Most notably, this would mean stipulating that viability means that the foetus is capable of life outside of *any* womb, natural or artificial. In addition, it is imperative that any new abortion legislation addresses the following issues: (1) the moral status of the embryo; (2) whether a woman can request the termination of both her pregnancy and her foetus; (3) whether a woman should be forced to transfer her embryo/foetus to an artificial womb following the abortion of a pregnancy; (4) the concept of viability;

and (5) whether an artificial gestation process can be terminated. As it is impossible to predict how legislatures and other international governing bodies will react to technological advances, such as the artificial womb, it should not be assumed that regulation that erodes currently existing abortion rights will be enacted. It is merely one legal possibility. As a result, the potential erosion of abortion rights as a result of artificial wombs is surmountable.

To answer one of the main questions arising in the literature: no, artificial wombs are not a solution to abortion. Having said that, artificial wombs can and should be viewed as a possible alternative to the death of the foetus following an abortion procedure, for those who wish to use it as such. Providing women with another reproductive option – both in terms of using artificial wombs as a fertility treatment, as well as in situations where the woman wishes to end the pregnancy but keep the foetus alive – could be viewed as a positive development. This means that when a woman makes the decision to become a mother, she would[410] be able to decide whether to become pregnant and gestate the child herself, or to use an artificial womb instead. Furthermore, if a woman becomes pregnant naturally and artificial wombs existed, she would have the option of continuing to gestate and eventually bear the child, or to transfer the embryo/foetus to an artificial womb. One significant way that artificial wombs could expand reproductive options would be in cases when a woman becomes pregnant but for whatever reason, is unwilling or unable to continue the pregnancy, but also does not want to end the life of the foetus. At present, her only options are gestating and bearing the foetus, or having an abortion (which inevitably results in the death of the foetus). For women in this situation, the existence of the artificial womb could be seen as a positive development, as it would permit them to end their pregnancy without ending the life of their foetus. In any event, providing women with another option when they are pregnant, in fact, could be viewed as increasing their reproductive autonomy, as long as artificial wombs are viewed as just that – another option.

[410] Indeed, elements like cost and geographic location would also be an issue, as they are with any other assisted reproductive technology, such as IVF.

Chapter VI: Ethical problems relating to commodification and commercialisation resulting from artificial womb technology

6.1 Introduction

Whilst the concept of buying and selling parts of the human body is not new, advances in technology, such as artificial wombs, can create a different set of ethical challenges relating to the commodification and commercialisation of the human body. The use of artificial wombs in both the experimental treatment stage and clinical practice will bring with it the potential to create and sustain each stage of the human gestation process, from zygotes, to embryos, to foetuses and finally, babies. The fact that the entire gestation process takes place outside of the human body means that this process, which was once only possible via a woman's uterus, would be able to take place without being entirely reliant upon a human being for nine months. This lack of dependency on a woman to gestate means that human beings would be able to be grown in a laboratory or other medical facility. The multiple stages in the artificial gestation process and materials involved present various opportunities to commercialise and commodify the different components and stages of the process, including gametes, embryos, foetuses, babies, body parts and pregnancy/childbirth.

This chapter examines the potential for commercialisation and commodification brought on by the use of artificial wombs, and any associated ethical problems. It begins by analysing the concepts of commercialisation and commodification, including visiting the existing debate on the subject in relation to the human body. It then explores the impact of the widespread clinical use of artificial wombs on commercialisation and commodification. This is followed by a normative analysis of the resulting ethical problems, and ends with conclusions on the topic.

6.2 Concepts

In order to determine how and whether artificial wombs result in commodification and/or commercialisation, it is important to first define the terms. By "commodification" I refer to the process whereby something or someone is transformed into an entity that could be bought or sold; packaged and advertised; fetishised, commercialised, or objectified; and/or consumed or assigned values

and prices.[411] However, even if something is deemed to be and treated as a commodity, it does not mean that restrictions of some variety cannot be imposed on it from being commercialised for moral, social, economic and/or political reasons.[412] Whilst commodification refers to the broader *notion* that someone or something can be bought or sold, commercialisation is the *process* of turning goods and/or services into something that can be bought or sold. In other words, commercialisation is a specific form of commodification. However, these two terms are frequently used as synonyms in the scholarly debate and are not very clearly distinguished in the literature. For the purpose of this chapter, the two concepts will be addressed together, as commercialisation frequently results from commodification, and ethically, is of concern in relation to the human biological materials discussed in this chapter. The two concepts will be addressed separately when appropriate.

For the purpose of this chapter, the existence and use of artificial wombs could potentially result in the commodification and/or commercialisation[413] of human biological materials and processes. By "human biological materials" I mean any internal or external part of or substance produced by the human body, and by "processes" I mean any physiological process occurring in a human being. In relation to artificial wombs, the primary processes involved would be conception, gestation and childbirth. Many of the human biological materials discussed in this chapter have already, to a certain extent, been commodified and, in some circumstances, commercialised. However, the existence of artificial wombs is significant in each of these scenarios as it has the potential to drastically increase the commodification and/or commercialisation of these materials. This chapter will also address the commodification and commercialisation of babies – a potentially serious consequence of the existence of artificial wombs.

Medicalisation – or the transformation of a traditionally non-medical process or event into something that now requires medical attention and consideration – may

[411]Definition adapted from Nicole Constable, "The Commodification of Intimacy: Marriage, Sex and Reproductive Labor," *Annual Review of Anthropology* 38 (2009): 50.
[412] David B. Resnik, "The Commodification of Human Reproductive Materials," *Journal of Medical Ethics* 24 (1998): 388.
[413] Or, in some cases, the *further* commercialisation and commodification of biological materials.

also play a role in the commodification of human biological materials, pregnancy, and childbirth. The more that the processes of conception, gestation and childbirth rely upon medical intervention – such as the various forms of assisted reproduction – the more it can be argued that those processes are being both medicalised and, in turn, commodified. Indeed, artificial wombs could potentially lead to the further medicalisation of conception, gestation and childbirth. The impact that the medicalisation of reproduction has on the family should also be considered. As reproduction becomes increasingly medicalised, it is changing the concept of what it means to be a family. Artificial wombs will increase the medicalisation of reproduction, and in turn, the number of what could be considered "non-traditional" families.[414] Whilst medicalisation is an interesting and important factor to bear in mind when considering the ethical implications of the development of artificial wombs, as well as the subject of an ongoing ethical debate, it will not specifically be dealt with in this chapter, as most of the same issues will be dealt with in the discussion of commodification.[415]

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[414] Whilst the changing concept of the family is certainly interesting, it will not be dealt with further in this dissertation. For further information, see, for example: Hilde Colpin, et al., "New Reproductive Technology and the Family: The Parent-Child Relationship Following *in vitro* Fertilization," *Journal of Child Psychology and Psychiatry* 36(1995): 1429-1441; Kaja Finkler, Cecile Skzynia and James P. Evans, "The New Genetics and its Consequences for Family, Kinship, Medicine and Medical Genetics," *Social Science & Medicine* 57(2003): 403-412; Susan Golombok, et al., "Families Created by the New Reproductive Technologies: Quality of Parenting and Social and Emotional Development of the Children," *Child Development* 66(1995): 285-298; Radhika Rao, "Assisted Reproductive Technology and the Threat to the Traditional Family," *Hastings Law Journal* 47(1995); 951-966; John A. Robertson, "Assisted Reproductive Technology and the Family," *Hastings Law Journal* 47(1995): 911-934; Lisbeth Sachs, "The New Age of the Molecular Family: An Anthropological View on the Medicalisation of Kinship," *Scandinavian Journal of Public Health* 32(2004): 24-29.

[415] For further information on medicalisation, see: K.K. Barker, "A Ship Upon a Story Sea: The Medicalization of Pregnancy," *Social Science & Medicine* 47(1998): 1067-1076; Heather Cahill, "Male Appropriation and Medicalization of Childbirth: An Historical Analysis," *Journal of Advanced Nursing* 33(2001): 334-342; Frank A. Chervenak and Laurence B. McCullough, "An Ethical Critique of Boutique Fetal Imaging: A Case for the Medicalization of Fetal Imaging," *American Journal of Obstetrics and Gynecology* 192(2005): 31-33; Celeste M. Condit and Melanie Williams, "Audience Responses to the Discourses of Medical Genetics: Evidence Against the Critique of Medicalization," *Health Communication* 9(1997): 219-235; Peter Conrad, "Medicalization and Social Control," *Annual Review of Sociology* 18(1992): 209-232; Peter Conrad, Thomas Mackie and Ateev Mehrotra, "Estimating the Costs of Medicalization," *Social Science & Medicine* 70(2010): 1943-1947; Joseph E. Davis, "How Medicalization Lost its Way," *Society* 43(2006): 51-56; David Field, "Palliative Medicine and the Medicalization of Death," *European Journal of Cancer Care* 3(1994): 58-62; Bonnie Fox and Diana Worts, "Revisiting the Critique of Medicalized Childbirth," *Gender & Society* 13(1999): 326-346; Eugene B. Gallagher and Joan Ferrante, "Medicalization and Social Justice," *Social Justice Research* 1(1987): 377-392; Ann Garry, "Medicine and Medicalization: A Response to Purdy," *Bioethics* 15(2001): 262-269; P.A. Kaufert and M. Lock, "Medicalization of Women's Third Age," *Journal of Psychosomatic Obstetrics and Gynaecology* 18(1997): 81-86; Paula M. Lantz, et al., "Health Policy Approaches to Population Health: The Limits of Medicalization," *Health Affairs* 26(2007): 1253-1257; Diana

6.2.1 Language

Regardless of one's position on the commodification and commercialisation of human biological material and processes, the commonly used terminology to describe and refer to parts and products of the human body reflects the notion that they are already, to some extent, commodified. The human body is often described using words that denote some level of worth, including being "valuable" or "precious." Even the words used to describe the bits of the body and the resulting material – "parts" and "products" – suggest an element of commodification and commercialisation. In fact, the term "reproduction" itself draws upon images of manufacturing and a factory.[416] In addition, the term "donor" is not always accurate when used to describe a person who gives, sells or provides human biological materials or processes. Whilst it is appropriate in some circumstances – when it is an actual, altruistic donation for which the donor received no compensation – in many others it is not, particularly in gamete donation which is typically compensated.

Are the words we use to discuss human biological material and processes influenced by the commodification and commercialisation debate, or do the words themselves influence the debate? Hoppe, whilst discussing whether property rights to the human body exist, states that prior to any sort of related legal regulation, an ethically acceptable manner of dealing with the human body and its materials must be established.[417] In order to do so, he suggests that it is first necessary to determine whether we are struggling with a question of ethics or language: in other words, are people uncomfortable with the ethical dimensions of commodification and commercialisation, or merely feel that "the tools provided by everyday language do not adequately encompass the special status which the human body enjoys."[418] As a result, people may be uneasy using words such as

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C. Parry, "Women's Lived Experiences with Pregnancy and Midwifery in a Medicalized and Fetocentric Context," *Qualitative Inquiry* 12(2006): 459-471; Laura Purdy, "Medicalization, Medical Necessity, and Feminist Medicine," *Bioethics* 15(2001): 248-261; Elianne Riska, "Gendering the Medicalization Thesis," *Advances in Gender Research* 7(2003): 59-87; Marcel Verweij, "Medicalization as a Moral Problem for Preventive Medicine," *Bioethics* 13(1999): 89-113.

[416] Corea, *The Mother Machine*, 16.

[417] Nils Hoppe, *Bioequity – Property and the Human Body*, (Surrey: Ashgate, 2009), 5.

[418] Ibid., 5.

"things," "property," or "ownership" when referring to the human body or related biological materials, and the chances of having an unbiased discussion on the topic decrease with the use of terms such as "commodification," which carries with it a negative connotation.[419] Hoppe contends that this terminology denotes the ultimate alienability of something, indicating that it is merely an object that does not possess a deeper value than that of its raw materials.[420] It is important to take into consideration the manner in which human biological material and processes are discussed, perceived and framed in order to better understand the general debate about the commodification and commercialisation of human biological materials and processes.

6.3 Debate surrounding the commodification/commercialisation of human biological materials and processes in general

Compensation for human biological materials and processes can take several forms and methods. De Castro offers three scenarios in which monetary exchange for human biological materials and processes can take place: (1) providing/accepting monetary compensation for human biological material and/or services in accordance with some predetermined agreement; (2) providing/accepting money as a gift that represents the beneficiary's appreciation for the donation of human biological material and/or services and/or assistance received earlier; and (3) providing/accepting money or goods as compensation for time lost or expenses incurred.[421] Each type of compensation presents a different scenario fuelled by different motivations and open to a wide spectrum of interpretation. In the first scenario, the compensation is a condition for providing the biological material or service, and in all likelihood, would not have taken place without a predetermined agreement and assurance of being paid.[422] In the second scenario, the donor would most likely have offered the biological material or service without the promise of compensation.[423] In the third scenario, the

[419] Ibid.
[420] Ibid., 6.
[421] L.D. de Castro, "Commodification and Exploitation: Arguments in Favour of Compensated Organ Donation," *Journal of Medical Ethics* 29 (2003): 143.
[422] Ibid.
[423] Ibid.

assurance of compensation may or may not exist; in addition, it may or may not be a part of a predetermined agreement between the donor and recipient.[424]

Although each scenario involves some exchange of money, people's attitudes towards each type of compensation and conditions under which the compensation occurs might differ significantly. As de Castro points out, the difference between the first and second scenarios "can set apart a praiseworthy hero from a shameful mercenary" despite the fact that a monetary exchange has taken place in both cases.[425] Furthermore, de Castro questions whether it is the assurance of monetary compensation that most sets the two scenarios apart.[426] In the first, someone takes risks with full knowledge of (and most likely a result of) impending compensation; whereas in the second, the compensation is not a requirement for the transaction and is never guaranteed. De Castro goes on to argue that society provides monetary compensation in numerous situations: as awards, for information leading to the arrest of criminals, to the families of soldiers killed in battle, and as gifts for various occasions; yet in these situations it is not thought that the compensation commodifies the recipient or diminishes the value of his or her contribution to society.[427] Another varying factor is the relationship between the recipient and the donor. In many ways, this relationship also influences whether or not the transaction is seen as ethical or unethical, depending on whether the relationship is amongst family members, friends, employer/employee, or members of different socioeconomic classes.[428] Again, despite the fact that the action in each scenario is the same – the transfer of biological material from one person to another – the relationship also determines the involvement of compensation, and therefore is a determining factor of whether or not it is perceived as ethical and acceptable, or not.

[424] Ibid.
[425] Ibid.
[426] Ibid.
[427] Ibid.
[428] Ibid., 144.

6.3.1 Arguments in favour of and against commodification and commercialisation of human biological materials and processes

There are three main arguments put forth in the literature in favour of the commodification and commercialisation of human biological materials and processes. The first is that permitting the commercialisation of human biological materials and processes would lead to an increase in the low supply of organs required for transplantation. The second argument is that it is a person's right to decide whether or not to sell his or her biological materials and processes. The third argument is that in transplant and donation situations, everyone – aside from the donor – is compensated or receives something.

In addition, there are four main arguments put forth in the literature against the commodification and commercialisation of human biological materials and processes. The first is that the commodification and commercialisation of human biological materials and processes treats people as objects and violates their human dignity. The second argument contends that the commodification and commercialisation of human biological materials and processes would be a "slippery slope" which could eventually lead to the commodification and commercialisation of human beings, babies, cadavers, et cetera. The third argument is that the commodification and commercialisation of human biological materials and processes would lead to exploitation. The fourth argument is that human biological materials and processes are too valuable or precious to be sold.

6.3.2 The debate surrounding the commodification and commercialisation of human biological materials and processes

6.3.2.1 Arguments in favour of commodification and commercialisation of human biological materials and processes

Increase in much-needed transplant materials

Perhaps the simplest and most obvious argument in favour of commercialisation of the human body and biological material is that there is a shortage of biological material that would increase significantly if the sale of parts or products of the

human body were legal.[429] This, in turn, has the potential to save millions of lives of people around the world in need of various organs and tissues, in addition to people requiring blood for medical procedures, or even gametes for reproduction. This model appears to work in Iran, which has had a compensated and regulated living-unrelated donor renal transplant programme in place since 1988, and as a result, has seen a decrease or elimination of transplant waiting lists.[430]

To combat the dearth of organs available for transplantation, Erin and Harris suggest creating an ethical market for human organs from living donors.[431] They insist that any commercial scheme must be strictly regulated, ethically supportable, and have inbuilt safeguards against exploitation, as well as taking into account concern for the vulnerable, and considerations of justice and equity.[432]

Autonomy and the right to sell your own biological materials and processes

It has also been argued that the commercialisation of one's body is his or her right, and that people should be able to make the decision whether or not to sell their biological materials or processes. Savulescu questions why we can sell our labour, but not the means to that labour.[433] He also points out that people take risks for pleasure (such ask skiing or smoking) or financial gain (doing a dangerous job) and it is viewed as socially acceptable; yet people are not permitted to sell their own biological materials and processes for financial gain or make decisions regarding what is best for them, which he deems "paternalism at its worst."[434] Savulescu also points out that when people voluntarily go to war – which certainly carries a risk or injury or death – they are heralded as heroes, yet are not permitted to risk death or injury selling their biological materials or processes in order to improve the quality of their lives or their children's lives or

[429] Julian Savulescu, "Is the Sale of Body Parts Wrong?" *Journal of Medical Ethics* 29 (2003): 138.
[430] For further information, see: Ahad J. Ghods and Shekoufeh Savaj, "Iranian Model of Paid and Regulated Living-Unrelated Kidney Donation," *Clinical Journal of the American Society of Nephrology* 1(2006): 1136-1145.
[431] Charles A. Erin and John Harris, "An Ethical Market in Human Organs," *Journal of Medical Ethics* 29 (2003): 137.
[432] Ibid.
[433] Savulescu, "Body Parts," 138-139.
[434] Ibid., 139.

for anything else they value. He concludes by saying that we should have the right to sell biological material, even if this would not increase the supply or improve the quality of human organs available for transplantation.[435]

Compensation for everyone but the donor

Erin and Harris contend that the ethics of buying and selling human biological material is laden with hypocrisy, pointing out that everyone involved in the process is in some way compensated, aside from the donor.[436] In other words, the surgeon and medical team are paid for their time, and the recipient of the biological material receives a life-sustaining gift, whilst the donor "is supposed to put up with the insult of no reward, to add to the injury of the operation."[437] In addition, the donor's task does not end after surgery: he or she also faces a post-operation recovery period, as well as potential health complications resulting from the donation. So not only is the donor the only uncompensated party, but he or she also faces potential additional hardships following the donation.

6.3.2.2 Arguments against commodification and commercialisation of human biological materials and processes

Human dignity

Some argue that Kant's position that commodifying human beings is wrong because it treats people as mere objects which violates their human dignity does not necessarily have to be completely rejected by those in favour of the commodification/commercialisation of the human body.[438] Some argue that it is possible to accept Kant's position, whilst commodifying human beings without violating their human dignity and worth.[439] In fact, distinctions must be made between a person and the human body. Whilst the body and the person are inextricably linked, this holds mostly between the *whole* body and the person, not between parts or products of the body.[440] For instance, someone does not become

[435] Ibid.
[436] Erin, and Harris, "An Ethical Market," 137.
[437] Ibid.
[438] Resnik, "Commodification," 389.
[439] Ibid.
[440] Ibid.

any less of a person after getting a haircut, or donating blood or gametes.[441] Consequently, some argue that a part or product of the body can be commodified without commodifying the entire body.[442] The argument may also be made that selling the whole body is immoral and therefore unacceptable, but selling parts or products of the body is morally acceptable.[443]

Some believe that the sale of any integral parts (or materials) of the human body denies that person's right to human dignity.[444] Cohen distinguishes between vital and non-vital parts of the human body: parts of the body that are integral to its functioning (such as kidneys, livers, brains and hearts) have special dignity and worth because of their role.[445] Human biological material such as hair and fingernails do not. Cohen claims that setting a price for human beings, or any of their vital components, denies the "special value of human beings."[446]

De Castro argues that if people are uncomfortable with the commercialisation and commodification of human biological materials, this reluctance by itself does constitute proof that it denies human dignity. He contends that whilst most people would be reluctant to part with integral parts of their body, their reluctance might not necessarily arise solely out of receiving compensation for their donation, as much as it would stem from the fact that they are giving up integral parts of their body.[447] Furthermore, de Castro states that even if someone's reluctance to part with their integral body parts *does* have to do with receiving money for them, it is most likely not a result of them recognising that they have a "certain dignity."[448] De Castro questions how the exchange of money for human body parts denies the dignity and worth of human beings.[449] For example, if one person sells his or her kidney, how does that in any way diminish the value or dignity of someone else's kidney? De Castro would argue that it does not.

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[441] Ibid.
[442] Ibid.
[443] Ibid.
[444] See Cynthia B. Cohen, "Selling Bits and Pieces of Humans to Make Babies: *The Gift of the Magi* revisited," *Journal of Medicine and Philosophy* 24 (1999): 292.
[445] Cohen, "Selling Bits and Pieces," 291.
[446] Ibid., 292.
[447] de Castro, "Commodification and Exploitation," 143.
[448] Ibid.
[449] Ibid.

"Slippery slope"

Another argument put forth against the commodification and commercialisation of human bodies is the "slippery slope" concern: that whilst it may not be inherently wrong to sell parts or products of the body, the acceptance of this practice will inevitably lead to undesirable social consequences and may result in the commodification/commercialisation of the body as a whole.[450] Those that put forth this argument contend that this downward slide may begin with the commodification/commercialisation of body parts, but eventually lead to the commodification/commercialisation of entire bodies, babies, cadavers, and may even lead to the sale of people into slavery.[451] In order for this not to occur, they argue, no part or product of the human body must be commodified or commercialised.[452]

Arguments made against the commodification/commercialisation of human biological materials and processes because it may eventually lead to the commodification/commercialisation of human beings, babies, cadavers, et cetera, could be countered by the fact that falling down any alleged "slippery slope" can be offset by putting regulations against such occurrences in place.[453] If the commodification/commercialisation of human biological materials and processes was legal, then regulations on local, national and most likely international levels might be enacted in order to prevent any sort of exploitation, trade on the black market, or inappropriate commerce of any other variety.

Exploitation

Another argument put forth against the commercialisation of human biological materials and processes is that legalising the trade in human organs and other biological materials and processes would certainly lead to exploitation. This could be particularly true for the economically disadvantaged.[454] In other words, people

[450] Resnik, "Commodification," 389.
[451] This argument is discussed, but not advanced by Resnik. Resnik, "Commodification," 390. See also L.R. Kass, "Organs for sale? Propriety, Property and the Price of Progress," *Public Interest* 107 (1992).
[452] Resnik, "Commodification," 390.
[453] Ibid.
[454] Ibid.

could decide to sell their body parts and products in order to make ends meet. This already occurs with the selling of gametes and blood plasma. Those who make this argument do not believe that autonomy extends to a person's right to determine what happens to his or her own biological materials. Those who criticise this argument contend that far from exploiting the economically disadvantaged, permitting people to see their biological materials and process would provide them with another option and source of income.

However, like many things that have the potential to be harmful or cause exploitation in some contexts, if clear legal regulations and safeguards are in place specifically tailored to regulate a legal market in human biological materials and processes whilst combating exploitation, then at least there would be certain safeguards and institutions in place to assist those selling their biological materials and attempt to eliminate any forms of exploitation that could occur during the process.[455] De Castro argues that the mere possibility of exploitation does not outweigh the benefits of a system that permitted the legal, regulated trade in human biological materials and processes, and if anything, this system has the potential to save and enrich more lives.[456]

In fact, the system that currently exists, in which the selling of human biological materials and some processes takes place in a black market setting, might have far greater potential for exploitation than if the commercialisation of human biological materials and processes was legal, particularly amongst those of a disadvantaged socioeconomic status. Although there is no way of knowing the extent to which exploitation could occur in any context, it is presumptuous to think that more exploitation would occur if a regulated system of commercialisation of human biological materials and processes was in place. Furthermore, it is difficult to predict or, in fact, measure the extent of exploitation in either a regulated or non-regulated setting. It is possible, however, to take into account that exploitation does currently occur in an illegal black market setting. If a regulated system was in place, some of the now-illegal trade may be done legally, leading to more appropriate compensation for donors and less potential

[455] See de Castro, "Commodification and Exploitation," 145 for further arguments.
[456] de Castro, "Commodification and Exploitation," 145.

for exploitation. However, as mentioned above, it is impossible to predict whether or how this would occur. It is important to note that in a non-regulated system, not only is there the potential for the exploitation of those from disadvantaged areas and backgrounds, but there are not even institutions in place to assist those who end up selling their biological material, nor is there after-care or other safety mechanisms in place.[457]

The human body is too valuable

Most human biological materials and processes are not currently permitted to be bought and sold. Being opposed to the commercialisation of human biological material – body parts and organs in particular – appears to be the default position of many on the matter. In fact, one of the primary objections to permitting the commercialisation of human biological material is that it would lead to the commodification of the human body – something which many believe is too "valuable, precious or sacred" to ever be permitted in the marketplace[458] or even thought of as something that could be bought or sold. For some, the thought of buying or selling parts of the human body offends common notions of decency.[459] As a result, some deem parts of the human body to be too valuable to ever sell.

6.4 Impact of artificial wombs on commercialisation and commodification of human biological materials and processes

The existence and use of artificial wombs has the potential not only to drastically alter how human beings and their biological materials are created, but also how they are perceived. It raises issues such as whether human beings and their biological material and bodily processes are priceless, or commodities that can be bought and sold. As discussed previously in this chapter, there is currently a debate over the extent to which the human body and its biological materials and processes should be commodified and commercialised, taking into account the fact that in certain cases, this has occurred already.

[457] Ibid.
[458] Ibid., 142.
[459] Ibid.

Currently, the successful gestation of a human being still requires the use of a woman's uterus – either that of the genetic mother, or a surrogate. The process is approximately nine months in length and has the potential to cause health complications, or at the very least, be potentially uncomfortable for the pregnant woman. If artificial wombs were used for the gestation process instead of women, an entire component of the reproductive process would be eliminated. Rather than a woman having to plan her life and exist around the gestation of a foetus for nine months, a machine could do it instead. This simple, yet crucial fact is the basis upon which the existence of artificial wombs could even further commodify the gestation process. Removing the human requirement and component from the gestation process has the potential to be perceived as being more industrial, resulting in products – babies. Would the resulting babies be viewed any differently because of the way they were gestated, or would this be true only for the artificial gestation process itself? Whilst it is possible that resulting babies would be viewed differently than those gestated naturally in a woman, it is likely that the babies would be treated in the same manner as those created currently by assisted reproductive technologies, such as IVF (which, in reality, is no different than the treatment of babies created without the use of artificial technologies).

Regardless of how the resulting baby is viewed by society, the use of artificial wombs would certainly further commodify the process of pregnancy and childbirth, expanding on the commodification and commercialisation that has already occurred as a result of surrogacy. Artificial wombs would only encourage the buying and selling of the gestation process and consequently, childbirth, via an artificial womb. In this scenario, the existence and use of artificial wombs would result in the commercialisation of the artificial gestation process. This would occur separately from the commercialisation of the natural gestation process, which is already possible via surrogacy. The existence and use of artificial wombs will in all likelihood not, however, result in the further commercialisation of the natural gestation process. If anything, it is more likely to result in a decrease in the commercialisation of the natural gestation process, as parents may opt to use artificial wombs rather than surrogates.

On the other hand, the existence and use of artificial wombs has the potential to further commodify human pregnancy and childbirth, possibly placing either a higher or lower value on natural gestation (as opposed to artificial gestation), depending on whether an artificial womb is viewed as a more or less desirable environment for gestating a child. In other words, the natural gestation process taking place in a woman's uterus may be viewed as being even more valuable than it is currently if it is seen as the preferable – possibly perceived as the safer and more "natural" option – method of gestation. Conversely, if artificial wombs are proven to be even safer than a woman's uterus or have the potential to produce healthier and/or smarter babies, then the value of the human gestation process may decrease. This scenario specifically pertains to the commodification of the gestation process – both natural and artificial.

In order to determine the extent to which artificial wombs can impact on commodification and commercialisation of the gestation process (both natural and artificial), it is first necessary to examine each type of scenario in which the artificial womb may be used. Firstly, artificial gestation in an artificial womb can take place in either a commercial or non-commercial context. The commercial artificial gestation scenario would most likely involve a corporate entity charging money for the use of an artificial womb. Customers of this service could avail of it as a fertility treatment, or simply to avoid being pregnant. Conversely, artificial gestation could also occur on a non-commercial basis. This would take place in scenarios in which artificial wombs are used as a fertility treatment in public hospitals. In these cases, artificial wombs would be viewed in a similar light to other medical technology used and provided in public hospitals, such as life support. The commercial and non-commercial use of artificial wombs can be thought of in a similar light to using private health insurance versus the public health care system. If the patient meets the criteria for the public health care system, then he or she is free to avail of it. It is viewed as a service, rather than a commercial enterprise. On the other hand, the commercial for-profit artificial wombs could also be available for those who may not meet the public health care system's criteria (such as women who are physically able to be pregnant, but choose not to be) as well as being another option for those who do qualify for the public system, but would elect to pay for a different type of care and/or service.

Consequently, the availability of artificial wombs may, in certain cases, involve commercialisation of artificial gestation, yet would not in others.

Secondly, in commercial and non-commercial artificial gestation, there is the potential for commodification to occur. If artificial gestation takes place in a commercial setting, commodification could occur if the gestation process and the resulting babies are being sold as products at unreasonably high prices. If artificial gestation takes place in a non-commercial setting there is also the potential for commodification and non-commodification. Commodification in a non-commercial setting could occur if the artificial gestation was treated as a manufacturing process of sorts, with quality checks, lists of functions, and other elements similar to those that occur when a product is created. At the end of the process, the parents could inspect the resulting baby and if it was not up to their standards, they could refuse to accept it. Conversely, the non-commercial use of artificial wombs for the artificial gestation process could also occur without commodification. In this scenario, there would be established guidelines and ethical standards regarding the artificial gestation process agreed to by the parents and public health provider prior to the artificial gestation process commencing. The artificial gestation process would be treated like any other type of assisted reproductive technology.

The use of artificial wombs has the potential to commodify and commercialise several elements of the conception and gestation process of human beings. Currently, gametes and the fertilisation process are already, to a certain extent, commodified and commercialised, thanks to the widespread use of IVF and artificial insemination. Both eggs and sperm are already bought and sold, and it has been possible to purchase IVF treatment and its related services for more than 30 years. Whilst this will not change drastically with the existence of artificial wombs, the possibility of the gestation process taking place outside of a human being may result in an increase in trade in gametes by those who are unable to gestate their own children and may be uncomfortable with using a surrogate. In these cases, artificial wombs would eliminate several psychological, social, ethical, legal and logistical concerns surrounding surrogacy, therefore increasing the level of commercialisation of gametes. Rather than sourcing, selecting and

relying upon a surrogate mother to gestate a child, prospective parents would have the option of using an artificial womb instead. Although it is impossible to predict the costs of using an artificial womb, it is likely that it may be less costly than using a surrogate, as the artificial womb would not incur the same costs as a woman would during and after pregnancy and childbirth. Therefore, there may be an increase in the purchasing of sperm and eggs from fertility clinics, as a result of having the option of gestating a child in an artificial womb.

Similarly, thanks to surrogacy, the natural gestation process itself has already been both commodified and commercialised. However, as explained before, artificial wombs could commodify and commercialise both the natural and artificial gestation process even further. It is also worthy of note that even though it is the device capable of a human biological process, but not human biological material, the artificial womb itself would be a commodity – a machine used in production. It would also be commercialised, as people would be able to pay doctors or medical staff to use both their services and the artificial womb. The artificial wombs would also result in a product – the child. Ethical guidelines must be put in place to ensure that only the artificial gestation process and artificial womb itself can be bought or sold – not the child. Whilst purchasing the services of medical staff and the artificial womb ultimately results in a baby, artificial wombs should not be used as a device for creating babies for the purpose of selling them, because that is a clear violation of human dignity. Regardless of one's position in the debate surrounding when human life begins and when human rights are first applied to a person, by the time a baby is born and viable outside of a womb, it can be agreed by most that this baby is a human person with full human rights. As such, it would violate this baby's human dignity and human rights to sell it in any capacity, despite the fact that the baby could have been sold for a wide range of reasons from being purchased by parents who desperately want a child, to being purchased by someone who will treat it as a slave. In either aforementioned scenario (and, indeed, the many that fall in the spectrum between the two) the action of selling a human being is wrong and ethically problematic. This issue will be discussed in greater detail later in this chapter.

In addition to the gametes, the gestation process and babies, the clinical use of artificial wombs also has the potential to result in the commodification and commercialisation of embryos, foetuses and their biological materials. It is unlikely that embryos would be created, partially gestated in an artificial womb, and then removed and placed in a woman's uterus for the remainder of the gestation process. However, it would be possible for embryos and foetuses to be partially grown in an artificial womb in order to harvest their biological material. Singer and Wells discuss this as a possibility, explaining that artificial wombs could be used to grow and sustain embryos to be used as a source of tissues and organs.[460] Firstly, Singer and Wells suggest that embryonic tissue and organs would be less likely to be rejected by the recipients.[461] Secondly, they suggest that embryos could potentially be genetically "tailor-made" for their recipients through cloning, so that rejection would not occur.[462]

Singer and Wells explain that whilst embryos may appear to be too small to produce organs and tissues for adults, it may be possible to grow the embryo to the point of differentiation of parts, and then remove the tissue or organs and continue to grow them in a culture.[463] Whilst Singer and Wells acknowledge that the moral status of the embryo will be an issue for some people, they contend that the embryo would only be available to use for its tissue and organs until the brain and nervous system developed.[464] They argue that a lack of brain function is the medical profession's criterion for whether transplantable material can be utilised, as would be the case with these embryos grown from transplantation purposes.[465] They explain that in the case of brain death, the absence of brain function indicates that vital organs may be taken from the person.[466] In this case, an embryo would also have no brain function, as it has not yet developed a central nervous system. Furthermore, they contend that until a brain and nervous system develops, there is no possibility for the embryo to feel pain – or at least no more of a possibility than it is for brain dead individuals – a current source of transplant

[460] Singer and Wells, *The Reproduction Revolution*, 138.
[461] Ibid., 139.
[462] Ibid.
[463] Ibid.
[464] Ibid., 147.
[465] Ibid.
[466] Ibid.

tissue and organs.[467] These issues will be discussed in greater detail later in this chapter.

Lastly, embryos and foetuses could be grown in artificial wombs for research purposes. Firstly, the ability to grow embryos outside of a woman's uterus may assist researchers in further developing techniques used in embryonic stem cell research, for example. Furthermore, an embryo could be placed in an artificial womb and grown to a foetus or other specific phase and then removed from the artificial womb at the desired developmental stage, and used to conduct research on that specific stage of the development process. This research could potentially (figuratively and literally) shed some light to what goes on during the gestation process, possibly determining causes of various developmental disabilities and problems that occur during the gestation process. If this were, in fact, to take place, the embryos and foetuses that were partially grown would be treated as commodities, rather than early stage human beings or persons with human dignity, as their sole purpose would be being the subject of research. Both the embryos and foetuses themselves could be commercialised, in addition to the findings of the research that was conducted on the embryos and foetuses.

Consequently, the existence and use of artificial wombs may lead to ethical problems relating to the commodification and commercialisation of pregnancy and childbirth; the commodification and commercialisation of gametes; the commodification and commercialisation of embryos and foetuses used as research materials; the commodification and commercialisation of embryos to create biological materials for transplantation; and the commodification and commercialisation of babies. Each of these potentially ethically problematic areas will be discussed in depth in the normative analysis.

6.5 Normative analysis

As discussed above, the existence and use of artificial wombs would result in a unique set of ethical dilemmas regarding the commodification and commercialisation of human biological materials and processes, as well as,

[467] Ibid.

potentially, the resulting babies themselves. This section examines each of the potential ethical problems described above relating to commodification and commercialisation resulting from the existence of artificial wombs, and analyses them within the framework set out in the principles established in the UNESCO Principles, in order to determine whether or not these problems are surmountable.

6.5.1 Commodification and commercialisation of pregnancy and childbirth

As mentioned previously in this chapter, the existence and use of surrogates has already, to a certain extent, commodified and commercialised pregnancy and childbirth. If human gestation can literally be bought and sold for a specific price, the human gestation process itself has the potential to be viewed as having a set value – both monetarily and non-monetarily. Whilst some women relish the experience of gestation and childbirth, others are biologically incapable of performing these processes, and others simply choose to pay someone else rather than becoming pregnant and giving birth themselves.

Currently, when a surrogate attaches a price to her gestation and birthing services, it can vary greatly, depending on factors such as health, geographic location, and socioeconomic status. Some surrogates only charge for costs incurred related to the pregnancy, such as medical costs, maternity clothing, et cetera. Others may decide to charge an additional fee for their services on top of the routine costs of the pregnancy. Parents using a surrogate also take other costs into consideration, such as travel costs to and from where the child is born, the IVF treatment required to make the embryo that is implanted in the surrogate, and possible adoption costs, depending on the applicable legislation in their home jurisdiction. Much like other artificial reproductive technologies, using a surrogate to gestate and bear a child places a specific cost on the gestation and childbirth processes required to create the child. These parents have to pay a specific monetary cost for a human process that, up until relatively recently, could only be undertaken by the genetic mother, and could not be bought or sold. Once surrogacy began as a commonly used and accepted practice, pregnancy and childbirth became commodified and commercialised.

As mentioned previously in this chapter, despite the existing commodification and commercialisation of pregnancy and childbirth resulting from surrogacy, the existence of artificial wombs could further commodify and commercialise these processes. Firstly, artificial wombs would remove the human requirement for gestation and childbirth. In other words, a baby could be created and gestated entirely outside of a human body. Neither the genetic mother nor a surrogate has to spend nine months gestating a child, culminating in its birth. This process could be outsourced entirely to an artificial womb. This transition from woman to machine – and even the mere existence of the technology – represents a major shift in the way gestation and childbirth are perceived. What was once solely capable in a woman now can take place in a machine. The fact that the machine (the artificial womb) is a non-human entity has several implications on the gestation and childbirth process, including the fact that the device will not lose nine months of its life (as it does not have a "life," per se) gestating a child, nor will the device experience any sort of hormonal bonding with the child, which may make it difficult to hand over to its parents.

Secondly, artificial gestation and childbirth could potentially cost significantly less than using a surrogate. There are numerous costs associated with using a surrogate. Firstly, there are the medical costs, which include pre-pregnancy tests and care for the surrogate, the fertility treatment itself (IVF or artificial insemination, depending on the source of the gametes), the medical care required during pregnancy, the birth itself, and post-birth care for the surrogate. Secondly, there are various legal costs associated with surrogacy, based on jurisdiction. Thirdly, there are also other costs incurred by the surrogate during the pregnancy, such as clothing and supplements. Fourthly, there may be travel expenses for both the surrogate and the individual(s) who requested her services. Lastly, in the case of commercial surrogacy,[468] the surrogate also charges a fee for her services. The costs associated with surrogacy differ greatly in various parts of the world, which can lend itself to fertility tourism – travelling for the purpose of obtaining fertility treatments outside one's home country.

[468] As opposed to altruistic surrogacy, where the surrogate does not charge a fee for her services.

On the other hand, it is impossible to estimate what the costs of using an artificial womb would be at this stage. Like other forms of assisted reproductive technology, artificial wombs will most likely also be costly, and only available to those who can afford it, at least when the technology is relatively recent. There are, however, certain costs that are highly likely to be incurred when using artificial wombs. Firstly, all of the costs associated with IVF, such as the ovary stimulating medication the woman takes before her eggs are retrieved, along with the actual IVF process itself, must be covered. Secondly, the cost of operating the artificial womb must also be considered. At this stage, it is not known whether it will also take an artificial womb nine months to gestate a child. However, regardless of the gestation period, the artificial womb must be paid for for the duration of the gestation process. This could include the cost of operating the machine itself (i.e. the electricity required for it to operate, as well as any nutrients or other products required throughout the gestation process), as well as the costs of the doctors and technicians that are responsible for operating the artificial wombs. However, it is reasonable to estimate that the cost of renting a woman's uterus could be more than the cost of using an artificial womb, as it should be less costly to rent a machine than a person for a gestation period.

Whilst surrogacy is currently something only those with ample monetary resources can consider, the existence of artificial wombs could open the opportunity of having their own genetic children to significantly more people, if the costs for artificial wombs are, in fact, less than that of hiring a surrogate. This would thereby potentially increase the number of children born via wombs that do not belong to their genetic mothers, and could possibly further commodify and commercialise the gestation and childbirth processes. This could potentially occur because the more commonplace it becomes to use an artificial womb as an acceptable, alternative means of gestation, the more any type of gestation – natural or artificial – could be thought of as a commodity.

Whilst both of these factors – removing the human requirement for gestation and childbirth, and making outsourcing a pregnancy more affordable – may be viewed as positive outcomes by some, others will inevitably view this transition from reproduction being solely the domain of human beings to the introduction of

reproduction by artificial means as a serious ethical problem. The removal of the human requirement for reproduction, and the subsequent decrease in cost for outsourcing pregnancy and childbirth could potentially further commodify and commercialise both gestation and childbirth as explained above. Whilst cost figures are already, to a certain extent, attached to the gestation process and childbirth, thanks to the use of surrogates, this method is typically only used as one of last resort, in situations where a person or couple are physically unable to have children (or in other cases, can simply afford to pay someone else to be pregnant for them). In other words, the use of surrogates – whilst firmly embedded in the public consciousness – is hardly a reproductive technology in widespread use. Most people still think of reproduction in terms of the genetic mother being responsible for gestating and bearing her own child. However, the widespread use of artificial wombs could change this perception.

If artificial wombs existed and were a commonly used and accepted way of gestating and bearing children, it could have a significant impact on how pregnancy and childbirth are viewed; in this case, as commodities. When making the decision of how to gestate their children, if artificial wombs were seen as a viable option, parents would have to take various factors into perspective in terms of cost. Costs such as the pre-implantation IVF treatments and the use of the artificial womb would be weighed against costs of a traditional gestation and childbirth, such as medical costs, costs incurred during the pregnancy by the mother (supplements, clothing, classes, et cetera), and wages lost as a result of the mother leaving work during the final stages of the pregnancy and for a potential recovery period following the birth. The existence and widespread use of artificial wombs would mean that both natural and artificial pregnancy and childbirth would be thought of – among other ways – in terms of cost, thereby potentially further commodifying both natural and artificial pregnancy and childbirth.

6.5.1.1 Human dignity and human rights

The first UNESCO Principle regarding the respect for human rights, human dignity and fundamental freedoms, can be used as a framework through which to determine whether or not the ethical problem of the commodification and

commercialisation of pregnancy and childbirth is surmountable.[469] Firstly, it could be argued that the existence of a technology that permits the commodification and commercialisation of pregnancy and childbirth undermines the human dignity of all children, as they could be thought of more as commodities than human beings. Whilst this is a valid argument, it is one that will be addressed later in this chapter, as it pertains more specifically to the resulting child itself rather than the process of pregnancy and childbirth discussed here.

Consequently, this principle is far more applicable – in the case of the commodification and commercialisation of pregnancy and childbirth – to the birth and genetic mother.[470] From the mother's perspective, the commodification and commercialisation of pregnancy and childbirth could be viewed as strengthening and respecting her human dignity. Currently, without the existence of artificial wombs, women bear the sole responsibility for gestating and bearing the world's population. Whether this occurs via the genetic mother or a surrogate mother, a woman's uterus is required for the gestation and birth of a child. No other options exist. If artificial wombs existed, however, it would not be taken for granted that women would have to gestate and bear their children. There would be the possibility to outsource the pregnancy and childbirth to an artificial womb, which would produce the same results as a woman's uterus, but without any of the potentially harmful side effects of pregnancy and childbirth, such as pregnancy-induced illnesses,[471] difficult labours, and ultimately, death by childbirth.[472]

Consider, for example, a woman who is prone to difficult pregnancies, or who is likely to get pregnancy-induced diseases such as preeclampsia, or who has

[469] Universal Declaration on Bioethics and Human Rights, 2005, Art. 3.
[470] As explained in Chapter V, a child can have up to three types of mother-figures: a biological mother (who gestates and bears the child), a genetic mother (who provides the egg for the embryo) and the social mother (who raises the child). In this case, the commodification and commercialisation of pregnancy and childbirth affect both the genetic and biological mothers – who are potentially the same person.
[471] Centers for Disease Control and Prevention, "Pregnancy Complications," last accessed 22 February 2012, available from http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/PregComplications.htm.
[472] Whilst dying during or following childbirth is on the decline, the World Health Organisation estimates that 358,000 women worldwide died in 2008 during or after complications from childbirth. See: World Health Organisation, "Trends in Maternal Mortality: 1990 to 2008," last modified 2010, last accessed 15 May 2012, available from http://whqlibdoc.who.int/publications/2010/9789241500265_eng.pdf.

undergone a hysterectomy and is therefore unable to gestate and bear her own children. She may perceive her own dignity to be rooted in her ability to be a mother, yet would prefer not to use a surrogate (or perhaps could not afford one). In this case, the fact that pregnancy and childbirth have been commodified and commercialised to the point of her being able to source and use an artificial womb, might be perceived as something positive.

In addition, the commodification and commercialisation of pregnancy and childbirth may actually increase the respect shown towards women who have undergone pregnancy and childbirth. What was once expected and not commercialised, now comes with a corresponding price. Whilst some may view the commodification and commercialisation of pregnancy and childbirth as diminishing the dignity associated with the ability to gestate and bear children, the fact that such a high price is currently placed on surrogacy indicates that pregnancy and childbirth are difficult and disruptive enough to a woman's lifestyle to charge a large sum of money for it. Consequently, if artificial wombs existed, it would provide another means of gestation and childbirth, and in turn, further commodify and commercialise the processes, thereby awarding a value to the processes, whether undertaken by artificial wombs, or women. In other words, where women were once expected to bear sole responsibility for gestating and bearing children, the existence of an additional option such as an artificial womb indicates that those processes are, in fact, valuable – in both a monetary and non-monetary capacity.

Whilst some women may view pregnancy and childbirth as the ultimate distinction from men – biological processes of which men are simply not capable – they may perceive the commodification and commercialisation of pregnancy and childbirth as a threat to their human dignity. These women may view the commodification and commercialisation as a threat to their human dignity, because for them, the ability to gestate and bear a child is a crucial component of their identity and in turn, dignity. Even though they would still be completely capable of gestating and bearing a child themselves if artificial wombs existed, they might find the increased element of commodification and commercialisation troubling.

However, on balance, and taking only the commodification and commercialisation of pregnancy and childbirth into consideration, giving women other gestation options, making the reproductive process potentially safer, and gaining some acknowledgement of the difficulties and strains of bearing the responsibility for reproduction, the commodification and commercialisation of pregnancy and childbirth does not harm a woman's dignity. Therefore, any ethical problems resulting from the commodification and commercialisation of pregnancy and childbirth resulting from artificial wombs are, in fact, surmountable.

6.5.1.2 Autonomy

Along the same lines, the commodification and commercialisation of pregnancy and childbirth that could result from the existence and use of artificial wombs expands a woman's autonomy – the third of the UNESCO Principles.[473] Artificial wombs would provide women with another reproductive option, thereby expanding their autonomy. If artificial wombs existed, determining which way to gestate and bear their children could become an integral part of the reproductive process. This has the potential to result in more planned children. In other words, not only would birth control be available – as it currently is – to allow people (particularly women) to control their reproduction, but the existence of artificial wombs would mean that the *entire* reproductive process – from conception to birth – could be carefully planned. Whilst it can be argued that the availability of birth control marked a distinction between sex and reproduction, the ability to outsource pregnancy and childbirth to an artificial womb would further solidify this concept, and truly make reproduction something that can be controlled, to a very large extent. On the other hand, people would certainly be permitted to opt in and out of any or all of this technology, thereby expanding autonomy even further. This certainly represents an expanding of autonomy, not just for women, but for all potential parents.

On the other hand, a woman's autonomy could be compromised if artificial wombs are eventually seen to be the safer gestation option. For example, a woman

[473] Universal Declaration on Bioethics and Human Rights, 2005, Art. 5.

who has a potentially dangerous profession that could be prone to accidents could be advised by her doctor to use an artificial womb to gestate her children. Another example could be a woman who is prone to alcoholism and becomes pregnant. In this scenario, the doctor could require the woman to transfer her embryo or foetus to an artificial womb in order to provide a safer gestation. However, an embryo or foetal transplant procedure may be quite invasive and complicated. This would mean that not only could the woman be forced to gestate the child in an artificial womb against her will, she would also be subjected to an unwanted medical procedure. If, in either of these cases, the woman would prefer not to use an artificial womb, but the doctors force her to, it would essentially limit her autonomy, as it would remove potential reproductive options. Even if gestating the child in an artificial womb is most certainly going to be the safer option, the fact that having a natural gestation could potentially be prohibited for some women could limit their autonomy. In this case, the woman being forced to gestate in an artificial womb would view the commodification and commercialisation of pregnancy and childbirth as creating the ethical problem of compromising her autonomy.

However, as is the case with some medical treatments, limiting a person's autonomy in order to protect them – or in this case, both the mother and child – has the potential to improve their quality of life, or even save their lives. Furthermore, whilst the limiting of autonomy in order to have a safer pregnancy and childbirth by using an artificial womb may be ethically problematic for some, it could be viewed by others as life-saving intervention. The most ethically problematic scenario that could arise from the commodification and commercialisation of pregnancy and childbirth would be if a woman is forced, against her will, to undergo embryo or foetal transplant surgery and place the child in an artificial womb for the rest of its gestation because the doctor deems the artificial womb to be a safer gestation environment than the woman. Situations like these could potentially be avoided if, when a woman becomes pregnant, she is required to sign contracts granting or withholding consent for various actions that could be taken throughout her pregnancy, such as transferring the embryo or foetus to an artificial womb. If a woman chooses to sign this document, it could also act as a contract to do everything in her capacity to provide a safe

environment for the developing embryo/foetus. As discussed in the previous chapter, there is no guarantee that having contracts will solve or avoid any problems, but they do, at least, provide some level of commitment or agreement, and may be helpful in some situations. As a result, there are reasonable grounds to accept that ethical problems arising from the commodification and commercialisation of pregnancy and childbirth relating to autonomy are surmountable.

6.5.2 Commodification and commercialisation of gametes

Similar to pregnancy and childbirth, gametes are already, to a large extent, commodified and commercialised.[474] Purchasing gametes is, at this stage, a widespread and commonly accepted practice.[475] Whilst there are certainly some ethical problems that arise from the commodification and commercialisation of gametes, those issues have been in existence for decades, and indeed, prior to the existence of artificial wombs. However, the longstanding commodification and commercialisation of gametes does not automatically mean that this practice is entirely ethically acceptable. Regardless of any ethical problems existing as a result of the commodification and commercialisation of gametes, these problems would and do exist without the existence and use of artificial wombs. Indeed, the commodification and commercialisation of gametes may occur on a larger scale with the existence and use of artificial wombs, but from an ethical perspective, the problems themselves will be present with or without artificial wombs.

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[474] The first pregnancy achieved using a donor egg was in 1984, and the practice of purchasing "donated" eggs has continued since. Artificial insemination via donor sperm has been practiced for more than a century, although the first published reports about the practice were in 1945. (American Society for Reproductive Medicine, "Third Party Reproduction (Sperm, Egg and Embryo Donation and Surrogacy): A Guide for Patients." 2006, http://www.asrm.org/uploadedFiles/ASRM_Content/Resources/Patient_Resources/Fact_Sheets_and_Info_Booklets/thirdparty.pdf.). Furthermore, between 1992 and 2009, 30, 783 babies were born in the United Kingdom after being conceived using donor gametes. (Human Fertilisation and Embryology Authority, "Donor Conception – Births and Children," last updated 27 January 2012, last accessed 22 August 2012, http://www.hfea.gov.uk/donor-conception-births.html.)

[475] See, for example: Rene Almeling, "'Why do you want to be a donor?'" *New Genetics & Society* 25(2006): 143-157; Rene Almeling, "Selling Genes, Selling Gender: Egg Agencies, Sperm Banks, and the Medical Market in Genetic Material," *American Sociological Review* 72(2007): 319-340; Rene Almeling, "Gender and the Value of Bodily Goods: Commodification in Egg and Sperm Donation," *Law & Contemporary Society* 72(2009): 37-58; Lucy Firth, Eric Blyth and Abigain Farrand, "UK Gamete Donors' Reflections on the Removal of Anonymity: Implications for Recruitment," *Human Reproduction* 22(2007): 1675-1680; Guido Pennings, "The Right to Choose Your Donor: A Step Towards Commercialization or a Step Towards Empowering the Patient?" *Human Reproduction* 15(2000): 508-514.

The existence of artificial wombs would, however, further commodify and commercialise gametes. Where once a woman's uterus was required for gestation, an artificial womb would then be available to gestate and bear the child, therefore making the option of having children available to increasing numbers of people. Take, for example, a homosexual male couple, who, in order to have a baby, would be required to find an egg donor and a surrogate mother. The existence of artificial wombs would mean that they would only need to procure an egg and then implant it in an artificial womb, following IVF with one of their sperm. Whilst both purchasing an egg and acquiring the services of a surrogate mother would be costly, eliminating the need for a surrogate – and the direct dependence on another human being – from the equation may make the reproductive process somewhat easier. In turn, this could potentially result in an increase in the scale of the commercialisation gametes, as it would eliminate the need for a surrogate and reliance upon another human being to gestate and bear children, which may make this process more accessible to more people.

Another potential ethical problem relating to the commodification and commercialisation of gametes is the implications on the wellbeing of the resulting child. These include the same ethical issues associated with the already-existing practice of sperm and egg donation, such as whether the children have the right to know the identity of their genetic parents, and how many gamete donations one person can make. It can be argued the children have the right to know the identity of their genetic parents – a possible challenge if a child was conceived using purchased or donated gametes. Furthermore, it could be potentially problematic if one person supplies the gametes that result in numerous births, as there is the possibility that half-siblings could end up unknowingly involved in non-platonic relationships and reproducing. This, in turn, could result in various genetic problems for their resulting offspring. Indeed, there are numerous other factors to take into consideration when analysing the potential impact on the wellbeing of the ectogenic child, including possible physical, psychological, social and emotional difficulties, none of which we are likely to discover until after the birth of the first children via artificial womb. Whilst this is an important issue worthy of consideration (and one that was briefly discussed in Chapter II), these

additional potential consequences for the ectogenic children would be results of being gestated in an artificial womb in general, and not specific to issues surrounding the commodification and commercialisation of gametes.

As explained in the section above, providing people with further reproductive options expands their autonomy – the third of the UNESCO Principles.[476] Allowing people to purchase gametes in order to have children does, in fact, expand their reproductive options and therefore, also expands their autonomy. Furthermore, the existence and use of artificial wombs further commodifying and commercialising human biological materials that have already, to a large extent, been commodified and commercialised for years, does not diminish human dignity or human rights, the first of the UNESCO Principles.[477] Whilst it is possible that the existence and use of artificial wombs will increase the use of purchased or donated gametes, the ethical problems caused by the commodification and commercialisation of gametes already exist prior to the use of artificial wombs, and will likely continue to exist with or without the development and use of artificial wombs. As a result, the existence and use of artificial wombs will not create any ethical problems that do not already exist.

6.5.3 Commodification and commercialisation of embryos and foetuses used as research materials

One potential scenario that could result from the use of artificial wombs would be growing embryos or foetuses to a certain stage in order to conduct research on the partially gestated human biological materials. This could be done in order to gain a better understanding of each stage of the gestation process and what happens to the embryo and eventually, foetus, at each stage of development. This research has the potential to provide a better insight into gestation in general, thus garnering the knowledge necessary to provide better care for pregnant women. It could also provide crucial information on various developmental disabilities and genetic diseases. The best example of this would be the use of embryos in stem

[476] Universal Declaration on Bioethics and Human Rights, 2005, Art. 5.
[477] Ibid., 3.

cell research, which, it can be argued, has already been commodified and commercialised to a certain extent.[478]

If artificial wombs existed, an embryo or foetus could potentially be grown to any stage, removed from the artificial womb, and used as research material. If this occurred, the embryos and foetuses used as research materials could be commercialised, and, in turn, commodified. Whilst there is the possibility that they could be grown by researchers who conducted the research themselves – therefore ensuring that no money is exchanged – there is still a real possibility that the embryos and foetuses could be grown to a particular stage of development and then sold to various research facilities. Even in cases when the researchers grow their own research materials via artificial wombs, it is possible that any relevant results of this research could be sold, and therefore commercialised and commodified. Consequently, the process of creating research materials – regardless of their potential to become human lives – could potentially result in both the commodification and commercialisation of the research materials.

As discussed in Chapter IV, the Polkinghorne Report provides guidelines for the use of foetuses and foetal materials for research purposes. The Polkinghorne Report stipulates that the management of the pregnancy should not be influenced by the prospective use of the foetus,[479] and that no inducements should be offered to the mother to abort in order to allow the foetus to be used for research

[478] For further information on the commodification and commercialisation of embryos and stem cells for research purposes, see: Diane Beeson and Abby Lippman, "Egg Harvesting for Stem Cell Research: Medical Risks and Ethical Problems," *Reproductive BioMedicine Online* 13(2006): 573-579; Tania Bubela, "Commercialization and Collaboration: Competing Policies in Publicy Funded Stem Cell Research?" *Cell Stem Cell* 7(2010): 25-30; B. M. Dickens and R. J. Cook, "Acquiring Human Embryos for Stem-Cell Research," *International Journal of Gynecology & Obstetrics* 1(2007): 67-71; Donna Dickenson and Itziar Alkorta Idiakez, "Ova Donation for Stem Cell Research: An International Perspective," *International Journal of Feminist Approaches to Bioethics* 1(2008): 125-144; Russell Korobkin, "Buying and Selling Human Tissues for Stem Cell Research," *Arizona Law Review* 49(2007): 45-67; Fiona Murray, "The Stem-Cell Market – Patents and the Pursuit of Scientific Progress," *The New England Journal of Medicine* 356(2007): 2341-2343; Sean O'Connor, "The Use of MTAs to Control Commercialization of Stem Cell Diagnostics and Therapeutics," *Berkeley Technology Law Journal* 21(2006): 1017-1054; Radhika Rao, "Coercion, Commercialization, and Commodification: The Ethics of Compensation for Egg Donors in Stem Cell Research," *Berkeley Technology Law Journal* 21(2006): 1055-1066; David B. Resnik, "The Commercialization of Human Stem Cells: Ethical and Policy Issues," *Health Care Analysis* 10(2002): 127-154.

[479] Ibid., 3.2.

purposes,[480] nor should she be informed of the specific use which may be made of her foetal tissue, or whether it is used at all.[481]

Regarding abortion and the use of foetal materials, the report states: "The decision to carry out an abortion must be reached without consideration of the benefits of subsequent use. The generation or termination of pregnancy to produce suitable material is unethical."[482] In other words, it is unethical for a woman to become pregnant with the sole intention of aborting the foetus in order to use it for research purposes. However, it is unclear as to why the report finds abortion ethically permissible, yet states that it is unethical to generate a pregnancy in order to provide tissue.[483] The Polkinghorne Report claims that doing so would be treating the foetus instrumentally, yet neglects to explain how this is any different from aborting the foetus in the interests of the mother's health.[484] Keown asks, "Surely a fetus which is destroyed in order to promote the woman's health is being used no less instrumentally – as a means to an end – than one generated and terminated for that purpose?"[485] Similar arguments could be made in terms of using an artificial womb to partially gestate an embryo or foetus for research purposes.

6.5.3.1 Human dignity and human rights

Many will object to partially growing embryos and foetuses for research purposes because it violates the human dignity and human rights of the embryos and foetuses, according to the first UNESCO Principle.[486] Whilst the fact of whether or not partially grown embryos and foetuses constitute full-fledged human persons with full rights is debatable, there is no question that the research materials in question differ from other tissues or cultures grown in a medical facility – these either have human dignity already or they have at the very least the potential to become persons with human dignity.

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[480] Ibid., 3.3.
[481] Ibid., 3.4.
[482] Polkinghorne, "Foetal Materials," 3.1.
[483] Keown, "Polkinghorne," 118.
[484] Ibid.
[485] Ibid.
[486] Universal Declaration on Bioethics and Human Rights, 2005, Art.3.

Currently, most IVF regulations stipulate that an embryo can only be grown for 14 days before it is implanted, frozen or discarded.[487] Unless this changes – which is possible given the fact that the advent of artificial wombs would most likely result in a revisiting of artificial reproduction regulations – the same timeframe would hold true for embryos if artificial wombs existed. In other words, research could be conducted (in jurisdiction where it is legal) up until the 14-day mark, provided that the embryo has not yet been implanted – in this case, in an artificial womb. Therefore, any embryos or foetuses grown specifically for research purposes are a different case entirely, as they must be implanted in an artificial womb, and therefore do not fall under any existing 14-day IVF regulations.

Even for those who do not believe that an embryo and foetus are full-fledged human persons deserving of full rights and protections, growing them to various stages of development in artificial wombs in order to use them as research subjects is a troubling notion. This scenario is different from situations when miscarried foetuses are used for research purposes, as those foetuses were not created for the sole purpose of being research material. Would this be a good time to employ Singer and Wells' theory that an embryo can be grown until it feels pain? In that case, they were talking specifically about creating and partially growing an embryo to create organs for transplantation – not research. Is there a difference? Should there be?

In the case of organ transplantation discussed by Singer and Wells, the sole purpose of partially growing the embryo was to grow it to the stage at which various organs could be developed further *in vitro*, independently of a growing embryo or foetus. The goal would be to create body parts that have the potential to save the lives of others. In the scenario where embryos are partially grown for research purposes, the research that would take place could have the possibility of saving lives at some stage in the future. The difference in these cases is that the

[487] This guideline was established in the United Kingdom's Warnock Report in 1984, and recommends that "No live human embryo derived from *in vitro* fertilisation, whether frozen or unfrozen, may be kept alive, if not transferred to a woman beyond fourteen days after fertilisation, nor may it be used as a research subject beyond fourteen days after fertilisation. This fourteen day period does not include any time during which the embryo may have been frozen." See Department of Health & Social Security, "Report of the Committee of Inquiry into Human Fertilisation and Embryology," (1984): 81.

embryos grown for transplant purposes would have a direct, immediate impact, providing human biological materials for those in need of them. The embryos grown for research purposes have the potential to be used in research that results in a discovery that helps many people, but the impact is indirect. Should the direct versus indirect nature of the use of the embryos determine whether or not it is acceptable to partially grow and use them?

In this case, it is useful to employ the Singer and Wells theory. If artificial wombs existed, it should be permitted that they could be used to develop embryos further – to the point of developing a nervous system and being able to feel pain – for both transplantation and research purposes. Once they reach the stage where they have developed a nervous system and can feel pain, growing embryos and certainly foetuses to use as research materials (along with for their materials for transplant) is ethically problematic. At that stage, it could be viewed as cruel and violating their potential human dignity to inflict pain upon embryos and/or foetuses in the name of research. It should also be noted that utilising this theory would exclude foetuses from being grown in artificial wombs for research purposes, as by that stage of development, foetuses have a nervous system and the capacity to feel pain.

6.5.3.2 Benefit and harm

The benefits of any research undertaken using partially grown embryos and foetuses from artificial wombs must be weighed against the harms of the research, in accordance with the second UNESCO Principle.[488] In the case of embryos and foetuses used for research purposes, the benefit would be any potential knowledge or understanding gained from conducting the research. This research into the human reproductive and development processes has the potential to benefit humankind if something is discovered that in any way improves or makes safer the creation and/or gestation of a child. There could also be research conducted on early stages of various diseases and conditions that could result in significant medical gains and benefits.

[488] Universal Declaration on Bioethics and Human Rights, 2005, Art.4.

However, the harms in this scenario are quite clear. In order for this research to take place, an embryo must be grown to a certain stage, perhaps to a foetus. As discussed in Chapter IV, even though the embryos and foetuses are not considered full-fledged human persons deserving of full rights and protections, it is important to consider that unlike other human biological material, an embryo (and certainly a foetus) has the potential to become a full-fledged human person deserving of full rights and protections, and is therefore deserving of more respect than human biological materials that are only parts or products of the human body. Consequently, the harms to the embryos and foetuses are quite significant, as their potential for human life ends when they become research materials.

6.5.4 Commodification and commercialisation of embryos to create biological materials for transplantation

As described previously in this chapter, another possible use for artificial wombs is to grow embryos to a certain stage in order to harvest their biological materials and grow organs and tissues for transplant purposes. Many of the ethical dimensions of this scenario have already been discussed in the previous section and throughout the rest of this chapter.

6.5.4.1 Human dignity and human rights

The same line of thought holds true for embryos for transplantation purposes as with growing embryos for research purposes: growing embryos past the point when they develop nervous systems and can feel pain does not respect their dignity. Whilst they are not full-fledged human persons deserving of full rights and protections, the fact that they have the potential to become human persons should be, at least, respected. Growing potential human persons past the point of developing a nervous system and being able to feel pain – even if the end goal is creating much-needed tissues and organs for transplantation – does not respect human dignity and sets a very dangerous precedent.

6.5.4.2 Benefit and harm

As with partially growing embryos for research purposes, partially growing them for transplantation also comes with benefits and harms. There is currently a significant shortage of human organs and tissues required for transplantation.

Many people die each year on waiting lists for these biological materials. As a result, some people see artificial wombs as a means to create these crucial human biological materials for transplantation. Singer and Wells' theory that embryos can be grown to the point of differentiation, but prior to the stage where they develop a nervous system and are able to feel pain, and then used to grow various organs and tissues for transplantation, is utilised here because it presents a convincing argument in favour of permitting research on early-stage embryos: research that has the potential for wide-reaching benefits.

However, growing an embryo to any stage in order to harvest its biological materials could set a dangerous precedent. Being used for its materials for transplantation purposes would certainly harm the embryos, as they would not longer have the capacity to develop into human persons.

6.5.5 Commodification and commercialisation of babies

One of the most significant potential ethical problems that could arise from the existence of artificial wombs is the commodification and commercialisation of babies, and in turn, human persons. For some, artificial wombs conjure up images of factories full of machines producing hundreds of babies simultaneously, which could then be sold to people who want children. This scenario, although unlikely, would certainly be highly ethically problematic.

Unlike other scenarios of commodification and commercialisation discussed previously in this chapter, babies are not legally commercialised. This is a practice that is not acceptable anywhere, regardless of whether it is purchasing a baby from someone, or the trafficking of babies and children. In other words, whilst it is possible to pay a surrogate to gestate a child, or purchase gametes, it is not possible to legally purchase a baby. Even those in favour of commercialising human biological materials for transplant purposes would likely draw a distinction between selling parts of human beings and selling an entire human person. It is also important to note here that unlike the already-commercialised human biological materials and processes, a distinction must be drawn between the potential commodification of babies as a result of the existence of artificial wombs, and their actual commercialisation.

However, whilst babies may not be bought and sold on the free market at this stage, it can be argued that they are, to a certain extent, commodified. Even though babies are not currently legally commercialised, they can be viewed as commodities, being the end result of artificial reproductive processes. Despite the fact that there is not a "going rate" for a baby, parents of children produced as a result of artificial reproductive technology could certainly add up the costs of the process to come up with a figure that was spent creating their child. In this case, the baby, it can be argued, is commodified to the extent that it cost a certain amount for the parents to create. Furthermore, emerging reproductive technologies such as PGD also have the potential to treat babies as commodities, permitting parents to not only screen for genetic diseases and defects, but also to select their child's gender and possibly other physical characteristics such as eye colour, thus treating babies as the product of a commercial process.

Like most emerging technologies, there is indeed a possibility that artificial wombs, if left unregulated (or even if regulated), could lead to extremely ethically problematic situations for several reasons which will be discussed later in this section. However, as is the case with most other emerging technologies, closely monitoring the development of the technology and establishing a set of ethical guidelines and regulations for artificial wombs is crucial. As was evidenced by the legislative action taken by States when cloning first came to the public's attention, law-making bodies will waste no time in legislating to prevent side effects from technology that are widely seen to be ethically problematic, such as the creation of children for the purpose of buying and selling them. In fact, there are several long-established international laws that prohibit various aspects of the commercialisation of human beings, including babies and children. The Optional Protocol to the Convention on the Rights of the Child on the sale of children, child prostitution and child pornography (2002) is the most directly relevant piece of international law, as it specifically prohibits the sale of children.[489] In addition, various other aspects of the commercialisation of babies/children are covered in other pieces of international law, such as the Convention on the Right of the

[489] Optional Protocol to the Convention on the Rights of the Child on the Sale of Children, Child Prostitution and Child Pornography, 2002, Art. 1.

Child's prohibition on adoption that results improper financial gain for those involved,[490] and the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organised Crime's prohibition on the trafficking of children (which involves giving and receiving payments to obtain another person, in this case, a baby).[491]

6.5.5.1 Human dignity and human rights

Creating fully gestated babies in artificial wombs and then selling them is a clear violation of their human dignity and human rights, the first of the UNESCO Principles, as it treats human persons like property which can be bought and sold.[492] Whilst the status of the embryo and foetus at various stages of development is debatable, once the fully gestated, fully formed baby is removed from the artificial womb – the equivalent of being born – it should be regarded as a human person, deserving of human rights and respect for its human dignity. As a result, babies resulting from artificial wombs should not be commercialised in any way.

The selling of any born-human person at any stage of life – from a newborn baby to an elderly adult – is a clear violation of human rights and human dignity. Everyone has the right not to be sold – whether that is being sold into slavery, or otherwise. Regardless of how one views the potential property value (or lack thereof) in human biological materials and processes, it is clear that whole human persons are not pieces of property that other human persons can purchase and sell. Permitting the selling of babies born via artificial wombs sets a dangerous precedent, as it could potentially lead to attempting to sell human persons at other stages in life. As explained previously, the selling of human persons is something that has been universally outlawed since the end of slavery and is not something that is likely to ever be viewed as being acceptable again.

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[490] Convention on the Rights of the Child, 1990, Art. 21(d).
[491] Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organised Crime, 2000, Art. 3.
[492] Universal Declaration on Bioethics and Human Rights, 2005, Art. 3.

It could also be argued that the buying and selling of babies gestated and born via artificial wombs violates not only their own human dignity, but the wider concept of universal human dignity. The fact that a certain portion of the population could be gestated and born via artificial wombs raises questions as to what this means for humankind. Will the babies gestated and born via artificial wombs be seen to be less (or perhaps more, or equally) human than persons gestated and born via a woman's womb? Will this create some sort of divide or prejudice between those gestated naturally and artificially? At this stage, it is impossible to answer either of these questions, or know whether or not babies being gestated and born via an artificial womb will make any difference to the dignity of wider humankind at all. As discussed previously, like any form of assisted reproduction (such as IVF) it may take several generations to fully comprehend the impact that these technologies have on the persons who result from it.

6.6 Conclusions

As has been discussed throughout the previous chapters, the commodification of human biological materials and processes has already – to a certain extent – occurred. Organs, tissues and other body parts or materials are already viewed as commodities to a certain extent – including by those who believe that human biological materials and processes should never be commercialised or commodified because they are too priceless or valuable.[493] In other words, even if people do not agree with the commodification and commercialisation of human biological materials and processes, it is undeniable that pregnancy and childbirth (which has already been commodified and commercialised thanks to surrogacy), gametes (which are regularly bought and sold), and research materials have already, to a certain extent, been commodified and commercialised. Indeed, the existence and use of artificial wombs will exacerbate the already-existing commodification and commercialisation of pregnancy, childbirth and gametes, but, in all likelihood, not to an extent that is any more problematic than it is at present.

[493] See de Castro, "Commodification and Exploitation," 145 for further information on this argument.

Whilst the notion of growing pre-nervous system embryos and foetuses for either research purposes or to harvest their biological materials for transplant purposes is certainly ethically problematic, clear regulations can be established prior to the use of artificial wombs for this purpose, thereby ensuring that this could not occur legally. Likewise, violations of a baby gestated in an artificial womb's human dignity and human rights can potentially be avoided with proper regulation in place prohibiting their commercialisation. Whilst regulations specific to artificial wombs should and most likely will be implemented, the Optional Protocol to the Convention on the Rights of the Child on the sale of children, child prostitution and child pornography – which already exists – would also apply.

Moreover, unlike abortion regulations which are extremely difficult both to create and implement as the issue is very divisive amongst both lawmakers and the general public, regulations prohibiting the growth of late-stage embryos and foetuses for the purposes of being used as research material or transplantation material would be far less controversial. Legislators are likely to agree on at least the most basic of prohibitions on those issues as well as the commercialisation of babies gestated in artificial wombs.

Overall, the ethical problems raised by the potential and further commodification and commercialisation of human biological materials, processes and entities resulting from the existence and use of artificial wombs are, in fact, surmountable. In some cases, the commodification and/or commercialisation have already occurred and as a result, relevant and useful ethical guidelines may already exist. In other cases, legal regulations (either in existence or created closer to the advent of the technology) could be put in place to prohibit any unwanted or unethical commodification and commercialisation. However, the extent to which artificial wombs could play a role in the commodification and commercialisation of human biological materials and process, as well as babies, should not be underestimated. Whilst commodification and commercialisation of gametes and pregnancy, for example, have already occurred, it has been, for the most part, on a relatively small scale. The existence and use of artificial wombs has the potential to significantly impact the way certain human biological materials and processes are perceived – pregnancy in particular.

Chapter VII: Conclusion

This chapter will first present the results of my research, and answer the research question examined in this dissertation. It will then outline both the scholarly and societal relevance of my work. Lastly, it will provide an outlook on the future of the development of artificial wombs.

7.1 Results

As stated in Chapter I, the purpose of this dissertation is to answer the question: Is the development of artificial wombs ethically desirable? If the answer to that question were to be affirmative, then three necessary conditions must be met: (1) Several of the objectives of the further development of artificial wombs must be valuable; (2) Any ethical problems arising from the further development of artificial wombs must be surmountable; and (3) The development of artificial wombs must be technologically feasible. If all three necessary conditions are met, then, when taken together, they would be considered a sufficient condition for the ethical desirability of the development of artificial wombs.

Valuable goals

In order to determine whether or not these conditions are met, I first surveyed and analysed the existing academic literature that discusses the ethical issues surrounding artificial wombs. From there, I examined each of the valuable goals that could result from artificial wombs that were mentioned in the literature. I then used Frankena's value theory to determine whether or not the goals deemed to be valuable by the authors were, in fact, valuable. As demonstrated in Chapter III, there are at least seventeen valuable goals that could result from the existence and use of artificial wombs. It may be the case that when artificial wombs do exist, some (or all) of this set of valuable goals may not be able to be achieved. Additionally, when artificial wombs do come into existence, other valuable goals may arise that have not been considered in this dissertation. In any event, there is a strong case for the presumption that at least some valuable goals will result from the existence and use of artificial wombs.

It is important to note that whilst some aspects of artificial wombs may be ethically problematic (as discussed in Chapters IV-VI), some of the valuable goals

that could result from the existence and use of artificial wombs would be widely welcomed by those of varying moral stances and viewpoints. In other words, the valuable goals that could result from artificial wombs do not just appeal to liberals, or non-conceptionalists: they have far-reaching benefits and are perceived by many (including conceptionalists, conservatives, Roman Catholics, et cetera) to be positive. For example, it would be very difficult to argue against the use of artificial wombs to help save the lives of premature neonates. In this scenario, artificial wombs would not be radically changing reproduction; rather, they would simply be an updated and improved version of the already-existing incubators used to keep premature neonates alive. Another example of a widely appealing valuable goal is that artificial wombs could be used as another option following the abortion of a pregnancy. As discussed in Chapter V, this could involve placing the foetus in an artificial womb following the termination of a pregnancy, and permitting the foetus to continue its gestation in an artificial womb. Scholars on both sides of the abortion debate welcome this possibility. Those against abortion rights perceive this to be a "solution" to abortion and a way of permitting women to end their pregnancies whilst preserving the life of the foetus. Those in favour of abortion rights view artificial wombs as expanding women's reproductive options, and giving women who decide to end their pregnancy the option of continuing the gestation of their foetus in an artificial womb.

Ethical problems

When I found that there were, in fact, several valuable goals that could result from the use of artificial wombs, I tried to determine whether the ethical problems that could result from artificial wombs are, in fact, surmountable (the second necessary condition). Whilst there are numerous ethical problems that could result from artificial wombs that are mentioned in the literature, I chose to focus on the three I found to be the most significant and challenging – (1) the ethical problems surrounding the experimental treatment stage of development; (2) the ethical problems surrounding abortion, such as whether women could or should be forced to use artificial wombs after ending a pregnancy; and (3) whether artificial wombs could lead to the commodification and/or commercialisation of embryos, foetuses, babies, transplant materials and research materials – and analysed each problem in order to determine whether or not it was surmountable. The three multi-faceted

ethical problems were analysed in Chapters IV, V and VI, and, following the analysis, I have argued in favour of the surmountability of these three ethical problems.

In addition I argue that there is a strong case for the presumption that the other potential ethical problems that could result from the existence of artificial wombs might also be surmountable. There are, of course, limitations to my analysis of the potential ethical problems. I have only examined three of the ethical problems[494] that could result from the existence of artificial wombs. As discussed in the literature review, there are many additional ethical problems to the ones analysed in this dissertation. However, as explained previously, these three problems were selected for in-depth analysis because I believe that they are the most significant and important ethical problems that could result from artificial wombs and represent various stages of the development process, and pose the greatest risk of being insurmountable.

In addition, these three ethical problems were also chosen because they provided rich, multi-faceted ethical issues to discuss; whereas some of the other ethical problems raised by the literature, whilst important, require less analysis. One example of this is the ethical problem that we are currently unaware of whether being gestated in an artificial womb will have harmful effects on the child, physically, emotionally, intellectually and/or psychologically – the second-most cited ethical problem in the literature. Whilst this is certainly a significant concern, it in many ways mirrors the questions that were asked prior to the widespread use of IVF – questions which, to a large extent, remain unanswered, because the first baby born via IVF is only 34-years-old, and it may take at least the lifespan of the first children born via IVF before any potential long-term consequences of the procedure are truly understood. For example, the various stages in the life of the IVF children as they grow up must be studied, followed by any effects it may have on their ability to reproduce (along with any effects it may have on their offspring), in addition to monitoring any potential long-term effects

[494] Or, more accurately, three categories of ethical problems, as some of the chapters presented several ethical problems surrounding the same issue (such as abortion, or commodification/commercialisation.)

on the individual, up to and including in old age. In any event, there is no way of knowing, at this stage, whether the use of artificial wombs will have any adverse effects on the ectogenic child.[495] Therefore, at this stage, it is impossible to absolutely determine if such an ethical problem is, in fact, surmountable. This means that at this stage we cannot exclude the possibility that in the long term artificial wombs might be developed that are reasonably safe.

It is also important to note that there may be other ethical problems that could result from artificial wombs that emerge in the future. These could be ethical problems that have simply not been considered at this stage, or, potentially, additional problems that emerge as a result of other advances in technology. Additionally, there may be ethical problems that arise in the future that prove to be insurmountable. However, until that occurs, there is a strong case to accept the presumption that the ethical problems discussed here that could result from the existence of artificial wombs are surmountable, and that all other ethical problems *might* be surmountable.

Technological feasibility

The final necessary condition for the development of artificial wombs to be considered ethically desirable is that the development of artificial wombs is technologically feasible.

As discussed in Chapter IV, there will, in all likelihood, be a somewhat natural progression from currently existing incubators for severely premature neonates to increasingly advanced incubators designed to mimic the mother's womb, capable of gestating increasingly younger neonates and, eventually, foetuses. However, at this stage, it is impossible to determine whether or not science and medicine will ever establish how to bridge the gap between creating an embryo via IVF at one end of the development spectrum, and finishing the gestation process in an

[495] Indeed, there are certain issues with IVF (such as twinning) and because IVF will be an integral part of the artificial gestation process, these issues should be taken into consideration. (See, for example: M. Hansen et al., "Twins Born Following Assisted Reproductive Technology: Perinatal Outcome and Admission to Hospital," *Human Reproduction* 24(2009): 2321-2331.) However, at this stage it is impossible to know how advanced IVF technology will be when artificial wombs come into existence. At that stage, it might be possible to only implant the number of embryos that the parents hope to result in children.

incubator. There is still so much that is unknown about the interaction between the mother and foetus – such as hormone levels, how the mother's mood affects the foetus, the development of the foetus's organs, nutrition, et cetera – that the middle part of the gestation process may prove to be far more difficult to mimic artificially than anticipated.

The technological feasibility of the development of artificial wombs is not, in itself, an ethical issue; rather, it is an issue for science and medicine. At this stage, it is impossible to know whether or not the development of artificial wombs is technologically feasible – it is intrinsically speculative. There is a possibility that it may turn out not to be technologically feasible at all.

Is the development of artificial wombs ethically desirable?

In *Nicomachean Ethics,* Aristotle states that the mark of an educated person is to look for precision in each class of things just as far as the nature of the subject permits: "it is equally foolish to accept probable reasoning from a mathematician and to demand from a rhetorician scientific proofs."[496] In the context of this dissertation, that means that it is unfeasible to demand mathematical precision when assessing the ethical desirability of the development of artificial wombs. The subject matter of this study is so complex and the number of variables that might affect the outcome is so high that the result of the analysis is necessarily provisional and has an intrinsic element of impreciseness.

With this important Aristotelian caveat in mind, we can draw the following conclusions. There are, in fact, numerous valuable goals – appealing to many across a broad spectrum of moral stances – that could result from artificial wombs. In addition, there is a strong case to accept the presumption that all the ethical problems resulting from artificial wombs might be surmountable. Lastly, I have also accepted the presumption that the development of artificial wombs might be technologically feasible (until technology or science prove otherwise). As a result there is a strong case in favour of the presumption that the further development of artificial wombs is ethically desirable. However, this result might

[496] Aristotle, *Nicomachean Ethics* Book 1, Section 3.

have to be revised as a result of future developments. For example, it might turn out that artificial wombs are fundamentally unfeasible, that the risks are too great and will remain unacceptable, or that a certain novel ethical problem, as yet not identified in the scholarly debate, is not surmountable.

7.2 Relevance

The contributions of the research conducted for this dissertation can be placed into two categories: relevance to new knowledge and scholarship, and societal relevance.

Scholarly relevance

This dissertation has contributed to new knowledge and scholarship in five main areas.

Firstly, this is the first academic work to conduct a thorough, systematic analysis of the ethical desirability of the development of artificial wombs using this methodology. Whilst artificial wombs have been the topic of several journal articles, an edited volume, and a monograph, none of the existing literature examined both the valuable goals and a carefully-chosen selection of ethical problems with wide-reaching, generalisable consequences.

Secondly, this dissertation contains the only comprehensive review of the non-fictional academic literature discussing the ethics of artificial wombs. Even though the literature review in this dissertation focused solely on academic literature, it still represents an important contribution to the scholarly debate, as it provides several interesting insights into the types of publications discussing the ethics of artificial wombs, the timeframe in which these pieces of literature were published, the potential goals of artificial wombs that the authors found to be valuable, as well as the potential aspects of artificial wombs that the authors found ethically problematic. This literature review could be a helpful starting point for other researchers examining the ethics of artificial wombs.

Thirdly, this dissertation's discussion of the experimental treatment phase of the development of artificial wombs represents an important contribution to the

scholarly debate, as this is an area that has been largely neglected. Although 19% of the literature reviewed mentioned that there may be ethical problems relating to the research and development leading up to the creation of artificial wombs, only one chapter of an edited volume discussed this potential ethical problem in any detail. Whilst it is certainly necessary to discuss the ethical implications of artificial wombs when they are used in clinical practice, the entire development leading up to the use of artificial wombs must not be overlooked. As the ultimate goal of artificial wombs is to be able to create and gestate a human person entirely *in vitro,* and this is beyond the reaches of any currently existing technology, it is important to carefully examine how, precisely, this technology will come into existence. I found it surprising that such a significant aspect of artificial wombs was so overlooked in the academic literature, and felt it was necessary to analyse this process. In fact, it is such a crucial component of the development of artificial wombs that if it was found that there were serious, insurmountable ethical problems resulting from the experimental treatment stage of development, then the development of the technology as a whole would have to be deemed undesirable, and halted. As such, this was a fundamental component to my research question.

Fourthly, despite the fact that the impact that artificial wombs would have on abortion was widely discussed in the academic literature, the analysis presented in this dissertation took several different aspects of this issue into consideration. In particular, the discussion on the potential impact that artificial wombs could have on existing (or future) abortion legislation contributed something new to the scholarly debate, as that area had not yet been analysed in any significant detail. This is of particular importance, as abortion legislation is and will continue to be a contentious issue.

Finally, this dissertation provides the only systematic review of the potential for further commodification and commercialisation of various human biological materials and processes (and babies), which may result from the existence and use of artificial wombs. Whilst a few pieces of the academic literature reviewed mentioned that commodification of babies and/or pregnancy may result from artificial wombs, there was no analysis of all the potential types of

commodification and commercialisation that could result from artificial womb technology. This is particularly interesting, given the fact that when the subject of artificial wombs is mentioned, many people's first reaction is to ask if this will result in "baby factories" where babies are gestated and born on a massive scale. I believe that the consequences of the existence and use of artificial wombs have such a potentially wide-reaching impact on commodification and commercialisation that it was an area that required further ethical analysis.

Societal relevance

In addition to making several scholarly contributions, this dissertation also makes several contributions that could be beneficial to wider society.

As explained throughout this dissertation, prior to the existence and use of new technology, such as artificial wombs, it is important to first establish a set of ethical guidelines for the use of this technology. This set of ethical guidelines should then, ideally, be used as the basis for any regulation enacted relating to the technology. This dissertation has provided a clear ethical analysis of both the potentially positive and negative aspects of artificial wombs, through which, a set of ethical guidelines can be drawn.

Although ethical guidelines and regulations should adapt and react to new changes in the technology, at this stage in the development of artificial wombs, I would offer the following ethical guidelines that could be used as a basis for regulation.

Firstly, the development of artificial wombs should be closely monitored. Any research into artificial womb technology should first be carried out on animal models, prior to use on humans. As described in Chapter IV, the path to the creation of artificial wombs will most likely involve increasing advancements in neonatal intensive care, via more technologically sophisticated incubators that one day might be capable of not just sustaining life, but also aiding in the development of foetuses and neonates. During this phase, every care should be taken to ensure that the foetuses/neonates placed in the increasingly advanced incubators do stand a relatively reasonable chance of benefitting from the treatment, and that these

benefits outweigh the harms of the treatment. Creating human embryos for the sole purpose of serving as test subjects in order to attempt to implant and gestate them in artificial wombs should not be permitted. Any embryos utilised in initial uses of artificial wombs (following extensive animal testing, and the advancement of incubators to the point where they are considered artificial wombs and are capable of the entire gestation process) should be obtained with informed consent from the parents who own and created them. Additionally, foetuses or neonates should only be placed in advanced incubators/artificial wombs with the informed consent of their parents.

Secondly, women seeking abortions should be given the option of undergoing a foetal transplant and placing their foetus in an artificial womb for the remainder of its gestation. However, for reasons discussed extensively in Chapter V, this procedure should not be mandatory for all women seeking abortions. Rather, using an artificial womb should be seen as another option for women who no longer wish to be pregnant, but do not want to see the death of the foetus. Moreover, existing abortion legislation should change to reflect the new concept of viability – being externally viable outside of *any* womb, natural or artificial.

Thirdly, every effort should be made to secure the wellbeing of any children gestated in artificial wombs. This should be done through thorough monitoring of the developments of ectogenic children, both on a short- and long-term basis. As discussed in Chapter IV, data should be collected on a long-term basis to determine whether being gestated in an artificial womb has any unsafe or harmful consequences, both early and later in life. If the data collected shows that being gestated in an artificial womb has adverse effects on the child at any stage in life, then the use of artificial wombs should be reconsidered, depending on the extent and seriousness of the adverse effects.

Fourthly, despite the fact that the selling of children is already prohibited by international law, further regulations should be enacted to ensure that artificial wombs are never used as a means to create and then sell children, as discussed in Chapter VI. Furthermore, regulations should be adopted that ensure that artificial

wombs are not used to grow foetuses or babies for research purposes, or in order to use them as a source of organs, tissues or body parts.

Fifthly, once an embryo/foetus is being gestated in an artificial womb, the artificial womb should not be permitted to be switched off. At this stage, it is unclear as to how artificial wombs will handle foetuses with abnormalities that would have resulted in a natural miscarriage. If the artificial womb is not capable of miscarrying, and foetal abnormalities are detected which indicate that the foetus is incompatible with life, then, and only then, would it be permissible to end the artificial gestation process, as discussed in Chapter V. However, at this stage, the extent to which an artificial womb can react to foetal abnormalities (or whether foetal abnormalities would even occur in artificial wombs, if the embryos are pre-screened prior to implantation) is unknown.

Finally, once artificial wombs are used in regular clinical practice, contracts should be used to at least provide some form of legal documentation where the parties involved agree to certain components of the artificial gestation process, as stipulated in Chapters V and VI. Such contracts should include clauses regarding what should happen in circumstances when one or both parents are unable or unwilling to become parents during or after the artificial gestation process, and what should happen to the resulting child, among other areas. Indeed, the use of contacts will not solve all problems resulting from disputes arising from the use of artificial wombs, but it is an important first necessary step towards the most ethical and legal use of the technology.

These ethical guidelines are just the first step towards establishing effective regulation of artificial wombs. It is important to bear in mind that, like with other emerging technologies, the regulation of artificial wombs is not so stringent that it obstructs scientific development completely, nor so lax that it leaves too much in the hands of science. Indeed, these ethical guidelines will require updating as the technology advances.

7.3 Outlook

Artificial wombs have the potential to revolutionise the way that we think about reproduction. Whilst we have had the ability to outsource pregnancy to a surrogate for some time now, artificial wombs would allow that to happen without any of the legal or potential attachment issues associated with surrogacy, as discussed in Chapter II. Artificial wombs would allow a person or a couple to gestate their own child, with the option of providing their own gametes, or using those of a donor. The potential effects on gender in society – briefly discussed in Chapter II – are enough to fill another entire dissertation, and indeed, have been the subject of feminist works that have discussed how the responsibility of motherhood has shaped women's role in society.[497]

Of course, even if artificial wombs existed and were used in regular clinical practice, women would still have the right to choose to gestate and bear their own children. Artificial wombs would simply expand their already-existing reproductive autonomy, by providing women with another option of how to become a mother. However, artificial wombs should be seen as just that – another option – and not be used in any way that would diminish a woman's autonomy. This could occur, for example, by forcing a woman to use an artificial womb to finish the gestation process following the termination of a pregnancy,[498] or if insurance providers or employers required women to use artificial wombs to gestate their children, if they saw it as a means of saving money relating to medical costs and/or maternity leave.[499] Even if artificial wombs are proven to be equally safe or even safer and more effective than natural gestation, a woman should still have the right to determine how and through what means she conceives, gestates and gives birth to her own children.

[497] See, for example, Firestone, *The Dialectic of Sex*, 1970.
[498] In most cases. See Chapter V for further discussion of this.
[499] This could occur if artificial wombs are proven to be equally or more safe and effective as natural gestation. Insurance providers could require their clients to use artificial wombs to minimise pregnancy and birth-related hospital costs. Likewise, employers might require their female employees to sign a contract agreeing to gestate all children in artificial wombs so as not to disrupt their career or cost the company money for maternity leave, hiring a temporary replacement, etc. See Chapter II for further discussion.

Like many forms of technology both in development and in use today, artificial wombs could potentially have a dual use. In addition to being used by infertile couples or individuals to gestate their children, or being used by women to avoid the potential complications, discomforts and dangers of being pregnant, artificial wombs could also be used for purposes that are harmful to society. For example, artificial wombs could be used to gestate a large number of embryos specifically created to have a specific genetic makeup – a type of eugenic programme. Alternatively, as discussed in Chapter VI, there are numerous ways in which artificial wombs could be used for financial gain, such as using them to gestate and then sell babies to parents who are, for whatever reason, unable to adopt and desperately want a child. They could also be used to grow babies in order to harvest their body parts for transplantation purposes. The point being: artificial wombs can be used to achieve both valuable goals and negative goals.

However, the dual-use of artificial wombs should not halt their development. Similar to other forms of controversial emerging technology, ethical guidelines ideally should be established prior to the existence of artificial womb technology to ensure that it is only used for valuable goals, and not improper, unethical uses, such as those described above. These guidelines should be codified in law, as well as in a set of ethical guidelines for physicians, nurses, technicians and anyone else involved with the artificial womb technology. The misuse of artificial wombs should constitute a serious form of medical malpractice, and should be punishable by a severe sentence. Of course, that is not to say that having established ethical guidelines and legal regulations will stop or discourage the misuse of technologies, such as PGD, IVF or other forms of assisted reproduction. Indeed, the use of these technologies occurs in countries without regulation and, in all likelihood, the misuse occurs in countries with regulation. Furthermore, it may be extremely difficult for certain countries, such as Ireland, to enact any legislation in areas relating to emerging reproductive technologies, as they are viewed as being highly controversial and are largely avoided by politicians.[500] However, despite the fact that it may not solve all problems, it is very important to establish legal

[500] For further information, see: Elizabeth Yuko, et al., "Ireland and the United Kingdom's Approaches to Regulation of Research Involving Human Tissue," in *Biobanks and Tissue Research* , ed. Christian Lenk et al. (Dordrecht: Springer, 2011).

regulation based on well-developed ethical guidelines as, at least, a first line of defence.

When drafting regulation and ethical guidelines pertaining to artificial wombs, it will be important to strike a balance between establishing clear limitations for the use of the technology, whilst ensuring that these guidelines will not hinder, or negatively impact the research into the development of artificial wombs. Moreover, any regulations or guidelines that are enacted must be flexible to a certain extent, allowing for regular changes in order to accommodate any new technological advances. This will prove to be a challenge as it is oftentimes difficult for law to move as quickly as science, and for lawmakers to adequately comprehend how to legislate on scientific and medical manners in a way that both protects patients and encourages research and progress. Whilst claiming that establishing regulations and guidelines to ensure that artificial wombs are only used in an ethical manner may appear to be the easy way out in terms of explaining the surmountability of various ethical problems, in practice, the drafting of such regulations and guidelines will be quite difficult. As discussed in Chapter V, the issues involved with the development of artificial wombs – such as the moral status of the embryo – are, in many jurisdictions, highly contentious. This could make the lawmakers' job extremely challenging, as it will not be easy to get all parties involved to agree on the best way to approach this new technology.

In any event, it is important to begin considering both the potential benefits that could result from artificial wombs, along with the possible ethical problems. We must closely monitor the technological feasibility of the development of artificial wombs, along with any emerging ethical problems that could result from the technology. The fertility industry – from IVF to PGD to hormone treatments – is ever-expanding and shows no sign of weakening. As women are waiting until later in their careers to have children, the appeal of technology that enables them to accomplish this is becoming increasingly common and in-demand. The possibility of outsourcing an entire pregnancy, whilst sounding unnatural and possibly even morally wrong to some, could possibly have wide appeal to those who are unable or even unwilling to become pregnant, gestate and bear a child.

Furthermore, the fact that some see artificial wombs as a solution to abortion – in that, a pregnancy could end without terminating the life of the foetus – also makes the development of artificial wombs appealing to many. Although I do not agree that artificial wombs are a "solution" to abortion, the fact that artificial womb technology has visible benefits for people across a wide spectrum of moral beliefs is likely to propel (or at least not hinder) its development. Technology that once seemed impossible – such as creating a human being in a Petri dish – is now a widely accepted and used medical procedure. Since the same development might occur in relation to artificial wombs, future research must focus on developing guidelines for responsible research and clinical application. Simultaneously, research should focus on further analysis of ethical problems (particularly novel problems that have not yet been identified). Finally, the ethical analysis should always be informed by the latest scientific and technological developments. At this stage, with increasingly sophisticated means of creating other human beings and society's unwavering interest in artificial reproduction, I do not believe it is a question of whether artificial wombs will be developed, but when.

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