Ovum: Designing for Fertility Tracking as a Shared and Domestic Experience

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ABSTRACT

Medical devices are moving out of the clinic and into the home. The design of these devices shapes our experience of interacting with our bodies. We attend to ovulation tracking devices that aid conception. We present Ovum; a research product that will be deployed in a long-term, qualitative study with couples trying to conceive. The contributions of this pictorial are the framing of the design space around at-home ovulation tracking devices and the presentation of our approach to this design space through working with oppositional experiential qualities by designing for fertility tracking as a shared, domestic and do-it-yourself experience.

CSS Concepts

• Human-centered computing~Interaction design theory, concepts and paradigms

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Authors Keywords

Form giving; fertility tracking; research product, research-through-design; conception; ceramics; industrial design;

INTRODUCTION

Developments in the fields of digital technologies, health data analysis and the medical sciences have led to an increasing number of commercially available medical testing and tracking devices [10]. These devices represent a form of patient-driven health care that bring knowledge about the inner workings of the body into the home [19]. This development points to emerging cultures around health in society [11]. As technological devices start to move along the clinic-home continuum, their design also warrants continuous reconsideration in terms of the experiential qualities and the social constructions that they produce [1,5,12]. The influence of the material and form representations of the body on user experience has been explored in projects such as [6, 7, 13, 18], whilst [8] and [4] explicitly explore the design of the domestic data-collecting device itself. We follow by proposing that interaction design research can facilitate designing for the emotional, social and relational aspects of devices that test and track our bodies in our own homes [9, 14].

In this pictorial we address at-home ovulation tracking with the aim of conception, rather than contraception. Ovulation tracking has long been practised through the charting of the menstrual cycle and other physiological changes. Modern methods employ clinical tools for the detection and monitoring of fertility in the home, which have been described as a complex, knowledge-intensive, and highly personalized practice [3].

Through iterative explorations of materials and form, and in collaboration with a ceramist and industrial designer, we develop the saliva ovulation-tracking device "Ovum". The format of a pictorial allows us to elaborate on this form-giving process, and to represent the complexities of designing and related considerations [2,16]. We conclude with an analysis of how the framing of Ovum as a research product [15] firstly informed our design process, and secondly supports approaching it as a research vehicle. This vehicle will be used to understand how the design of fertility tracking devices impacts users' experience through deployment in a long-term, qualitative study with couples attempting to conceive.

We begin this pictorial by analyzing the design and experiential qualities [9] facilitated by current devices to unpack how these devices shape emotional and relational aspects of fertility tracking. We use this analysis to point to alternative experiential qualities not facilitated by these devices that are then used to inform the design of a fertility tracking device that enacts alternative processes of reading the body.

FERTILITY TRACKING DEVICES

URINE TRACKING

Function: These devices determine when ovulation is taking place through testing for Luteinizing Hormone (LH) in urine. The LH surge typically takes place in the middle of the menstrual cycle, about 24 -36 hours before ovulation, the most fertile period during the menstrual cycle. Urine testing previously took place in the doctor's surgery before coming onto the commercial market for at-home use.

Form: Testing sticks either come in digital or analogue form. Analogue versions are a strip of paper that show a line in the middle of the strip if LH is detected. This line is often faint and a cause of confusion for users. Digital versions have a re-usable reader that negate the ambiguity of the analogue strips through translating the test result into clear indicators on the LCD screen such as smiley face or line.

Interaction: First thing in the morning, the strips are either placed in the urine stream or in a cup of urine. Three to five minutes later, the device will show whether LH is present or not, therefore signalling whether the body is approaching ovulation. This information fades after a few hours and the test strips are discarded after each use.

TEMPERATURE TRACKING

Function: The basal body temperature (BBT - the lowest body temperature over a 24 hour period) rises sharply on ovulation. This means that daily temperature taking first thing in the morning, and the charting of the fluctuations over the month, can reveal when ovulation takes place. Once this information has been gathered over a few months, it can be used to predict when ovulation takes place within the menstrual cycle. Specific thermometers are required for BBT tracking as they require extreme accuracy to pinpoint the change in temperature. Recently, bluetooth thermometers that synchronize with apps have entered the market. These apps track the temperatures recorded and use algorithms to predict future cycles.

Form: Plastic and metal thermometer with a numerical LCD display. An app or a paper chart is used to record the temperature value each day in order to track patterns around ovulation.

Interaction: The temperature is taken first thing every morning. This number is then input into the app or chart. Since various factors other than ovulation also affect the basal body temperature, this method is not suitable during sickness, with a hangover, or less than 4 hours of sleep.

SALIVA TRACKING

Function: As estrogen levels rise in the 3/4 days leading up to ovulation, an increase in electrolytes (salts) cause changes in the consistency of cervical mucus and saliva. This change is visible when saliva samples are inspected through a lens or microscope. Fern shaped crystals increasingly appear as the body approaches ovulation and fade away after ovulation has taken place [17]. Saliva tracking previously took place in the doctor's surgery under a microscope.

Form: Commercial devices are sold for at-home use and are typically comprised of a 60x lens, a battery powered LED and a plastic "lipstick" style casing. One device we purchased arrived with a chart that users could use to record the results over the month as well as other physiological changes such as temperature and changes in cervical mucus.

Interaction: First thing in the morning, the user removes the lens from the casing and places a drop of saliva on the glass plate. This is left to dry and then replaced. A button on the bottom of the tube turns on the LED. The user can then peer into the tube and inspect the saliva sample through the lens.

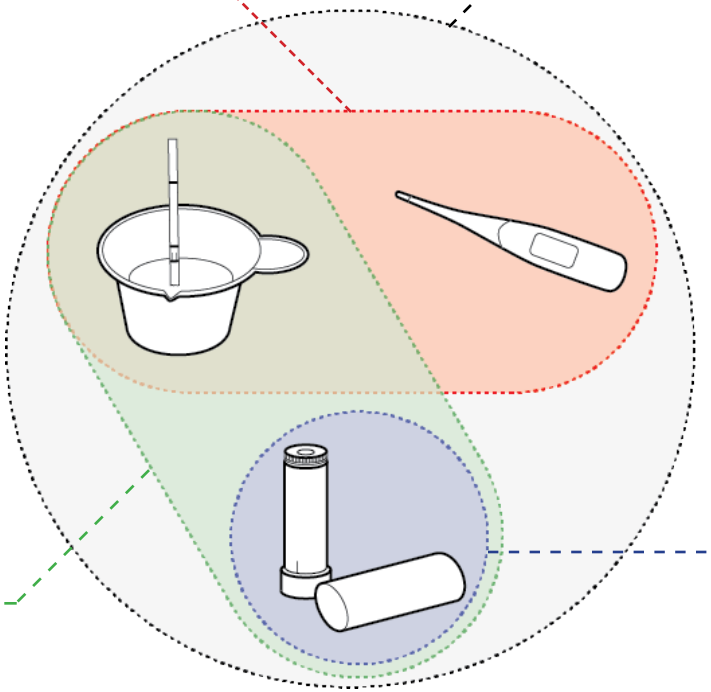
GROUPED EXPERIENTIAL QUALITIES OF EXISTING FERTILITY TRACKING DEVICES

BINARY

Temperature and urine tracking provides a binary representation of the body as being divided into two non-fertile/fertile categories. Saliva tracking shows more nuance between these stages as the crystals increase towards the most fertile period.

EXPERT

The temperature and urine testing devices still hold some expert authority through the fact that the analysis takes place through chemical and algorithmic processes. Only the result of these processes are communicated back to the user. This black-boxes the hermeneutic processes that take place and re-enacts the clinical expert-to-patient relationship.



CLINICAL

Thermometers, chemical tests and microscopes all represent clinical instruments. Fertility tracking and the act of heterosexual sexual intercourse that leads to conception are not medical procedures. Insemination is a more complex case where clinical aspects are often more pronounced. The dissonance between medical apparatus applied to non-medical phenomenon provokes certain understandings of the body that lead to medicalization.

INDIVIDUAL

Although it is mostly two people involved in the act of conception, these devices are designed for one person. The marketing accompanying these devices assumes it will be a woman purchasing and using devices, and there is no acknowledgement of the second partner. The exception to this would be apps that accompany temperature tracking devices which can be configured to send notifications to partners when the user is fertile. The fact that the mini-microscope is disguised as a lipstick also communicates that this is a private act to be hidden from others.

REAL-TIME INFORMATION

Saliva tracking and urine testing provide a real-time reading of fertility. This is in contrast to temperature tracking, where it is only the rise in temperature after the release of the egg that can be tracked and used to algorithmically predict the next month's fertile period. Temperature tracking assumes that the menstrual cycle is consistently regular, which is often not the case, and therefore can result in inaccurate information about the timing of ovulation.

DO-IT-YOURSELF

Saliva tracking represents the only form of fertility tracking where the sensemaking process is reliant on the user. The lens amplifies, rather than translates. With the use of magnification, this device allows the user to deduce directly from a saliva sample when they are fertile. This places the user in a different role and relationship to the act of fertility tracking - they have agency in reading their own body. This is represented by the fact that the user must focus the lens themselves in order to sharpen the projection. This is in contrast to the other examples where the information is mediated by the device and is still framed as the expert.

ARTICULATING THE DESIGN BRIEF

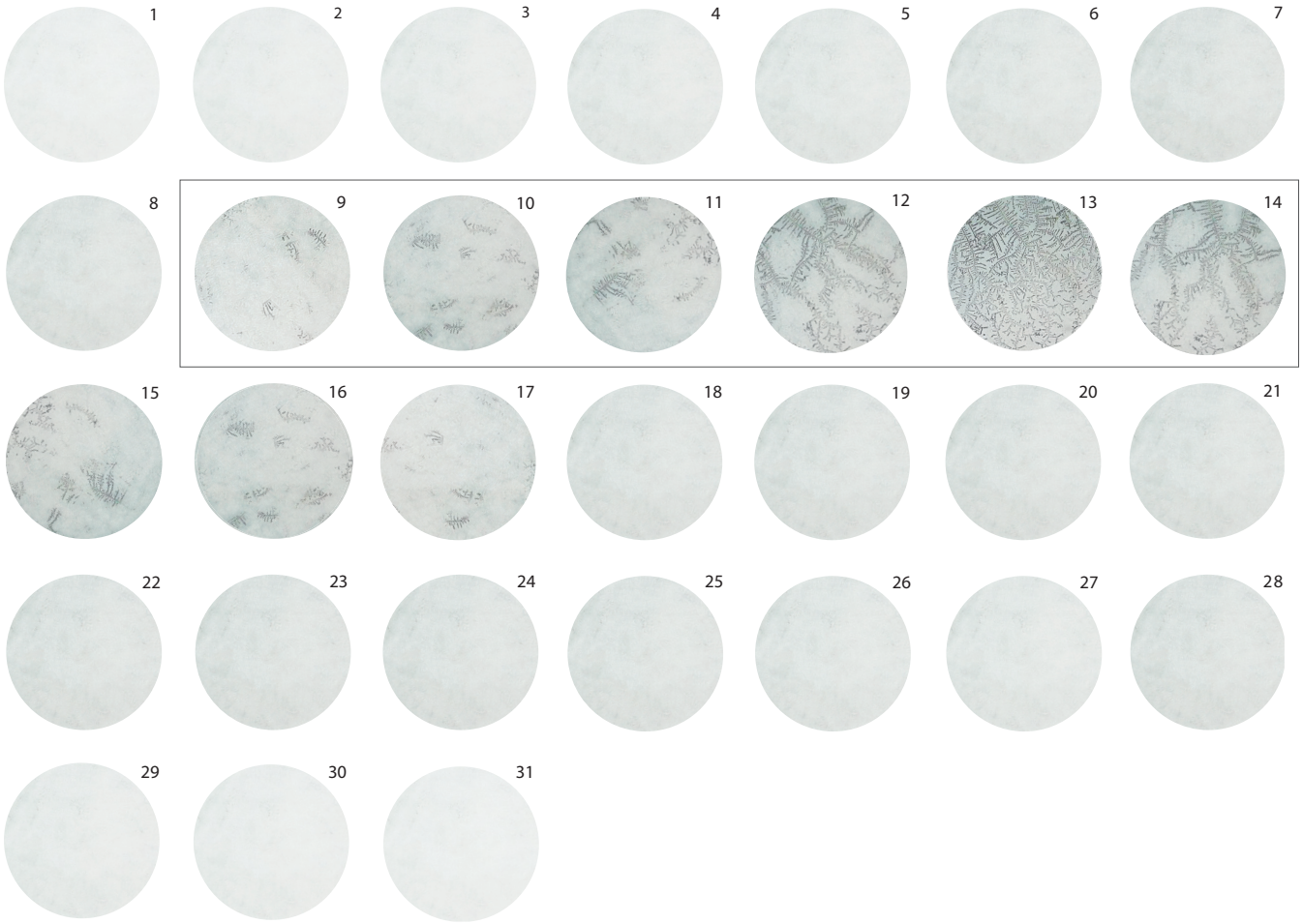
As shown in our analysis above, different experiential qualities are produced through the various methods and devices designed for fertility tracking. From this we draw out some alternative or under-explored qualities in order to frame a design space and design brief for our design.

1. The home is predominantly a shared environment, and particularly in the context of ovulation tracking, since two people are typically involved in the act of conception. From our analysis, we can see that this is not reflected in the design of fertility tracking devices, where the responsibility and labour of tracking is placed upon the partner who will become pregnant. Motivated by this, we bring the shared act of fertility planning into our design space.

2. Since these devices are to be used within the home, and in order to address the clinicalization of fertility tracking through the tools that are employed, we address these devices as distinctly domestic objects. This includes exploring the impact of the materials and form on the aesthetics of the devices within this context.

3. To challenge the expert role played by temperature and urine tracking devices, we expand on the D.I.Y. experience afforded by saliva tracking. The fact that this device provides unmediated access to information about the insides of the body, solely through magnification, removes the relationship between the device and the user as expert and layperson. The user of saliva tracking devices becomes an expert in reading their own samples.

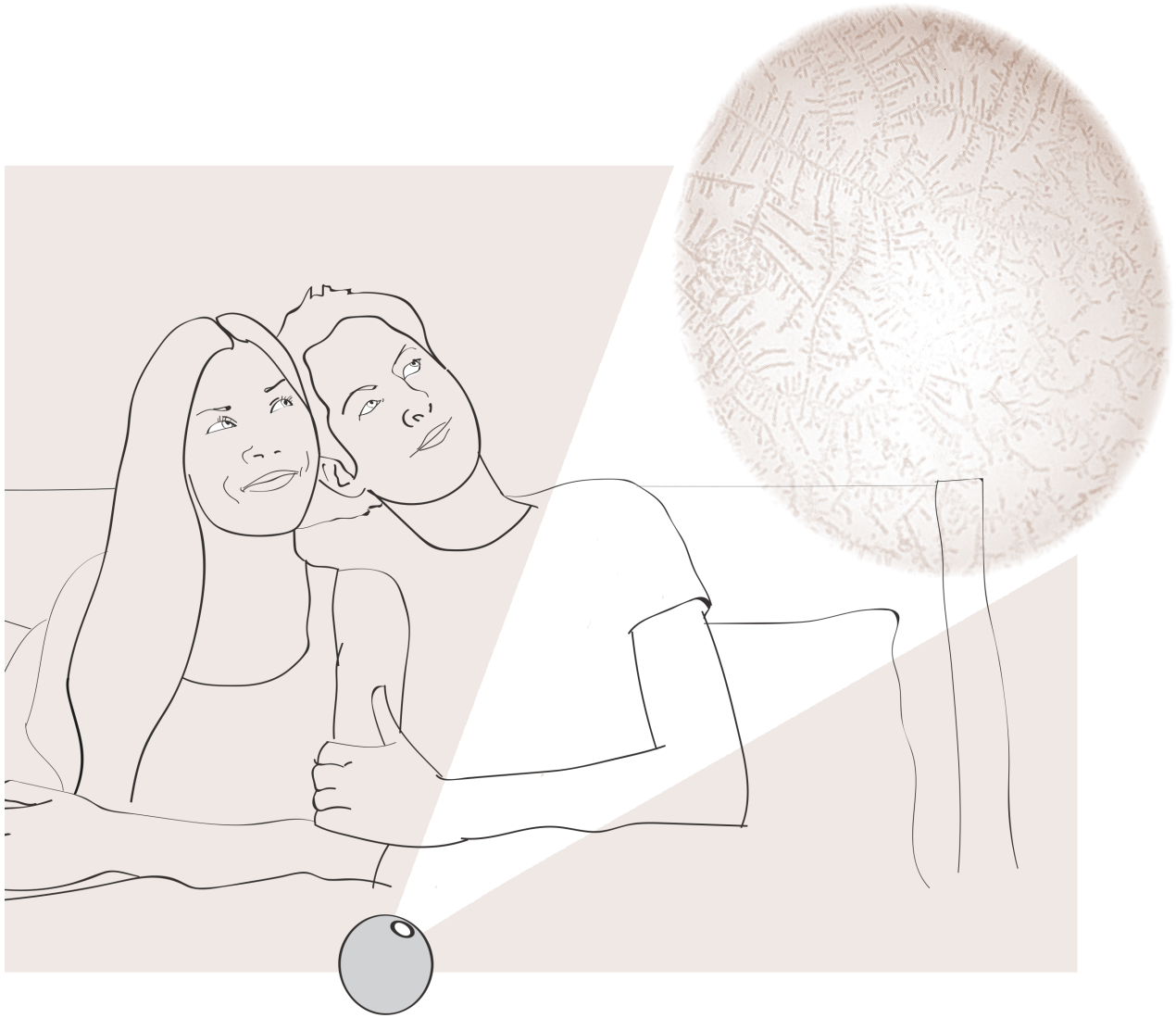
INDIVIDUAL → SHARED
CLINICAL → DOMESTIC
EXPERT → D.I.Y.



This figure visualises how saliva samples might look over a 30-day menstrual cycle. Day 9-14 shows the fertile period, with ovulation taking place on day 13 when maximum ferning crystals are visible [17]. The fertile window begins approximately 3–5 days before ovulation and continues to a point approximately 1–2 days (oocyte lifespan) after ovulation.

DESIGN BRIEF: FROM INDIVIDUAL TO SHARED

In designing for the shared rather than the individual, we address conception as a shared act that includes the emotional, relational and sensual aspects of conception. This is instead of reducing conception to a biological process that is typically the emotional burden of the partner who will become pregnant [3]. We explored how the saliva sample could be visualized beyond peering into a microscope. We found by taking out the lens and using a very strong LED to shine back through it, the saliva sample could be projected to around 2 metres onto a ceiling or wall. This affords for the process to be shared with others. This projection can be sharpened with the focusing ring to provide a precise image. The fact that the projection requires darkness to be visible puts an interesting constraint on the use of the device. That the projection looks like the moon also brings poetry and romance to the experience. This is reflected in the use scenario below, which became part of the design brief to communicate the concept to the design team. We acknowledge that heterosexual sex is not the only type of activity that leads to conception. Though this is not shown in the scenario, this method can also be used for tracking ovulation in cases where conception will take place through in vivo insemination.

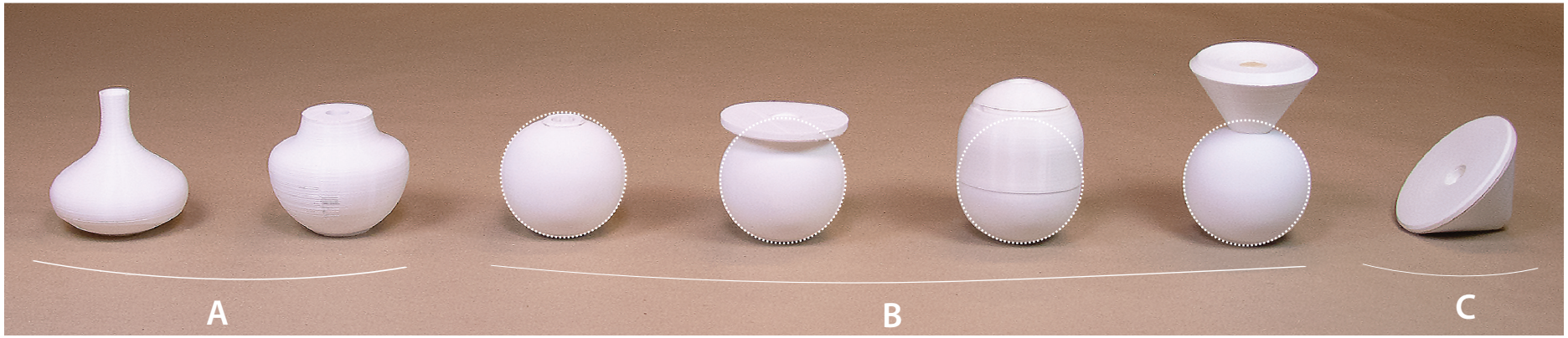


A woman wakes up, and rolls over. She leans sleepily over and picks up the device from her bedside table. She uses the duvet to dust off the glass lens and spits gently onto her index finger. She strokes her saliva onto the lens and places it back down to dry. She sits up and continues on with her day.

It is the end of the day. The woman yawns as she makes her way to the bedroom. Her partner is already in bed. She picks up the device and passes it to him as she gets under the cover. Her partner turns off the bedside light and turns the device on. The woman rolls over and places her head on the man's chest. The ceiling is filled with a constellation of interconnecting crystals. The man places the device back on the night stand as he turns to kiss the woman. He reaches down and gently slides a hand up her thigh.

Afterwards, the man lifts his head, switches the device off, and lies back down. He wraps his arms around the woman as they fall asleep.

DESIGN BRIEF: FROM CLINICAL TO DOMESTIC



A - Home Ware Inspired

To begin unpacking a domestic rather than clinical aesthetic, we sketched and 3d printed rounder prototypes inspired by Scandinavian home ware such as vases and pots. This was in order to contrast the lipstick disguise of the commercial devices that were designed to be secreted away in handbags and are clearly heavily gendered towards the female user. In following the brief of shared versus individual and domestic versus clinical, and since saliva testing devices do not need to be used in the bathroom, we wanted to create something that wouldn't look out of place on the bedroom night stand. However, on reflection, these forms seemed like an attempt to disguise the device as a vase, thereby possibly re-enforcing taboos around fertility tracking as something to be concealed.

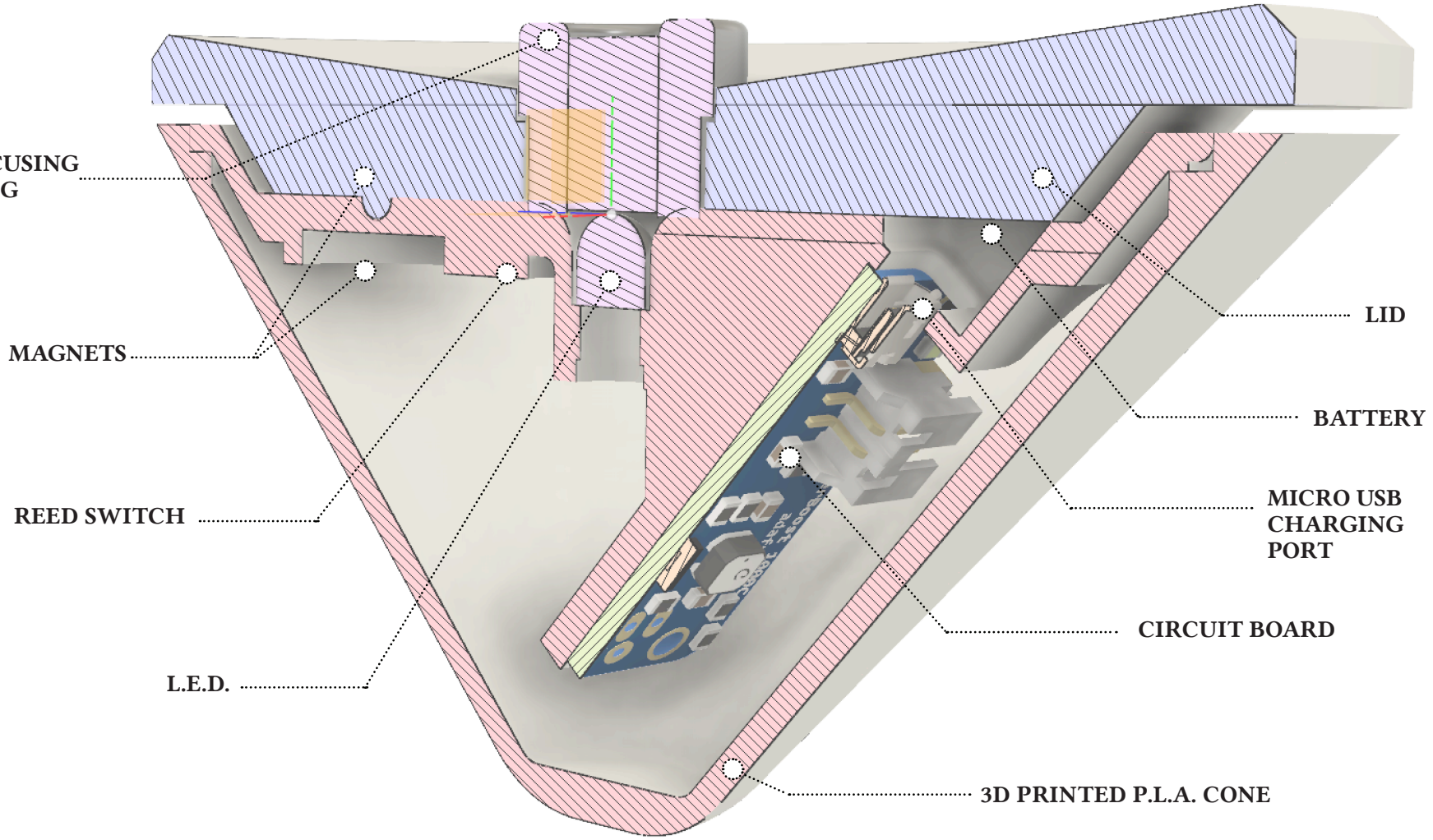
B - Ceramic Sphere Base

Here we introduced a ready-made ceramic sphere that allowed us to expand on the domestic theme. Ceramic gave a different feel through the texture, weight and warmth of the material. This went beyond 3d printed plastics. Ready-made objects were a convenient way to explore ceramics as we did not have easy access to a ceramic studio. This was also where we implemented the magnet-enabled reed switch that allowed the top part of the device to act as both the switch for the LED, as well as the place where the user deposits their saliva sample. We played with adding different 3D printed forms which held the electronic components. Once we had moved away from vase-like shapes, our designs were increasingly inspired by images of satellites and telescopes. We felt that these were in harmony with the moon-like projected image.

C - A Serendipitous Rolling Cone

The cone placed in the sphere was intended to complement the upwards movement of the projection. However, in order to fit the internal components, the cone became too large and the overall form off balance. We serendipitously removed the top and decided it had a stronger quality as a stand alone object without the round ceramic sphere. The cone on its own felt compact and dynamic. The fact that it does not stand vertically and instead rolls around gives it its own movement and expression. The device demands to be held in order to steady the projection of the saliva sample. We were interested in the fact that this seemed to invite an active rather than passive relationship between the user and the device.

ASSEMBLY

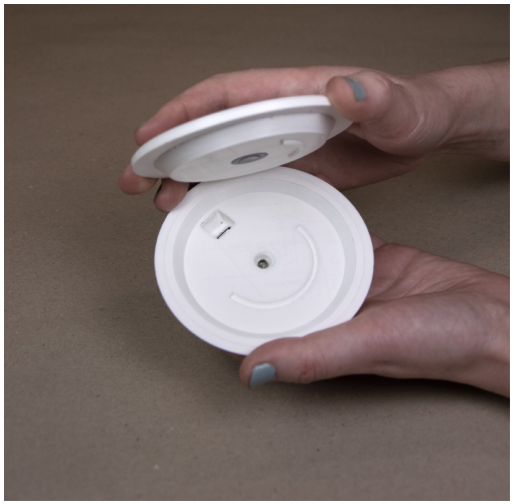

FOCUSING RING
MAGNETS
REED SWITCH
L.E.D.
LID
BATTERY
MICRO USB CHARGING PORT
CIRCUIT BOARD
3D PRINTED P.L.A. CONE

HOW TO USE THE DEVICE

Remove the lid and turn it over.

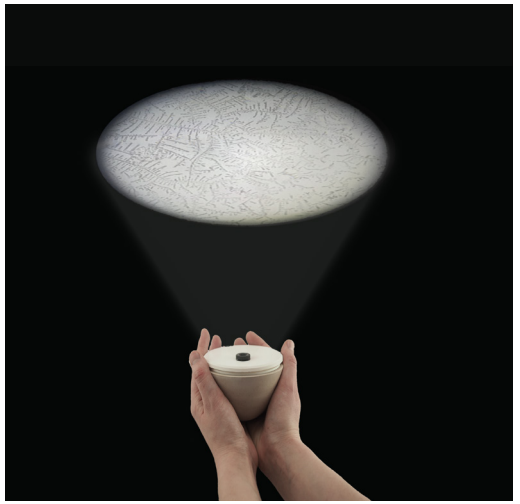
With the tip of your finger apply a drop of saliva that covers the glass surface.

Leave to dry for at least 10 minutes.



Replace the lid.

Once it's dark, find a flat, preferably white surface to project onto, such as a ceiling.



Twist the lid to turn on the light. Use the focusing ring to sharpen the image.

COMMISSIONING A CERAMICIST

Despite appreciating the qualities of the rolling cone prototype, we wanted to bring back the ceramic element that we had lost once we had removed the spherical base. We missed the weight, warmth and texture of ceramic in comparison with the 3d printed plastic cone, so we commissioned a ceramicist to remake the conical form in ceramic. Because we still needed the measurements to be accurate to fit the electronic components, the lid and inside supports would remain 3d printed in P.L.A. Collaborating with crafts-people that have expertise outside the realm of interaction design allows for new possibilities of forms and materialities [20]. Spending time in the ceramicist's studio allowed us to understand what forms and finishes were possible. This included choosing the glazes and finishes by looking at other examples to know what kind of aesthetic, texture and thickness we wanted.

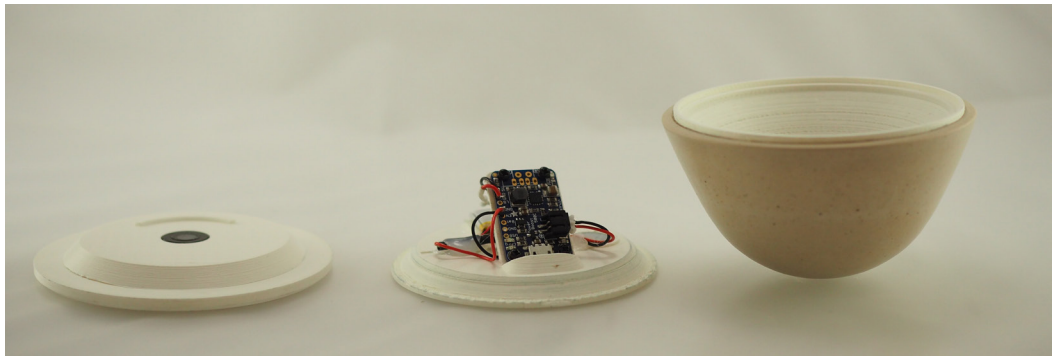
The constraints given to the ceramicist included the fact that we wanted: a shape that would not stand still vertically; the basic concept of the conical shape; and the diameter of the top of the cone that would be connecting with the 3d printing part. Other than that, and because it was an unpredictable shape to throw by hand and fire in the kiln, we left the overall form up to the ceramicist to experiment with. This resulted in a rounder shape than we had imagined, but we also appreciated the qualities of this version, which still gave some movement and expression. The rounded form and instability still invited for the object to be held, and even felt more suitable to be cupped in the hand than the previous conical version.

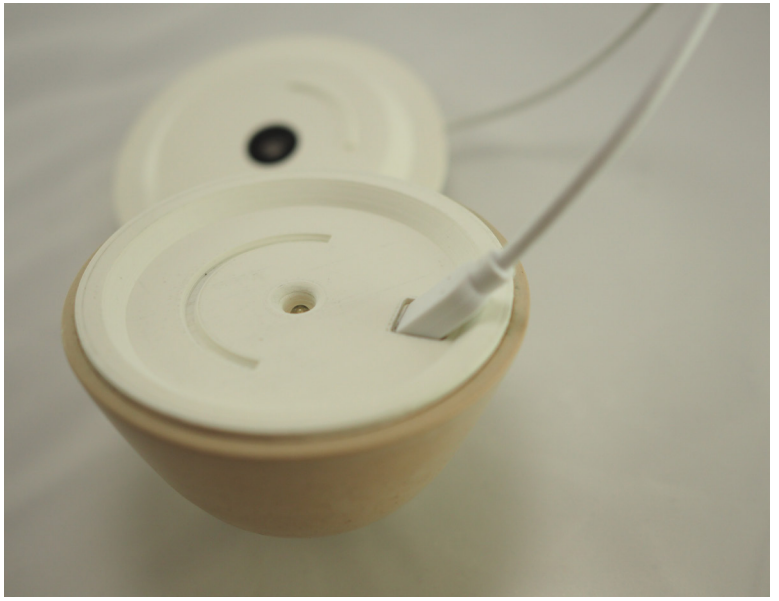
The ceramicist helped us decide what glaze to apply. This could significantly change the look and feel of the object. The most organic glaze spoke to us as being most appropriate for an object that would live in the bedroom; we discussed how other glazes looked more suitable for kitchenware. The fact that the glaze also let the gritty texture of the clay come through also gave an interesting contrast to the smoother 3d printed PLA.

Trying out different glazes that would suit the P.L.A.

The finished domes cooling after being fired in the kiln.

Testing the fit of the domes and the 3d printed parts





OVUM AS A RESEARCH PRODUCT

Our intention is to carry out a long-term qualitative study which will see the finished device deployed in the homes of couples trying to get pregnant. Odom et al. discuss how long-term studies require the development of research products, rather than research prototypes [15]. Four interrelated qualities define research products; finish, fit, independent, and the fact that they are inquiry driven. Considering in what ways Ovum represents a research product can help us articulate qualities of Ovum and how it facilitates the subsequent qualitative study.

Independent

Since research products will be deployed in participants' homes for long stretches of time, they must be able to be used independently, without the intervention of a researcher. This is reflected in the sturdy design of the object, something that was particularly worked upon by the industrial designer. Ovum can be used over and over again with no wear on the device. The fact that Ovum is rechargeable by using a micro-USB cable also means that it can be easily maintained by the participants independently.

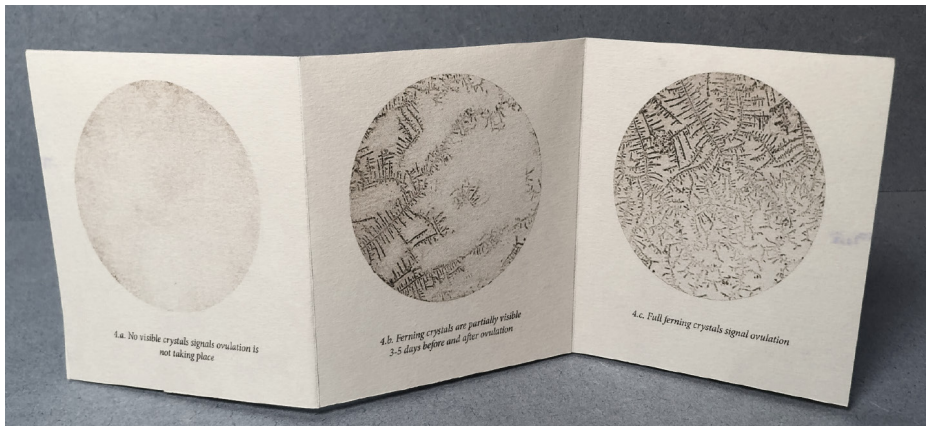
We see an important aspect of independence as also being in the way Ovum is presented to our participants. The packaging includes a leaflet that provides a full explanation and instructions for use. The packaging is designed with the aim of being able to post it to our participants without having to provide further information. We included simple instructions and diagrams and tested these to ensure they were clear and effective.

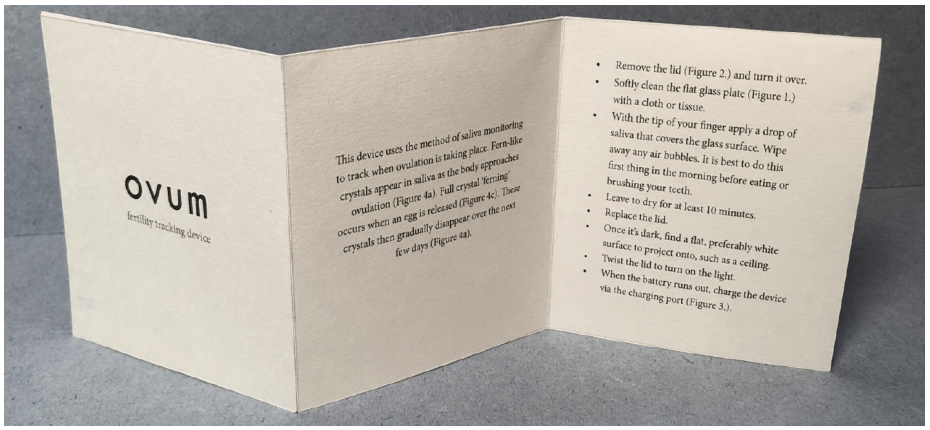
Finish

The finish of a research product allows users to focus on what the object already is, rather than what it might become. This demands that research products have a higher quality of finish than research prototypes. Having an industrial designer on our research team facilitated this; Ovum was designed to look and feel like a commercial product. We also took time in designing the logo and packaging and explanatory leaflet as if it were an off-the-shelf device. Since saliva tracking is not a well known method of fertility tracking, we were motivated to produce a research product that felt credible and reliable in order to give our participants confidence in the unfamiliar process. In other words, we hoped that giving credibility and familiarity to the object in our participants' hands would give users trust in the unfamiliar method of saliva tracking.

Fit

The fit of a research product refers to how well it balances being a device that is not too strange, nor too familiar, for participants to reflect on. The fit of the product was something we addressed by including non-essential aspects such as the micro USB charging port. This gives the device a more commercial feel that resembles rechargeable devices that we use in our everyday lives, such as portable speakers and electronic toothbrushes. The ceramic components of Ovum also help the device fit into the home





setting, whilst still being unfamiliar enough as a fertility tracking device to provoke reactions from our participants.

Inquiry driven

Ovum is fundamentally an inquiry driven object since it is designed as the vehicle for exploration of a defined area of research. In this case, we use the deployment of Ovum to investigate how self-tracking devices shape both the lived experience of the body, and societal conceptions of the body. During our long-term study, we will collect participants' experience of fertility tracking with Ovum over a three month long period. These experiences will reflect on how the experiential qualities that we worked with within our design brief translate into the lived experience of using Ovum. For example, whether the participants' current roles during fertility tracking are affected by having the saliva sample projected, or how having a real-time, D.I.Y. reading of fertility shapes users' understanding of themselves in reading the body.

CONCLUSION

The main contribution of this pictorial is the framing of the design space around at-home ovulation tracking devices and the presentation of our approach to this design space through working with oppositional experiential qualities. This approach could be applied to other self-tracking domains that are highly medicalized. The research product Ovum is an exemplar of this process. By working in opposition to the experiential qualities facilitated by current at-home fertility tracking devices, we have produced a device that re-configures the act of fertility tracking. Ovum points to the fact that at-home testing devices are embedded within, and consequently impact on, the complex social contexts of our own homes and relationships. Ovum is designed as a result of framing fertility tracking as a D.I.Y., domestic, and shared rather than an expert-led, clinical and individual experience. How these oppositional experiential qualities translate into the lived experience is the focus of a subsequent long-term, qualitative study with couples trying to conceive.

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