Freezing fertility: Oocyte cryopreservation and the gender politics of ageing

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Publication date
2015

Document Version
Final published version

Citation for published version (APA):

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Chapter 5

Embryonic Entanglements
Cellular Ageing in Time-lapse Embryo Imaging

Figure 2 Still from video “Baby Eva, Born 11 June 2013”

On 11 June 2013, a baby named Eva was born in Glasgow. Nine months prior, her embryo was selected for implantation in her mother’s womb with the aid of time-lapse embryo imaging technologies. Her birth made national headlines because she was the first to be born from an IVF procedure that used “Early Embryo Viability Assessment” (Eeva) for embryo selection (BBC 2013). Although her parents insist they intended to call their future daughter Eva before they ever heard about the test, the company that owns the Eeva technology, Auxogyn, boasts of the test’s significance as “the most important breakthrough in IVF in recent decades” in a press release titled “Baby Eva Named after Pioneering IVF Test” (BBC 2013; Kbhandal 2013b). The visual nature of this technology is emphasised by the press release’s inclusion of a video of Eva’s conception straight after the header (Kbhandal 2013a). The video shows a black and white image of the fertilised egg, which divides three times before the green-lettered
word “HIGH” appears above it, presumably referring to the embryo’s quality. The video is framed by the logos of the Glasgow fertility clinic and Eeva below and the caption “Baby Eva, born 11 June 2013” above.92

Two months prior, time-lapse embryo imaging had already been featured on BBC News as the new breakthrough technology in IVF (Walsh 2013). This news item reported on a different embryo imaging technology, the Embryoscope, which followed 46 embryos through to birth.93 Here the interviewed Dr Simon Fishel, managing director of the CARE Fertility Group, similarly claims time-lapse embryo imaging is an important breakthrough: “In the 35 years I have been in this field this is probably the most exciting and significant development that can be of value to all patients seeking IVF.” Notwithstanding the more or less ground-breaking technoscientific nature of these technologies, I will argue that they are innovative in bringing into circulation a new set of images of fertilised eggs and early embryonic life.

I include time-lapse embryo imaging in this wider project on egg freezing and ageing because it produces new visual mediations of extracorporeal fertilised eggs and foregrounds temporal parameters as key indicators in practices of assisted reproduction (Cruz et al. 2011; Walsh 2013). Forming a visual continuum with the egg portraits discussed in the previous chapter, the first frames of these time-lapse videos depict the eggs after fertilisation and their subsequent transformation into embryos as the cells divide. The timing of the embryonic developmental process—the early stages of embryonic ageing—forms the basis for selecting which embryo(s) will be implanted in the woman’s womb.94 Time-lapse embryo imaging thus introduces the temporal dimension into the assessment of embryos. In doing so, it brings embryonic ageing both visually and technically to the forefront in embryo selection.

In the OC procedure, embryo selection follows the thawing and fertilisation of the eggs. Due to the damage caused in cryopreservation to the egg’s zona pellucida, the membrane surrounding the egg, fertilisation of frozen and thawed eggs can only be achieved with intracytoplasmic sperm injection (ICSI), which is the procedure famously depicted in the scene of fertilisation by micro-injection (Franklin 2013b). If more than one embryo results from this procedure, the embryologist will have to choose which

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92 A modified version of this chapter is forthcoming in Assisted Reproduction in Movement: Normalizations, Disruptions and Transmissions, edited by Merete Lie and Nina Lykke, to be published with Routledge for the book series Routledge Advances in Feminist Studies and Intersectionality.
93 In a 2013 press release, Fertilitech, the company that produced the EmbryoScope, details that the system was cleared for clinical use in Europe in 2009. According to Fertilitech, it has been used by 275 clinics worldwide for 60,000 treatment cycles and they estimate that “more than 10,000 babies have been born using the EmbryoScope™ system” (Bahr 2013). Fertilitech was acquired by Vitrolife in 2014.
94 Embryonic age is an embryological term that signifies the age of the embryo since fertilisation. It is to be distinguished from gestational age, which signifies the duration of a woman’s pregnancy and is calculated from the first day of her last period. In this chapter, I read the time-lapse videos as visualisations of embryonic ageing.
embryo to implant and time-lapse embryo imaging can offer a tool for making this choice. Because the freezing of eggs increases the risk of aneuploidy (a condition in which a cell does not have the correct number of chromosomes), the claim that time-lapse embryo imaging detects this condition renders this technology particularly relevant to egg freezing practices (Gosden and Veeck Gosden 2012, 498).

In 2013, several UK fertility clinics started marketing this method of embryo selection to patients as an alternative to conventional selection. Conventional selection is based on a daily visual examination of the embryo’s static morphological appearance. In order to be examined, the embryos have to be removed from their incubator into a sub-optimal environment under the microscope. The time-lapse imaging technologies, by contrast, allow for continuous observation by taking photographs every 5 to 20 minutes while the embryos remain undisturbed in the incubator. The resulting videos not only give increased insight into the appearance of the embryos, but visualise a temporal dimension that remained invisible in the conventional method: the timing of cell divisions and the movements of embryonic growth. By matching the videos with growth patterns of embryos that developed into healthy fetuses, the time-lapse apparatus suggests which embryos are most likely to implant and grow in the woman’s womb. As such, time-lapse embryo imaging is a non-invasive alternative to pre-implantation genetic diagnosis (PGD) (Campbell et al. 2013; Swain 2013), a procedure in which embryo selection is based on the subtraction of a single cell which is subsequently genetically screened for particular traits and pathologies. The time-lapse embryo imaging apparatus gives embryologists more information about the developing embryos to avoid implanting those that are less likely to be viable while maintaining stable culturing conditions in the incubator. According to some biomedical studies, this approach results in increased implantation, pregnancy and live birth rates (Meseguer et al. 2012; Conaghan et al. 2013; A. A. Chen et al. 2013), while others—including a Cochrane review—hold that the evidence of increased pregnancy or live birth rates is as yet too limited to justify the widespread clinical adoption of time-lapse embryo imaging (Polanski et al. 2014; Armstrong, Vail, et al. 2015, 7; Armstrong, Arroll, et al. 2015).

With the clinical introduction of time-lapse imaging, embryo selection becomes a more visible step in the IVF process—one that is the basis for competition among fertility clinics and medical technology companies, and requires new decisions and

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95 The CARE Fertility group, the UK’s largest independent infertility treatment provider, for example, features time-lapse imaging on its homepage, presenting it more prominently than any other treatment they offer (CARE Fertility 2013a).

96 The claim that time-lapse imaging analysis predicts aneuploidy in embryos is significant because this is the largest single cause of miscarriage in IVF cycles (Campbell et al. 2013). This technology is also particularly relevant in the context of promoting single embryo transfer to avoid multiple pregnancies in IVF cycles (Swain 2013, 1082).
financial investments from patients. These technologies produce a new set of images of fertilised eggs and their division into embryos that circulate beyond the laboratory in the clinic, the patient’s private sphere and public discourses. Currently, three different time-lapse imaging systems produced by two biotechnology companies are used in fertility clinics: Vitrolife’s Embryoscope and Primo Vision and Auxogyn’s Eeva.  

As names like Embryoscope and Primo Vision suggest, the observation and visualisation of embryos play a key role both in the diagnostics and the marketing of time-lapse technology. Serving a double function, these videos both visualise an increased attention for the timing of cellular development in clinical embryo assessment and introduce a new visual means for patient communication and marketing of the treatment. As with other, existing medical imaging of prenatal life, it is hard to disentangle the medical and cultural meaning of visual mediations of clinical embryonic development (Van Dijck 2001, 103–4). Although scholarly attention has been paid to the use of time-lapse microcinematography in a scientific research context—most notably by Landecker (2005; 2006; 2007; 2012)—the use of the technology in fertility clinics and the resulting imagery have not yet received critical reflection.

In this chapter, in keeping with this study’s focus on ageing, I draw attention to the visualisation and instrumentalisation of embryonic ageing in time-lapse embryo imaging. I first explore how, and with what effects, embryos are visualised in time-lapse videos. Emerging in the wake of an increasingly visual interface with prenatal life, such as the iconic imagery of micro-injection and fetal ultrasound, both of which have had a profound impact on the public and private imagination of the reproductive process, time-lapse embryo videos add yet another visual dimension to the encounter with early human life on screen (Duden 1993; Van Dijck 2001; Franklin 2013a). What conceptualisations of embryos emerge from these videos and how do they engage human origin stories and the teleology of the reproductive process? What associations and disassociations between embryonic development and the future child may be attached to this new set of images of early human life? What makes these videos different from the familiar time-lapse videos of cellular growth that have existed for over a century? In dialogue with scholarship on reproductive technologies in feminist technoscience

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97 Although they all produce embryo videos with the aim of improving embryo selection, there are several technical differences between the three time-lapse imaging systems. The Embryoscope integrates the incubator and the time-lapse imaging system, while Eeva and Primo Vision are time-lapse systems that may be placed within an existing incubator. Eeva uses dark-field microscopy, which allows for accurate monitoring of the cell divisions, but offers less clear images of the cell’s interior than bright-field microscopy, which Embryoscope and Primo Vision use. Eeva images have a single focal plane, while Embryoscope and Primo Vision have 7 and 11, respectively. All systems have their proprietary culturing dishes; in Primo Vision and Eeva, the embryos share medium in a group culture and in the Embryoscope they grow individually in single culture. The Embryoscope culture dish constantly moves to bring each embryo into view and record images with higher resolution than the other two systems, in which the dishes are not moved (Kovacs 2014, 124).
studies, I engage these concerns with a visual analysis of the framing of the time-lapse embryo videos—particularly Auxogyn’s Eeva videos—that are publicly disseminated by fertility clinics, biotechnology companies and media outlets. In this reading of time-lapse embryo imagery, I will distinguish three approaches to visualising embryos as individuals, collectives and populations, all of which are represented in the embryo videos.

Subsequently, I ask how the instrumentalisation of embryonic ageing in time-lapse embryo imaging generates new risks and value in the process of embryo selection. Here I focus the analysis on the time-lapse embryo imaging apparatus as the condition of emergence for the embryo videos. Following Donna Haraway’s theorisation of the co-adaptive relationality between human and non-human entities as “world-making entanglements,” I address how embryos, human bodies and technologies co-adapt in time-lapse embryo imaging (2008, 4). I will also consider the different ways in which time-lapse embryo imaging may be employed to produce what Catherine Waldby calls “biovalue” and address the concomitant redistribution of responsibility and agency over the way embryos live in time between intended parents, clinicians and biotechnological industries (2002). In doing so, I explore how this method of embryo selection not only may result in more or less “IVF success,” but also affects the conceptualisation, representation and commercialisation of ageing at an embryonic level.

![Figure 3 Still from “Baby Eva, Born 11 June 2013”](image)
Embryo Videos: Future Children and Collectives of Potential

The first frames of Auxogyn’s Eeva video, with which I opened this chapter, show a black and white image of a single cell (Kbhandal 2013a). The image quality is too blurry to see the pro-nuclei that indicate that the egg has been fertilised. The egg has a light-coloured outline and is immersed in a grey dark background that is framed by a pronounced light border at the rectangular edges of the image. The ragged light border at the edges of the image is a reminder of the apparatus through which the cell’s image is produced, while the video’s frame is branded by company and clinic logos that reference the institutional context of its production. The fertilised egg neither floats in indefinite darkness like the fetuses in Lennart Nilsson’s influential photographs nor is the video only a private souvenir of a medical diagnostic image.98 With the video’s frame, and its inclusion in a press release, baby Eva and the recording of her first cell divisions are publicly presented as the result of the ingenuity of the Eeva system and the expertise of the Glasgow Centre for Reproductive Medicine (GCRM). The “HIGH” inscription that follows the fertilised egg’s cell divisions at once signals the embryo’s development, associates the institutions with success and suggests a link between a HIGH prediction and a healthy baby. The logos surrounding the image point to the novelty of the clinical use of the time-lapse microcinematography technique, which may not only improve pregnancy rates, but increases the visibility of the developing embryos in IVF procedures. In this section, I will address how the time-lapse videos represent the embryos both as individuals by association with the future child and as a collective to be scrutinised for selection.

By framing the embryo as an individual, the time-lapse video fits into the trend I identified in the previous chapter of visualising prenatal life at increasingly early stages of reproduction in a visual continuum from gamete to baby. The link to the child is established in this video’s departure from representing “everyembryo” to showing an individualised “Baby Eva” (Morgan 2009, 15). Quite literally, with its title “Baby Eva,” the visualisation of embryonic cell division is referred to as a baby and as the specific gendered individual Eva. The BBC report on the birth enlivens the embryonic imagery with family photographs and the parents’ narrative, ascribing symbolic meaning to the embryo as prenatal individual life (BBC 2013). Although moving images of dividing cells—and embryonic development in particular—are commonplace, time-lapse embryo imaging newly individualises this scene through its clinical application (Lavery 2006, 2, qtd in. Misek and Cameron 2014, 2). In keeping with this focus on the embryo-as-

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98 Nilsson’s 1965 photo essay “The Drama of Life Before Birth” in LIFE Magazine was a groundbreaking photographic depiction of prenatal life that has become part of “the mental universe of our time” (Duden 1993, 14). These images have been criticised for removing the context of the maternal body and their technological production, thereby suggesting fetal autonomy and individuality (Duden 1993; Lie 2012, 478).
individual, the Eeva website presents its technology to intended parents by pointing out that “your embryo’s journey is captured in video form during the critical first days of development.” This positions the videos as recordings of a singular embryo, whose journey starts in the observable embryonic cell divisions. The use of “your” emphasises a parental responsibility and proprietary relationship to this “early human life,” one that can be met by employing the technology at the “critical time” of the embryo’s early existence (Auxogyn 2012).

Described as “the ultimate home movie,” the embryonic time-lapse videos read like the earliest recording of the child’s existence (Wegner 2012). It therefore has a particular significance akin to that of fetal ultrasound imagery—a visual kinship that is affirmed in the video’s mirroring of the ultrasound’s traditional grey and blurry aesthetics. Like the ultrasound, and arguably to a greater extent because it shows human life at an even earlier stage of development, the video plays into a familiar “origin story,” which functions as part of a narrative that locates the origin of an individual life at an observable moment (2009, 16). Following Eggfreezer’s framing of the photographed egg in the previous chapter, here the videos present the development from the fertilised egg into an embryo. Whereas Eggfreezer’s egg was the “building block” of the potential future child, this “Baby Eva” embryo is individualised as the coming into existence of an identifiable person.

Wegner’s recognition of these videos as “home videos,” a genre characterised by its “confirmation of the intimate family life,” signals the kinship work implicit in individualising the embryo as a potential family member (2012). As Van Dijck has argued, in the recording of home videos, and the production of cultural memory more broadly, there is a “constant productive tension between our inclination to mark significant events and the cultural frameworks through which we recall them” (2004, 263). In these videos, the convention of filming culturally significant events in the lives of children to produce “future memories” meets the contemporary origin story that positions the in vitro existence of the embryo as the beginning of individual life (Van Dijck 2004, 263; Van Dijck 2008b). The presentation of this embryo video as “baby Eva” firmly attaches the identity of the future child to these images and, by extension, suggests the embryo’s first cell divisions make up a significant, observable life event: a future memory for both the potential child and her parents (CARE Fertility 2013b).

Within the clinical context, the visual encounter with the embryo was hitherto of a static nature. In the aforementioned study by Sheryl de Lacey, the IVF patients—all but one of whom became parents—described the experience of seeing static embryo images taken through a microscope as affirmation of them being “real”: 
“We’ve got a photo taken the day they [points to her twins] got implanted. So you look at it and you think ‘yeah, well there’s Kylie and Jason sitting there.’” Martha points out the impact of the visual: “They’re real [the embryos], they’re very real and not many people see their children at eight and ten cells.” (2005, 1666)

The embryo videos may similarly entail a significant visual encounter for patients, in which the embryos are not only recognised as “real,” but are especially striking because they present cell divisions as the active progression from the fertilised egg to the future child. In the context of OC, the observable development from cell to embryo visually can be employed to affirm an understanding of the egg as “building block” for the potential baby.99

In their depiction of embryonic growth, these videos resemble the early scientific films on cell development produced over a century ago, such as Julius Ries’ 1907 recording of a sea urchin’s fertilisation and development. As Ries’ films allowed “people other than scientists to participate visually in the sights of scientific work and the mode of experimental looking,” so the novelty of time-lapse imaging technology follows from its clinical introduction, as the embryo videos allow intended parents to partake in the embryologists’ gaze and encounter their embryos at this early stage of development (Landecker 2006, 123). Moreover, much as Baby Eva’s embryonic development over the course of days was compressed into a 1-minute video, so Ries showed students and broader audiences the sea urchin’s cellular growth over 14 hours in a convenient 2-minute film (Landecker 2006, 124). If the recording and playback speed would have been the same in the observation of human embryos, the cells would appear motionless, save for an occasional cell division. Sped up to an easily-observable speed in time-lapse imaging, the embryonic cells’ constant motion and sudden divisions represent the coming into existence of new life by dramatising a much slower, less spectacular process. In the early scientific films, the effect of watching these cells in accelerated motion was that they convinced audiences that “what they were seeing was really life” and had the effect of “making the subject more real […] than still images” (Landecker 2006, 129). In the time-lapse videos, too, the acceleration of time has the effect of making the embryos appear more alive, as they move and divide in their microwells.100

The increased speed imbues the cellular motions with a liveliness that is significant in the context of the pursuit of reproduction in fertility clinics. The effect of the recognition of “realness” in the visual encounter that Lacey’s intended parents expressed upon seeing

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99 See Chapter 4 for a further discussion of Lacey’s study.
100 Microwells are small depressions in the culture dish in each of which a single embryo is placed.
the static images of the embryos may thus be intensified with moving images of their embryos (2005).

When the single embryo frame is zoomed out, a second set of images emerges with this technology that shows a grid of several embryos developing at the same time. At the 2013 annual meeting of the American Society for Reproductive Medicine (ASRM), Auxogyn presented the merits of time-lapse imaging by showing this video footage of a grid of developing embryos recorded with the Eeva technology (2014). The video shows a collective of embryos growing side by side, each dividing their cells at different moments and wriggling independently within their squares. The grid visually juxtaposes the differences between the embryos and thereby invites a comparison: some move quickly, others remain still; some divide their cells steadily, while others lag behind. A valuation is attached to the active, inactive or seemingly erratic behaviour of the embryos in the last seconds of the video, when a red “LOW” or a green “HIGH” appears underneath each of them.

This visualisation of embryo selection naturalises an approach to the reproductive process that involves the agentic choice for the “best” embryo to be implanted in the womb. While a seemingly common-sense approach, it presents the group of embryos in a vastly different way from the individual embryo frame that was

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101 Images of pairs or grids of embryos are also featured in patient-oriented videos by Auxogyn and fertility clinics.
celebrated as Baby Eva. Baby Eva’s video situates the start of an individual’s origin story in the first moments of conception. By contrast, the grid video depicts the potentiality of life that a set of embryos hold collectively—a potentiality that is not only dependent on the quality of the organic material, as is emphasised in discourses about age-related egg quality in OC, but can be actualised through an investment in the right technology for selection.

Time-lapse imagery thus visualises an alternative organisation of the reproductive process, which includes a moment of embryo selection analogous to the sperm selection that takes place prior to conception in the female body. Popular and scientific understandings of sperm selection typically present the female reproductive tract as the in vivo selection mechanism to prevent substandard sperm cells from interacting with the single egg released in ovulation (E. Martin 2001b; Moore 2003). In these time-lapse images, the spatio-temporal organisation of gametes and embryos differs from in vivo conception, with its single egg and multitude of sperm cells that may interact to become an embryo. Rather than a single egg and a selected sperm resulting in a unique embryo, the time-lapse video present in vitro embryos in groups that require selection to produce a healthy live birth. The time-lapse video shows eggs and embryos as visibly fallible and therefore, much like sperm, requiring selection mechanisms. By presenting the embryos as fallible, time-lapse embryo imaging visualises embryo selection as a necessary and newly observable intervention in the reproductive process. “Natural” reproductive selection thus becomes a multifaceted technocultural selection that requires a highly specialised technological apparatus.

Auxogyn’s framing of a single embryo representing Baby Eva and the grid image of embryos in the time-lapse apparatus are thus indicative of two different origin stories. The former image, with its individualised embryo, appears to correspond to an origin story that has been upheld in pro-life debates that “life begins at conception” and indeed the image could be employed to visualise that standpoint (Franklin 2001, 348). However, the presentation of the single developing embryo in the Auxogyn press release does not ascribe personhood to every embryo, but specifically frames this image with the text “Baby Eva, Born 11 June 2013.” This particular embryo is therefore ascribed personhood because it was born; only after 11 June 2013 it retrospectively gains individuality as an embryo.

By contrast, Eeva’s grid image of the embryos, with its weak and strong elements, does not individualise the embryos but visualises the need for their selection in

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102 In the case of fraternal twins, triplets or higher-order multiple births, multiple eggs result in multiple births.
103 See Chapter 4 for Nightlight Christian Adoption’s Snowflake embryo adoption programme, in which embryos are referred to as “preborn children.”
anticipation of a potential pregnancy and birth. Auxogyn’s Eeva website presents its embryo selection method as the “difference you need for IVF success” and the test to “help reduce the risk of IVF failure” (Auxogyn 2012). This language of risk and success also characterises the CARE Fertility clinic’s presentation of its Embryoscope and CAREmaps—with “maps” being an acronym for morphokinetic algorithms to predict success—as “a whole system designed to maximise the chances of success” (CARE Fertility 2013b). This discourse of risk and success is matched in the grid image, which shows the embryo’s observably arrested, erratic or active development and overlays them with “high” and “low” inscriptions. With this visualisation of the fallible nature of the embryos, the time-lapse grid image may be employed to reframe reproduction as technological achievement and the embryos as material that requires selection. The textual and visual discursive construction of risk and success in the embryo grid, moreover, has a futural orientation as it references the embryos’ potential for continued growth after the video ends. While textual framing of “Baby Eva” individualises the embryo retrospectively, the “high” and “low” inscriptions are indicative of an anticipatory orientation towards the embryos in the grid image, in which they figure as a collective with weak and strong elements that holds the potential for a future live birth.

Time-lapse embryo imaging thus produces several representations of the embryo, including an individual embryo onto which ideas of personhood and individuality are bestowed and a collective of embryos that require selection prior to their further development. What distinguishes these two framings of the embryo is less a matter of content—one is simply a zoomed-in version of one of the embryos in the grid—and more a matter of temporality. While the image of the embryo grid signifies an anticipatory potential throughout the process of selection and awaiting pregnancy, the single embryo retrospectively becomes meaningful as an individual once a birth, or even an ultrasound, has taken place that establishes individual personhood.

Embryo Populations

Alongside the fallible group of embryos that require selection and the retrospectively individualised embryo, time-lapse embryo imaging visualises a third type of embryo: a population of embryos that is abstracted and superimposed over, or juxtaposed with, the image. The Eeva video with the grid of embryos shows brightly coloured rings overlaying the outline of the cells. Each coloured outline identifies whether this cell was formed in the first, second or third cell cleavage; it is therefore a temporal marker of embryonic development. The Eeva video concludes with a HIGH or LOW verdict by combining this visual analysis of the cells with data of earlier observations of the timing of embryonic development. In the Embryoscope, the embryonic population that provided the basis for
the embryo selection is visualised by graphs that juxtapose the group of growing embryos and provide the context for their interpretation. Depending on the observed growth patterns, the different frames in the embryo grid colour a transparent red, blue or green to indicate predicted quality. In the Primo Vision video, the timing of the observed embryos’ cell divisions is translated into a graph that shows the range of acceptable values based on earlier populations of viable embryos. The graph of the embryo under scrutiny indicates whether the timing of this particular embryo meets the normal range of developmental speed recorded in previous embryonic populations.

What these videos show, therefore, is a wider population of embryos translated into a body of visual and temporal information. As a result, the embryo videos depict not only a synchronous comparison between the incubated embryos, but also a diachronic one in relation to preceding populations. The time-lapse imaging systems watch through the lens of earlier observations caught in a database. In the incubator’s eye, the statistically rendered embryonic population becomes visible, colouring the image of the developing embryo. This visualised data is a palimpsest of earlier observations: the translation of embryonic tissue growth into images, images into averages, averages into visible colours, shapes and graphs that frame the embryo multiplying itself into existence.

In this way, the embryo videos visualise the double meaning of biology as the “thing itself” and the knowledge thereof. In these images, the representation of a group of embryos that preceded those currently in the incubator and the visualisation of the data derived from them are difficult to disentangle. In this sense, they make explicit how “biological knowledge, biotechniques and biology ‘itself’ reshape each other, and co-evolve” (Franklin 2006b, 168). In time-lapse embryo imaging, the observation, translation and projection of past embryonic populations shape the value and destination of the embryos under current scrutiny, while also potentially affecting future selections. In doing so, time-lapse embryo imaging complements ICSI’s scene of fertilisation as, Franklin argues, an explicit visualisation of Rabinow’s (2008) argument that life “will become technique” in a manner that reverses the order of Darwinian evolutionary time and telos, by making culture the origin of biology” (2013b, 40). The embryo videos visualise a model of technocultural selection that is not only based on the continued “survival of the fittest,” but on the calculated anticipation of future survival through the embryos’ approximation of the population-based temporal norms of development.

By matching the embryos’ cellular growth patterns to previous embryonic populations’ recorded developmental rhythms, time-lapse technology visually and conceptually brings the role of developmental time—embryonic ageing—to the forefront in embryo selection. In contrast with the daily observation of embryos in conventional selection and the inference of embryonic growth on the basis of their appearance in a
limited number of static images, the time-lapse method includes a consideration of the
time elapsed between cellular divisions. The basis for embryo selection thereby shifts
from static morphological analysis based on cellular aesthetics to the dynamic process of
cell division. Not only the appearance and progression of embryonic development, but
its particular speed determines which tissue can grow towards the fetal stage, which
returns to the freezer, is discarded or remains in the lab for further research.

Earlier I made a comparison between the cinematic scene of ICSI micro-injection
and time-lapse videos as images of technologised reproduction, yet the locus of what
becomes recognisable as technology is significantly different in time-lapse imaging.
Whereas the ICSI image features the injection needle as visible technological actor, in
the images of the time-lapse embryos the technology is located in the embryonic growth
itself. In *Liminal Lives*, Susan Squier claims the two forms of *in vitro* cellular growth of
most interest in tissue culture research are organised growth and unorganised growth,
which have been accessed with “iconic overdetermination” through the observation of,
respectively, embryos and cancer cells (2004, 61). The temporal specificity of organised
growth finds its clinical application—and is thereby rendered into a technology—in
time-lapse embryo imaging. The time-lapse embryo imaging approach synchronises
the embryo with a database from which temporal standards of the ideal-type embryonic
development are deduced, as indicator of anticipated growth and viability. Unlike ICSI
or PGD, time-lapse imaging does not require or visualise invasive instruments that alter
the cell’s morphology. On the contrary, the apparatus functions to cause as little
disturbance to the cellular tissue as possible. Giving new meaning to Franklin’s
“instrumental reframing of reproduction as technology,” the time-lapse apparatus
renders embryonic ageing, the temporal regularity of embryonic development and its
predictive value in anticipating future growth, into a technology (2013b, 40).

As the time-lapse embryo imaging apparatus incubates, observes and assesses the
embryo in complex ways, the embryonic tissue is variably visualised as a premature
individual, a collective that requires selection and as population data that becomes
integrated in the time-lapse technology. These approaches to framing and visualising the
embryo follow from different temporal vantage points, in which the cellular tissue
becomes meaningful retrospectively, anticipatorily or, combining the two, as historical
data for future selections. As the embryo videos become legible through the comparison
with earlier populations, the visualisation of the embryos’ development is rendered into a
tool for selection and embryonic ageing becomes itself part of the time-lapse technology.
To better understand the entangled relation between embryos and the time-lapse
technology, I will now discuss the other human bodies that are implicated in this method
of embryo selection.
Entangling Embryos in the Time-lapse

In the above-mentioned BBC News item on the Embryoscope, Dr Fishel is quoted as describing the time-lapse embryo imaging apparatus as “almost like having the embryo in the womb with a camera on them [sic]” (Walsh 2013). His remark signals that there are more bodies at stake in this procedure than the embryos depicted in the videos. The understanding that assisted reproduction “both includes and complexly exceeds the [woman’s] body” rings particularly true in the case of time-lapse imaging technology, which gives rise to specific interdependencies between non-human actors as well as women’s, embryologists’ and embryonic bodies (Murphy 2011, 25–6). Giving insight into similar interdependencies, Donna Haraway tells the story of National Geographic’s Crittercam project, which shares Fishel’s fantasy of positioning the camera and filming in hitherto invisible places.104 In When Species Meet, she details the composition of marine animals, scientists, cameras, associated equipment, the National Geographic Society and its television show and website that collectively made up the Crittercam project. Cameras were latched onto animals with the intention of creating images that reflect a novel point of view. Haraway reads the technology of the camera not as a passive instrument, but as a “full partner” in the sense that Don Ihde described as “insofar as I use or employ a technology, I am used by and employed by that technology as well […] We are bodies in technologies” (qtd. in 2008, 249). Crittercam matches time-lapse embryo imaging as a “techno-organic” interdependent effort between bodies and technologies to create new images. The time-lapse imaging technology and the bodies involved evidence a “mutual but unidentical coadaptation” in which “technologies adapt to the humans and vice versa. Human bodies and technologies cohabit each other in relation to particular projects or lifeworlds” (Haraway 2008, 262). Haraway’s approach emphasises the co-adaptive relationality between machines, bodies and embryos, in what she calls “world-making entanglements” (2008, 4). This section addresses how bodies, embryos and visualisation and incubation technologies co-adapt and entangle in time-lapse imaging practices.

The shared name of the Eeva system and baby Eva signals the entanglement of technologies and cells at the origin of prenatal life. This linguistic intimacy also references the quintessential origin story of the European and North-American cultural context in which the time-lapse videos are produced and circulated: Genesis 1-3.105 The

104 The womb’s inner space is routinely visualised through ultrasound, hysteroscopic or laparoscopic techniques. However, the continued observation of embryonic divisions that time-lapse imaging offers is not possible within the womb.

105 The embryo videos I discuss in this chapter are made with systems produced by US (Auxogyn) and Swedish (Vitrolife) companies, discussed in UK media (BBC), where the technology has also been relatively quickly implemented by major fertility clinics. The influence of the biblical story, of course, reaches far beyond these contexts.
Christian creation myth, derived from its Jewish and pre-monotheistic counterparts, is characterised by “the principle of differentiation” and presents an “account of the making of humanity in a progressive development of character” in which the first creature divided and resulted in two humans that were named Eve and Adam (Bal 1985, 23). The Eeva technology presents a secular creation story organised around a parallel move of locating human origin in progressive differentiation as embryo videos visualise the logic of cellular division into a nameable individual. The biblical constitutive power of naming that is central to the story of Genesis finds its counterpart in the naming of the embryo as baby Eva, which here not only individualises but also foretells the viability referenced in the Eeva acronym. The name of the time-lapse system further suggests a correspondence to the biblical name Eve, meaning “mother of all the living.” This association points to the renegotiation of the locus of life’s origin in the secular story told through the videos, as they present the first visible encounter with prenatal life while it is located inside the machine and outside of the maternal body. This uncertainty in establishing the locus of baby Eva’s origin also emerges in the naming conflict between the parents who insisted on naming their child Eva irrespective of the technology’s name and Auxogyn’s press release which announced that “Baby Eva [was] Named after Pioneering IVF Test.” The tension over who names and frames the embryo is indicative of how the embryo videos become the site of negotiating the complex and increasingly visible entanglements of gamete, embryo, machine and body that emerge with time-lapse selection.

Fishel’s abovementioned statement also draws attention to this entangled technorganic relation between the apparatus and the intended mother’s body in time-lapse embryo imaging, namely the externalisation of the first visual encounter with prenatal life from the maternal body. Rather than bringing the camera into the womb to film prenatal life, certain conditions of the womb—or rather the fallopian tubes—are mirrored in the culturing conditions of the time-lapse apparatus. In order to encourage undisturbed embryonic development, the technologies of the time-lapse apparatus adapt to the embryo’s needs. In doing so, particular aspects of the organic and inorganic—the fallopian and incubator—containers of the embryo come to resemble one another: the darkness, the temperature, the characteristics of the liquid medium that sustains its viability. Fishel’s statement suggests that the time-lapse embryo imaging apparatus functions as an alternative, technocultural “womb” in which embryos can not only

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106 Eeva stands for Early Embryo Viability Assessment.
107 One technical innovation of the time-lapse imaging apparatus is that it introduces a camera in a conventional incubator without damaging the embryonic development with the increased light exposure required for taking pictures (Kirkegaard et al. 2012). Given the embryos’ sensitivity to light, the Embryoscope, for example, uses a custom-designed single red LED (635 nm) that illuminates the embryos for 0.032 seconds per image (Fertilitech 2014, 4).
develop, but be observed through the integration of the camera. This idea of the machine emulating the body through enhanced visibility is a further extension of Van Dijck’s thesis in *The Transparent Body*, in which she argues that medical imaging technologies “are the material embodiment of collective desires and fantasies,” including the pervasive ideal of bodily transparency in Western medicine (2005b, 15–7). Not only does the visualisation of live embryo development affirm the association between increased visibility and medical progress that Van Dijck describes, the time-lapse embryo videos also have the potential to function like ultrasound images, which have become widely understood and circulated as visualisations of the first encounter with prenatal life (Van Dijck 2001, 108–9).

While the ultrasound image presents the fetus as an interior other, with whom a relation can be established through the visual register, time-lapse embryo imaging externalises the locus of new human life in the incubator. In this way, the embryo videos subscribe to a broader visual convention in scientific and medical imagery of externalising cellular entities from the body and depicting them as autonomous entities (Lie 2012, 478). In doing so, the embryo videos present a configuration of reproduction that was widely criticised in fetal ultrasound imagery, namely the presentation of a prenatal life as existing independently of its embodied uterine surroundings, thereby erasing the maternal body from view (Petchesky 1987; Stabile 1992). These embryo videos could similarly contribute to an understanding of reproduction that positions the locus of the start and selection of future human life in technoculture rather than in the maternal body.

The implications of presenting time-lapse embryo imaging as a “camera in the womb” also follow the logic of the “model system” Sarah Franklin has described in relation to IVF, which is “at once an imitation and a substitute for the *in vivo* process it models *in vitro*” and thereby “replicat[es] it in glass in a manner that both reveals how it works and changes this process into something else” (2013a, 306). The embryonic grid images are also presented as the means to reveal the inner workings of the womb. This naturalises the process of embryo selection by suggesting the *in vivo* existence of the depicted simultaneous development of multiple embryos—which would not in fact occur in the body. Even if knowledge of the absence of such *in vivo* embryo selection would be presumed in the audience, the video of the single developing embryo as future child could be framed as comparable to an intra-uterine scene. This comparison implies that the time-lapse apparatus’ conditions are as favourable to embryos as women’s bodies and

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108 The incubator that contains the embryos is integrated in the Embryoscope system. The Eeva system is attached to clinics’ existing incubators.

109 Testifying to her foresight, the embryo videos literalise Duden’s assertion that “the fetuses we live with today were first conceived not in the womb, but in visualizing technologies” (1999, 15).
in fact constitute an improvement on the inconveniently opaque body as it allows embryologists and intended parents to observe the embryos. While the time-lapse apparatus facilitates a mode of reproduction in which the embryos are distant from the intended mother’s body, the concomitant increased visibility of the embryos may function to mediate this distance by positioning the visual—rather than embodiment—as the key mode of accessing the desired future child.

In addition, time-lapse embryo imaging affects the techno-organic relation between embryologists and technologies:

in the same way we are looking at biology when we see an embryo through the microscope, we are also using our own biological bodies to do this—to observe, to interpret, to move the focal plane up and down, coordinating our eyes with our hands, our hands with our brains, our brains with other’s people’s brains to work out what we are seeing. (Franklin 2006b, 168)

The increased and continued visibility of the embryos in the incubator through time-lapse imaging changes the embryologist’s embodied labour of observing, culturing and selecting the embryos. Rather than handling the embryos and controlling conditions during observation outside of the incubator, monitoring developing embryos becomes a matter of watching their digitised image on the screen and analysing statistical and visual data. In doing so, the embryologist’s eyes coordinate with those of the incubator, her hands touching the computer rather than the petri dish and her brain working with the technology’s software in order to see and analyse the embryos. As a result, not only the maternal body’s, but also the embryologist’s body’s relation to the embryo—at least during the incubation stage—is no longer tactile, but rather visually mediated through the digital image on screen.110

In creating these images, the time-lapse apparatus co-adapts to the limitations of the embryologist’s body. Microscopes magnify the cells into observable size and automated visual analysis of the embryos computes information on the comparison of one particular embryo to a wider population. The integration of the incubator and the camera moreover avoids the need for the embryo’s daily journey into the suboptimal environment under the microscope, which the embryologist requires to observe it. The Embryoscope machine, and time-lapse equipment like it, is at once incubator, observer and visual interpreter. This machine seeks to imitate the dark, liquid, warm environment

110 Potentially, as Charles Kingsland from the Liverpool Women’s Hospital has anticipated, embryo culturing and selection could be done through a remote office connected to the laboratory by means of an “EmbryoServer” transmitting the information about the embryos incubated within the time-lapse systems (2014, 109).
of the reproductive tract and emulate it with the lab’s precise and continuous observation. It thus integrates the work of the intended mother’s fallopian tubes and that of the embryologist’s eye-brain.

Equally, the nature of the resultant videos reflects the embryologist’s and other humans’ bodies. Both in the conventional daily embryo observations and the time-lapse systems, cellular movement is inferred from what happens “in the spaces between the sequential slices of preserved moments” (Landecker 2007, 38). With images taken anywhere from 5 to 20 minutes apart, cellular movement remains a matter of inference, but the spaces between moments of observation become much smaller in time-lapse embryo imaging than in the conventional method. In the time-lapse videos, the time between moments of observation is reduced as the playback rate of sequential slices “exceeds the rate of recording, causing very slow movements to become legible” and thereby mediating the cellular “temporalities of motion so that they can be perceived by the human eye” (Misek and Cameron 2014, 1, 4). In these technologies, the slow rhythm of photographic observation matches the slow speed of cellular division, and its speedy playback matches the image processing capacities of human embodied vision. As a result, time-lapse imaging presents embryonic development as a dynamic process that occurs more speedily than would be inferred from an observation through the microscope. Just like the embryo videos bring together the embryos’ size with the human capacity for seeing scale by magnifying the cells into observable proportions, so they match the speed of embryonic growth with the human ability to see motion by accelerating the images’ playback to suggest movement to the brain. The visuality of the time-lapse imaging system thus co-adapts to the temporal specificities of both the embryonic and adult human body.

In a relation of “mutual but unidentical coadaptation,” the human body can not only be traced in the technologies, but, vice versa, the technologies exceed their presupposed boundaries of digits and mechanics into “world-making entanglements” (Haraway 2008, 4). This particularly pertains to the embryonic tissue, which is not only observed and incubated by the time-lapse apparatus, but whose presence translates into images, which translate into data on developmental growth, which subsequently become part of a technology that is marketed, sold and patented. As technologies like the Embryoscope-CareMAPS combination and Eeva include the data sets of previous observations, as well as computational and visualisation models to match them with current observations, the integrated apparatus has a commercial potential that is in part founded on the embryonic bodies it interacts with. In the next section, I discuss how

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111 As Kelty and Landecker have argued with respect to the mathematical modelling of organic form, the time of the apparatus itself linking the temporalities of embryonic growth and human vision may be characterised as “lightning speed, in the silicon and metal registers of a machine” (2004, 56).
biovalue is created and contested in these co-adaptive entanglements of bodies, tissues, and machines.

The Biovalue of Embryonic Ageing

The distinguishing value of time-lapse embryo imaging results from the inclusion of the “fourth dimension” of time in the assessment of embryos, which introduces the construct of embryonic ageing as a selection criterion in IVF (Albertini 2012, 859). In earlier chapters, I discussed egg freezing as a form of biopreparation for future infertility. According to this logic, the possession of “good eggs” that stay at a certain age “forever” prepares women for the future age-related loss of the eggs that remain in the belly (Schellart 2010). In time-lapse imaging, cellular ageing becomes a possession in a different sense as its observation is rendered valuable through its computation and projection as a patentable, predictive parameter. In the context of time-lapse imaging, embryonic ageing has entangled corporeal, informational and methodological dimensions; it signifies at once the physical changes of the tissue, its observation and transformation into cell cycle data, and the use of that data as a method to match the age-specific development of other embryos. In the translation from cell divisions to observations to data to method, these technologies produce what Catherine Waldby calls “biovalue,” which “refers to the yield of both vitality and profitability produced by the biotechnical reformulation of living processes” (2002, 310). In these technologies, embryonic ageing is the foundation for potentially increasing both vitality by improving the selection procedure and profitability by offering a new step in IVF that comes with an additional price tag.112

Time-lapse embryo imaging generates biovalue by introducing embryo selection as a visible step in the reproductive process of IVF that requires new ways of managing risk. As it brings embryo selection into view, intended parents have new images through which to make sense of the reproductive process and are confronted with additional ethical and financial choices. Time-lapse embryo imaging presents patients with the risk of implanting the wrong embryos—a risk that becomes observable through the visualisation of the differences in their development—and a possibility for investing in reducing it. The availability of this technology thus “expand[s] the scope of risk” (Mitchell and Waldby 2010, 334). As time-lapse imaging offers a visible way of relating to the cultured embodiment of “your embryos,” it proposes an individualised and financial responsibility for managing the embryos’ potential in ways that increase the

112 The price tag for time-lapse embryo imaging in the UK typically amounts to an additional £750 on top of the existing IVF costs (Walsh 2013).
biovalue of both a more profitable embryo selection treatment and more efficient use of the analysed embryos themselves.

The time-lapse embryo videos also become valuable in the public promotion of embryo selection technologies by news media, clinics and biotechnology companies. The Eeva press release, with which I opened this chapter, employed the images to promote its particular time-lapse embryo imaging system and the fertility clinic that used it. In the CAREMaps presentation of time-lapse imaging, the videos have added value as “a special download” that intended parents may receive as part of their IVF cycle. These videos may function both as a desirable keepsake and as an affirmation of the value of including the extra step of time-lapse embryo selection as risk management. By visualising the developmental differences between embryos, the videos are employed to make the claim that embryo selection is the intervention that is key to “IVF success.” As a result, in the visual and textual discourses of time-lapse embryo imaging, not gamete quality, or culturing conditions, but the variation of embryo quality is highlighted as the reason for failed IVF cycles. Here, embryonic ageing takes precedent over the ageing of women—and their gametes—that are conventionally referenced in relation to the quality and viability of fertilised eggs.

Significantly, moreover, the visible, developing embryonic populations themselves become entangled with the time-lapse technology and the capital value it represents. If “we are all chimeras, theorised and fabricated hybrids of machine and organism,” as Haraway claims, it also holds true that technologies are hybrids that incorporate “us” (1991, 105). As embryonic ageing becomes a technology for embryo selection, the observed, ageing embryos may become subsumed as a proprietary part of the time-lapse apparatus. If time-lapse imaging technologies represent capital value, so does the observation and instrumentalisation of embryonic ageing. As Waldby states, “the process of producing biovalue is also the process of technical innovation that enables the patenting of cell lines […] as inventions, securing their status as intellectual property and possible sources of profit for their inventors” (2002, 310). Rather than generating new cellular life forms, time-lapse technology produces new forms of biovalue enabled by the patenting of the embryonic ageing process—its visual registration and its function as a tool for optical analysis—as property.

Time-lapse embryo imaging thus not only visualises and instrumentalises embryonic ageing for its predictive value, but provides the occasion for its integration in the apparatus as patentable property. Between 2011 and 2013, both US and European patent offices issued patents covering the timing of cellular development as “predictive parameters” in embryo selection to the Board of Trustees of Leland Stanford Junior University, with exclusive licensing to Auxogyn, the company producing the Eeva system. The patents describe the association of “good developmental competence” with
temporal markers of cellular development, such as a “duration of first cytokinesis […] between 0 and 30 minutes” and a “time interval […] between the resolution of cytokinesis 1 and the onset of cytokinesis 2 [of] 8-15 hours” (Baer et al. 2011; Wong et al. 2012; Wong et al. 2013). Rather than describing only the method of time-lapse analysis, the patent also covers some of the data about the time it takes for cells to divide and develop as part of Auxogyn’s intellectual property.

With the issuing of these patents, the question arises to what extent embryonic ageing itself is subject to becoming intellectual property. In academic discussions on this question, proponents claim the patents cover the “assays intended to distinguish optimal [and suboptimal] embryos for transfer in IVF” of time-lapse embryo selection, while critics maintain that the “naturally occurring” phenomenon of embryonic development itself—and its temporal specificity—“should not be owned by a company” and is now wrongfully subject to patenting (McKie 2013; Reijo Pera 2013, 113; Cohen 2013, 119).

Underlying this issue is the uncertain ontological status of embryonic ageing when it is incorporated in the technology. Parry and Gere state that, in property law, the human body and bodily parts are exceptional because it is widely considered morally and ethically undesirable to extend property rights to them. Nevertheless, the numerous new uses of human biological materials in biomedical research erode the maintenance of this property exclusion for the human body and its derivatives (Parry and Gere 2006, 142–3).

Within the context of tissue culturing, the ontological status of the body and bodily material is frequently uncertain when they undergo various technological transformations and adaptations within a laboratory or clinical context. The resulting highly engineered artefacts may retain a degree of corporeality as well as offer more “informational renderings of the human form” (2006, 139). While Parry and Gere argue that bodily material in biomedical contexts is characterised by a “categorical indeterminacy [that] unsettles the binaries on which so many regulatory regimes—particularly property regimes—rely for clarity, and effective operability,” so does the regulatory categorisation of embryonic development data as intellectual property introduce a categorical division between corporeal ageing and the information derived from it (2006, 139–40). If, as Parry and Gere claim, this division is not “at all meaningful in the context of contemporary bio-medical research” then the patent’s categorisation of embryonic development as purely informational both discounts and subsumes the corporeal foundations of these time-lapse imaging practices (2006, 155). The patenting discussion is indicative of how the introduction of time-lapse embryo imaging also entails a renegotiation of what embryonic ageing means in the context of embryo selection.

The kind of embryonic ageing that emerges in this context may be characterised as “the outcome of a dynamic engagement between a number of individuals,
technologies, institutions, practices and organizations” and is therefore “more akin to an embodied relation than an object” (Parry and Gere 2006, 155, 141). Indeed, as I have argued with Haraway, ageing in time-lapse imaging emerges in the co-adaptive world-making entanglements between machines, bodies and embryos. Through the material, digital and visual translational processes that are integral to time-lapse embryo imaging, the fundamental separation of embryonic ageing and time-lapse imaging technology becomes untenable. Instead of either conceptualising the timing of embryonic ageing as an autonomous, “natural” phenomenon or reducing it to an informational aspect of the time-lapse machine, embryonic ageing could also be approached as co-determined in, for instance, its tissue culturing and incubation conditions; its optical mediation, translation and analysis; and its relation to the gametes and the bodies from whom they originate.

The significance of a reflection on the various effects of time-lapse embryo imaging is highly pertinent given that the significant financial investments in this technology may be indicative of a swift infrastructural shift away from conventional to time-lapse embryo selection. Swedish Vitrolife, the company that produces Primo Vision, saw a continuous increase in sales of the apparatus from 13 to 30 million SEK per quarter in the 2013 – 2014 period. In 2014, Vitrolife acquired Fertilitech and its Embryoscope. The following year, its sales rose further from 50 to 80 SEK million per quarter (Vitrolife 2015a, 4). The distribution of significant numbers of machines to fertility clinics and laboratories entails a potential shift both in the knowledge production about embryonic development and in the experience of IVF for intended parents. In keeping with the rising number of time-lapse imaging systems in use, the number of scientific articles citing time-lapse embryo imaging is increasing, thereby suggesting that this development also has an impact on how scientific knowledge about embryos is produced, analysed and compared.113

Likewise, as fertility clinics invest in time-lapse imaging, patients are more likely to encounter this approach to embryo selection and more embryo videos will come into circulation, both within the clinic and beyond.114 The focus on intended parents in selling the technology is apparent in the presentation of the systems by the

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113 Although citations reports only offer a reductive insight into the dynamics of scientific knowledge production, the tripling of citations on time-lapse embryo imaging from 179 to 600 between 2012 and 2014 gives an indication of the rising impact of this technology on the field. I generated a citation report at Thomson Reuter’s Web of Science, searching for the topic “((time-lapse OR “time lapse”) AND (IVF OR ICSI OR “embryo selection”)).”

114 In the UK, time-lapse imaging has become widespread clinical practice at the time of writing, offered by major clinics including CARE Fertility, Bourn Hall, the Bridge Clinic and the London Women’s Clinic. According to Vitrolife’s optimistic assessment, half the IVF treatments in the UK are done with time-lapse imaging (Vitrolife 2015a, 3). In the Netherlands, the time-lapse technology is primarily used by several university hospitals for clinical studies in which intended parents may participate. Reinier de Graaf hospital was the first Dutch hospital to offer treatment with the Embryoscope as part of routine clinical practice.
biotechnology companies producing the time-lapse imaging machines. Vitrolife’s CEO Thomas Axelsson, for example, states that time-lapse imaging “improves clinics’ profitability through the availability of additional services [and] marketing of improved treatment results” (Vitrolife 2015c, 4). The above-mentioned “special download” that CARE Fertility offers to intended parents after embryo transfer is an example of such an additional service and points to the multiple functions of the embryo videos as diagnostic, communication and marketing tools. Significantly, these additional functions of the embryo videos are manifest in the Embryoscope apparatus itself, which features a dedicated “Embryoscope® Counseling App,” developed “to improve patient communication,” that may be used to show intended parents the merits of time-lapse selection with the visual aid of embryo videos (Vitrolife 2015b). If they opt in, the treating doctor can show them their developing embryos on the app. In this way, the framing and distribution of embryo videos to the intended parents is built into the time-lapse system.

Vitrolife’s major rival company, Auxogyn, which produces the Eeva apparatus, has taken patient communication one step further and markets the Eeva test directly to the intended parents. In 2014, Auxogyn merged with Fertility Authority, which is a “patient-matching technology platform serving the fertility industry” and, in their own words, “the world’s largest web portal dedicated to fertility” (Fertility Authority 2015). With 1 million visitors every month, Fertility Authority plays an important role in disseminating information about fertility treatments as well as arranging US-based referrals and financing plans.115 The merger of Auxogyn and Fertility Authority, named Progyny, uses the slogan “the patient is at the center of everything we do” and indeed Auxogyn, more so than Vitrolife, directly addresses the potential patient in its communications (Progyny 2015). Following the merger, Auxogyn launched a patient-oriented website, which features videos of developing embryos (2015). The website also presents a promotional video of intended parents with a healthy child who are shown viewing their son’s time-lapse embryo imaging videos on a laptop at home, framing the time-lapsed this time more literally as “the ultimate home video” (Wegner 2012). Both Vitrolife’s and Auxogyn’s approach show how the videos are employed not only as diagnostic material for predicting viability, but as material for communicating with intended parents in ways that statistics could not. This is indicative of a move towards making time-lapse embryo imaging as a patient-driven technology that brings the embryo selection step in IVF procedures into view. The move towards making time-lapse imaging more patient-driven in turn presents a demand on fertility clinics’ integrity and

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115 Fertility Authority also owns EggBanxx.com, for example, an online platform and national network of over 185 fertility doctors specialising in egg freezing, which provides financing schemes as well as cocktail parties to promote egg freezing.
ethical responsibility to counterbalance the fact that the intervention is not suitable or required in all IVF treatments and there are the significant financial stakes involved in the current investments in this technology. In these ways, the embryo videos become instrumental in the redistribution of the value of and responsibility for embryonic ageing between patients, clinics and companies.

Conclusion
Time-lapse embryo imaging introduces a temporal dimension in the clinical observation of embryos during IVF, which allows the precise timing of embryonic development to become observable and useful as an analytical tool. Besides potentially improving pregnancy and live birth rates, this shift towards the visualisation and temporalisation of embryo selection also has a number of cultural effects that pertain to the conceptualisation of early human life. If, as Sarah Franklin argues, “the over-determined coupling between embryonic bodies and technoscience” is “retelling us who we really are” then time-lapse embryo imaging brings a new set of images into public circulation that visualise an understanding of the embryo as the entity that lies at the foundation of “who we really are” (2006b, 170).

The embryo does not, however, have a single, clear-cut referent in these time-lapse videos. I have identified three approaches to visualising the embryo: the retrospective image of the embryo as individual, the anticipatory grid view of a collective of embryos and its layering with historical data of embryonic populations. The first presents an individualised embryo that bears a direct relation to the child; the first embryonic divisions depicted in the video are here framed as the start of an individual human life. The second, zooming out to the grid level, offers a view of multiple, fallible embryos that require time-lapse technology to actualise their collective potential for “IVF success.” While the time-lapse technology makes the footage of early embryonic development visible to the intended parents for the first time, and thereby offers a visual encounter with the earliest moments in the lives of their (potential) children, it simultaneously replaces the understanding of the embryo as individual by one of embryos as a group that collectively holds a potential for human life that is contingent on technocultural—as a variation on natural—selection. Thirdly, the layering of visualised population data on top, to the side or in the colouring of the images offers a reading of the presently incubated embryos in relation to earlier embryonic populations, whose temporal growth patterns have attained predictive value. Embryos, and their existence in time, therefore not only function as material to be selected, but are themselves entangled as part of the technological tool. The temporal specificity of their development functions
as a prism through which to observe other embryos and to determine viability through the recognition of organised growth.

In the entanglements of embryos and machine, there are also other bodies at stake. As the time-lapse apparatus reflects the specificities of the mother’s and the embryologist’s bodies it substitutes, this technology replaces the embodied and hands-on relations of these bodies to the embryo with a digital, visual mediation of prenatal life. As a result, the increased visibility of these embryos also entails an externalisation of early human development from the maternal body and a distancing between the embryo and the embryologist, who increasingly touches and observes the screen rather than the petri dish. The embryos, meanwhile, become more intimately entangled in the time-lapse apparatus—to the extent that the academic community engages in debate on whether embryonic ageing, in the context of time-lapse imaging, is a natural occurrence or a proprietary, patentable part of the method and machine.

The clinical instrumentalisation of embryonic ageing as technology in time-lapse imaging generates “biovalue” by increasing both profitability and vitality in embryo selection (Waldby 2002, 310). The introduction of embryo selection as an additional step in IVF cycles presents new negotiations of risk and financial investment to the intended parents. Moreover, the specific visualisation of this step in the embryo videos foregrounds embryonic ageing, more so than maternal or parental ageing, as a key factor in conceptualising the quality of fertilised eggs. Time-lapse embryo imaging thus illustrates how a representational technology, microcinematography, can be employed to introduce the temporal dimension into the assessment of embryos. It thereby couples the production of biovalue to a conceptualisation of embryonic ageing as at once a visible, culturally-significant process in an individual’s origin story, an added financial and ethical consideration for intended parents undergoing IVF and a phenomenon which commercial parties may claim as patentable property. The resultant multi-faceted clinical operationalisation of visible embryonic ageing as technology in time-lapse imaging positions cellular temporality at the basis of what is seen to count as a viable life that may be implanted in a woman’s body. In this reintroduction of the cellular tissue into the ageing body, different cryopreserved, patented and medicalised modes of living in time meet. While time-lapse embryo imaging visualises and instrumentalises the ageing of the embryo, in the next chapter I discuss how its subsequent implantation politicises the age of the intended mother.