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Maternal Machines: Imagining Experiences in Perinatal Care

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Abstract

Perinatal care is a term that broadly refers to the period of time from pregnancy up to a year after giving birth. Imaginaries, fictional scenarios, patents and actual designs to support affected stakeholders during this period reflect how this topic has for a long time fed into society's dreams, fears and desires about care. Smart monitors of infants' sleep, respiration, heart rate or temperature, cots with facial recognition, swing chairs that are 'Alexa compatible', chatbots for postpartum depression, 'maternal' Alexas or nanny robots are examples of the potentials that this topic offers for imagining scenarios for care and wellbeing. Often rich with insights about societal dreams, fears and desires about what we would like technologies to do for us, imagined scenarios can also indicate ways in which we regard those already engaged in roles of care, echoing cultural and gendered tropes. As AI and related technologies increasingly become entangled in situations of care, the imagined possibilities in contexts of such complex, sensitive and emotionally charged spaces are worth examining, whilst interrogating how HCI technologies in perinatal care could expand beyond quantifiable data and tap into sensorial, non-numerical forms of knowledge.

In this workshop, we will look at ideated scenarios with technologies related to maternal and infant care in contemporary, historical and cultural contexts including those from Japan, and we will create our own imagined scenarios of care. Through a mixture of activities that include presentations, drawing, hands-on interactions and group conversations we will discuss opportunities and implications in the design of technologies for maternal/parental and infant care around the perinatal period. Our imagined scenarios will explore in particular two interrelated themes in the research: non-numerical forms of knowledge and touch.

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CCS Concepts

• **Interaction design**; • **Human computer interaction (HCI)**; • **Life and medical sciences**;

Keywords

maternal, infant, perinatal, care, parenthood, speculative design, imaginaries, technology, interaction design

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1 BACKGROUND AND MOTIVATION

A number of design and HCI research projects have explored design opportunities with technologies to support experiences related to pregnancy, childbirth and postpartum care, focusing on aspects such as pregnancy monitoring [37, 43, 23, 28], breast feeding (including advocating for breastfeeding in public) [3, 12, 19, 45, 47]; infant monitoring of sleep, temperature and respiration [34, 30, 46, 52], pregnancy and post-partum depression monitoring through chatbots [42, 48], cognitive therapy and virtual reality [40], machine learning prediction [32] or social media [10]. More recent research initiatives in medical imaging explore possibilities for machine learning to detect cases of high-risk pregnancy and childbirth to reduce maternal and neonatal mortality, relying on AI's potential to predict clinical conditions using large volumes of data [25].

Attitudes towards technological interventions in such emotionally charged spaces are complex: for some, technology is seen as interfering or competing with ideals of care and instinctive knowledge [5, 15, 49, 50], whilst also representing safety, efficiency and reliance. There might be mismatches between ideologies and practices: many parents declare regarding Alexa or webcams with suspicion, yet they also admit relying on them in their daily tasks. Furthermore, often expensive, such technologies can also be seen as symbols of status and privilege [22, 50].

Aspirations to make use of design and technologies to support, alter or even replace humans in situations of gestation, childbirth and childrearing stem from a long history of imaginaries [21, 8] around reproduction and care, and have been manifested in literary fiction, film, comics and animations through to patents and realised designs. Patent drawings of artificial uterus [16], apparatus to support childbirth through centrifugal force [7], visualisations of artificial wombs [33, 11], imagined scenarios with humanoid nannies [27], robot mothers [39], maternal Alexas [54], or nursery robots [1] are reflections of how this topic has for a long time fed into society's entangled dreams, fears and desires about care. Often reflecting gendered roles or echoing cultural tropes about reproduction and care, and indicating the situated perspectives of those who imagined such innovations, this is a space rich with insights not only about possible designs, but also about fantasies of what we would like technologies to do for us that can also indicate ways in which we regard those already engaged in roles of care [41, 51]. Films such as *The iMom* [27] or *I Am Mother* [39], which present scenarios where infants and children are raised or cared for by robots, combine both efficiency and reliance with depictions of sinister outcomes showing how things might go wrong if we lose control over them. These are reflections of ambivalence towards technologies entering sensitive spaces of care [49, 50], that can also echo patriarchal ideas of control over reproduction and care in society. Interrogating the narratives used to validate previous designs and ideations can help designers in the design and HCI communities question the assumptions and biases that might be made when ideating technologies for care. For example, early incubators in the 1880s, were presented as possibly better than the real uterus due to "*mothers' irresponsible and unsanitary behaviours*" [2, 20] and 1960's projections about automated nurseries of the future presented scenarios of "*antiseptic infancies untouched by human hands*" [56]. In both cases, machines were unquestionably imagined as safer and more reliable than humans, and mothers presented as not trustworthy. Whilst designers and HCI practitioners are a much more diverse group today than innovators of many decades ago, many cultural tropes about machines, gender and roles of care might still prevail. For example, current narratives around AI to detect facial expressions of babies in smart cots [58], monitor depression in mothers through facial expression apps [59], or monitor infants' sleep, respiration or temperature [34, 30, 46, 52], depict very medicalised scenarios of parenthood and care that might marginalise forms of bodily knowledge and non-numerical readings, and overlook the complexity and diversity of experiences in the research space. The experience of parenthood includes a diversity of ways of knowing that go beyond quantifiable data, and includes knowledge that is ancestral, culture and context dependent, non-numerical and sensorial.

Our workshop motivation stems from a belief that designers in the HCI community could benefit from exploring ways to expand conceptualisations of technologies for perinatal care beyond quantifiable data and tap into sensorial, non-numerical forms of knowledge. Furthermore, narratives around many technologies related to our research space could be challenged to include more ludic or pleasurable approaches, looking into existing parental practices as sources for design. Many parents are natural innovators, often making use or adapting existing designs and technologies to care for their infants. Examples of this can be seen in the use of patting fish, as shared in multiple social media channels. Originally designed as wall adornments or as cat toys, patting fish are gently attached to the back of a sleeping baby to reassure them through its repetitive patting movement [55]. Other examples include the use of fans, hairdryers or food processors to produce noise or create repetitive movements to soothe an infant, creatively transforming domestic appliances into machines used for care.

This in person one-day workshop is part of the ongoing design research *Maternal Machines: Design Speculations About Fantasies of Care* [57], led by the first author, that interrogates and explores imaginaries and design opportunities with technologies related to maternal and infant care. In our workshop we aim to collaboratively, and from a diversity of perspectives, explore possible imagined scenarios where designs and technologies are conceived as interventions for care. We will interrogate and speculate about how technologies could address a diversity of experiences and forms of knowledge. We will start by looking at imagined scenarios and designs, both contemporary and historical and from various contexts, including Japan, which has a unique way of imagining robots [24], and we will create our own imagined scenarios of care. Our workshop will include a mixture of activities: presentations, drawing, hands-on interactions with artefacts and group discussions. We will address opportunities in the design of technologies for maternal/parental and infant care during the perinatal period, and we will create our own imaginaries around interrelated themes identified in the research. Our workshop will also cultivate critical discussions about practical and conceptual questions implicated in technologies for experiences in perinatal care.

The theme of CHI this year is Ikigai, which is based on the idea that the intersection of various talents in people can produce value and purpose. This is particularly pertinent for our workshop, which aims to integrate the knowledge and expertise of practitioners from diverse approaches and practices in design, HCI research and beyond.

2 WORKSHOP THEMES

Through presentations, discussions, hands on engagement with artefacts and drawing, we will address two interrelated themes, identified in the research:

2.1 Non-numerical forms of knowledge

Dominant imaginaries about machines for reproduction and care stem from a particular historical understanding of medicine and reproduction and from a particular relationship with technology, often rooted in western, northern traditions. Whilst they are dominant imaginaries and ways of knowing, they are not universal. In

rural areas in Peru, for example, the Awajun and Wampis communities still preserve ways of understanding pregnancy, childbirth and perinatal care dating from pre-hispanic days, combining knowledge about qualities in plants and herbs, with explanations about the origins of the world and care during the perinatal period or the role of the placenta (which midwives advise to bury under the bed of the birthing mother to ensure her child will not emigrate or marry someone from another community in the future [29] thus expanding perinatal care ideas to include social and cultural beliefs). Whilst many schemes in Latin America aim to improve maternal health care and reduce maternal and infant mortality through the implementation and distribution of modern medicine practices and birth monitoring technologies, there are initiatives that integrate obstetric and perinatal knowledge from western medicine with ancestral knowledge from local midwives who traditionally offer practical and spiritual support [36]. In the UK, in contrast, midwifery knowledge has increasingly become marginalized [31]. Historically, midwives were gradually excluded from practices that for centuries had been dominated by women, and were sometimes accused of witchcraft [38], which impacted on the prioritization of medicalized expertise over other forms of knowledge rooted in ancestral practices. Yet it is possible to hold diverse forms of knowledge without excluding one another. In fact, many parents do precisely that by learning to navigate official medical advice with information from, for instance, a doula or an alternative medicine practitioner. For example, many parents monitor the wellbeing of the digestive system of their infants by observing the colour, smell and consistency of their fecal matter, or are advised to pay attention to the amount of lochia, the vaginal discharge that takes place during the postpartum healing process after a vaginal birth, by observing the amount of pads that need to be changed, or the colour and smell of the discharge. These are non-numerical sensorial forms of bodily knowledge that coexist alongside other forms of knowledge and numerical readings from monitoring technologies. In our workshop, we will discuss ways in which multiple forms of knowledge coexist and address possible opportunities and implications in design.

2.2 Touch

Many technologies can monitor and quantify variables such as heart rate, growth rate, frequency of feeds, weight, size, sleep patterns, temperature. These interventions can present a medicalised version of parenthood that can be reassuring for many parents or carers, but that coexist with other, non-numerical forms of bodily knowledge. Machines such as breastfeeding pumps can quantify the volume of breast milk being produced, yet quantification can produce expectations to perform to imagined standards. Other sensorial forms of bodily knowledge, such as how heavy, hard or full a breast feels to the touch, or how soon the milk flows to satiate an infant's hunger are also forms of measuring, albeit non-numerical. Touch experiences can play a particularly important part in wellbeing, enabling both self and infant healthcare. For example, one way to evaluate if mastitis is present is to check if the breast feels painful when touched, or hot or hard. Skin-to-skin contact can provide benefits for babies and parents [14, 35, 6] as it reduces stress, encourages feeding, regulates an infant's temperature, heart rate and breathing, releases oxytocin and helps with bonding. With touch playing such a vital role in social role in physical and emotional well-being, although underexplored in the context of perinatal care, novel haptic technologies and robotics can expand opportunities for interactions involving human touch in a diversity of settings [53]. We will address this in our workshop through discussions, hands on interactions and ideated scenarios.

3 WORKSHOP GOALS

Our workshop aims to expand our enquiry about these themes through discussions that address the following:

- What kind of novel scenarios of perinatal care can we jointly imagine with new technologies? Can machines be maternal? Can they be maternal towards both infants and carers?
- What forms of experiences can be produced when engaging with non-numerical, sensorial ways of knowing?
- How can technological interventions engage with multiple forms of knowing? What are the socio-cultural and ethical considerations?
- What are the mechanics of touch in infant and maternal care? What are the ethical implications in considering technologies of touch in this research space?

4 INTENDED OUTCOMES AND POST WORKSHOP PLANS

We anticipate the following outcomes and post workshop plans:

- A network of collaboration with practitioners from a diversity of perspectives and disciplinary approaches.
- Discussions about understandings of care through interrogations of imagined designs and technologies of care, held in collaboration with participants from diverse backgrounds and approaches.
- One collaborative publication that illuminates design considerations to meaningfully engage with non-numerical, bodily forms of knowledge to support perinatal care.
- Identifiable design opportunities leading to wellbeing in perinatal care.

5 ORGANISERS

All organizers are HCI and design researchers with experience leading and contributing to workshops at CHI, DIS and C&C conferences. Encompassing a variety of design and HCI research perspectives, the combined expertise of our workshop organisers intersect research on intimate technologies, imaginaries, multiple forms of knowledge, touch, soma design and speculative design.

Paulina Yurman is a designer, researcher and lecturer at MA industrial design at Central Saint Martins, University of the Arts London. She is the recipient of a Wellcome Research EC grant for her research project *Maternal Machines: Design Speculations about Fantasies of Care.* Paulina is interested in our ambivalent relationship with technology, often experienced as both empowering and intrusive, feeding into users' imaginaries, dreams, fantasies and fears. Her work is informed by speculative and research through design approaches, often using drawing and making as forms of design research. Paulina's PhD was a design-led research into the

role of smartphones for mothers of young children who were their primary carers. Paulina has led and contributed to workshops at ACM CHI and ACM DIS.

Matt Malpass is a designer and theorist working to advance design's agency through critical design practice. He is a Reader in Critical Design Practice at University of the Arts London, Central Saint Martins, where he leads the Industrial Design Programme. His research works to contextualize the field of critical design practice by considering the approaches used to establish the critical move through design. He advocates design's agency in tackling complex social, political and environmental problems through critical, speculative, empathetic, plural and participatory design practices.

Madeline Balaam is a professor in Interaction Design at KTH Royal Institute of Technology. Madeline has worked at the intersection of HCI and intimate health for the last 10+ years. She is currently pursuing a research agenda exploring the intersection between touch, soma design and the intimate body. Madeline has previously led and contributed to workshops at ACM CHI and ACM DIS.

Caroline Yan Zheng is a Digital Futures postdoc fellow at KTH Royal Institute of Technology. Being a designer and researchers, she crafts technology and robot initiated soft robotic touch in care contextsthat enable emotionally rich experience. She was an awardee of the MedTech SuperConnector programme in the UK for translating soft robotic haptic technology into healthcare applications and a co-investigator in the Cancer Research UK-funded project 'Improving care through soft robotic tactile intervention – towards a smarter compassionate experience in cancer treatment (SOFTLI)' (2019-2021). Caroline has led and contributed to workshops at ACM CHI and ACM DIS.

Yoav Luft is a doctoral student in mediated communications, KTH, Sweden. Former software engineer, he had worked on several software projects both in academia and industry that range from embedded systems, soft robotics, internet services, mobile and web applications and games to IT infrastructure. His doctoral research focuses on how computations can be made more accessible for designers and researchers in digital touch to explore, while reducing the overhead associated with programming.

Celine Mougenot is associate professor in Collaborative Design at Imperial College London where she leads the Collective Innovation Lab. Her research focuses on advancing human-centred design through frameworks and toolkits that amplify diverse voices and promote interdisciplinary collaboration for inclusive, value-sensitive innovation. She also co-leads Imperial's Women's Health Network.

Maria Luce Lupetti is an Assistant Professor in Interaction and Critical Design at the Department of Architecture and Design at Politecnico di Torino (IT). Her research is concerned with all matters of human entanglement with the artificial world, especially concerning complex technologies such as AI and robotics. Maria Luce has previously led and contributed to workshops at ACM HRI.

6 CALL FOR PARTICIPATION

In this in person one-day workshop, we will explore imagined scenarios where designs and technologies are conceived as interventions for care during the perinatal period. We will interrogate and speculate about ways in which technologies could address a diversity of experiences. We will start by looking at imagined scenarios with designs, both contemporary and historical, before creating our own imagined scenarios of care. Our workshop will include presentations, drawing and visualisations, hands-on interactions with artefacts and group discussions. We will cultivate critical discussions about practical and conceptual questions implicated in technologies for experiences in perinatal care, and we will particularly explore two interrelated themes in our workshop: non-numerical forms of knowledge and touch related experiences.

We invite participants from diverse disciplinary fields and approaches to offer examples of interventions or ideations that utilise designs or technologies in experiences related to perinatal care, for either infants or their carers. Our workshop is open to all and aims to include a broad and inclusive understanding of caregiving roles during the perinatal period. Participants can make submissions as short papers or pictorials and can include hands-on demonstrations. Contributions are open to participants coming from a diversity of disciplines and to those whose research practices or interests might pan across healthcare, AI and ethics, imaginaries, care, soma design or speculative design. We will select participants based on diversity in submissions.

A website for the workshop will be created where information, call for participation and accepted submissions are to be published.

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