# The Temporal Qualities of Biodata as a Design Material

Sarah Homewood

University of Copenhagen, sfh@di.ku.dk

Perhaps due to the vague and indistinct qualities of the insides of our bodies, biodata is currently presented as information that allows us to understand our bodies from a utilitarian perspective. This paper will use three examples of design projects where biodata has been designed with as a material to offer a specific experience of the insides of the body. These designs specifically propose how designing with the temporalities of biodata point to new conceptions of the body in HCI and raises questions such as – how might designing with the temporal qualities of biodata change the design of our everyday devices? and in turn, change our experience of our bodies and the world around us?

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

**Additional Keywords and Phrases:** Biodata, self-tracking, temporality, design,

**ACM Reference Format:**

First Author's Name, Initials, and Last Name, Second Author's Name, Initials, and Last Name, and Third Author's Name, Initials, and Last Name. 2018. The Title of the Paper: ACM Conference Proceedings Manuscript Submission Template: This is the subtitle of the paper, this document both explains and embodies the submission format for authors using Word. In Woodstock '18: ACM Symposium on Neural Gaze Detection, June 03–05, 2018, Woodstock, NY. ACM, New York, NY, USA, 10 pages. NOTE: This block will be automatically generated when manuscripts are processed after acceptance.

## 1 INTRODUCTION

Biodata is data emanating from the body that provides some form of information about the body. Perhaps due to the vague and indistinct qualities of the insides of our bodies, biodata is currently presented as information that allows us to understand our bodies from a utilitarian perspective [10]. Recent research within HCI has explored different modes of representing biodata, e.g. [9, 11] and less positivist and more diffracted and entangled understandings of how we can work with biodata [1, 12].

Currently, the field of human-centred computing (HCI) does not account for how the changing inner state of the user influences interactions with technologies. Body-focused approaches within HCI such as embodied interaction design and somaesthetic interaction design propose methods to explore our interactions with technologies at an embodied and emotional level, e.g. [8]. These methods attempt to capture the state of the body of the user in the moment through techniques drawn from meditation, dance, and movement practices, but they do not attempt to capture a longer-term picture of the insides of the body in a state of flux [5, 6].

In this paper I use three of my own design examples to develop and contribute a new approach to the body in HCI: using the temporal qualities of biodata as a design material. Building on previous work using biodata as a material, I attempt to begin to develop some themes from my three design examples on the implications of focusing on the temporal aspects of biodata as a design material.

## 2 AMBIENT CYCLE

The first example, Ambient Cycle, is a menstrual cycle tracking app connected to a wifi-enabled lamp [7]. The user firstly inputs some data about their average menstrual cycle length and then chooses which colour best represents different phases of their menstrual cycle. These programmed colours are projected out into the room and becomes mood lighting for the menstrual cycle. Ambient Cycle seamlessly transitions through this colour program before beginning again at the start of the next menstrual cycle.

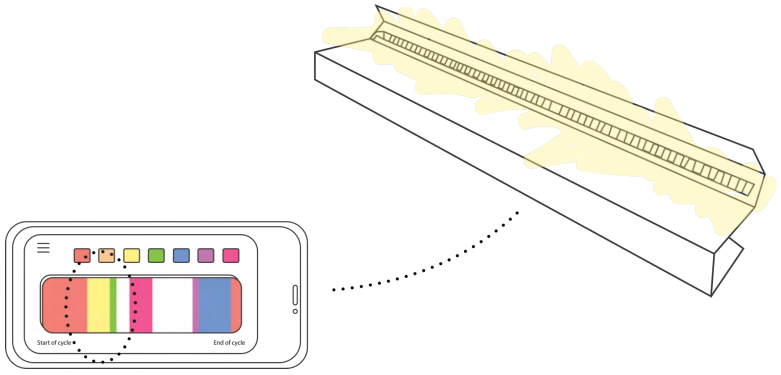


Figure 1. (Left) The Ambient Cycle interface where users can choose which colours they want to show over their menstrual cycle and when. (Right) the Ambient Cycle lamp.

Figure 2. Images of Ambient Cycle embedded in people's homes.

## 3 OVUM

The second design example is Ovum, a fertility tracking device. Ovum uses the method of saliva tracking to determine when the body is fertile; salt crystals appear in the saliva sample when the user is fertile [3, 4]. Rather than the person who wants to become pregnant peering into a microscope alone, the beautiful, moon-like, silhouette of the saliva sample is projected out into the room for both partners to enjoy. These crystals increase as ovulation is imminent and fade away post ovulation.

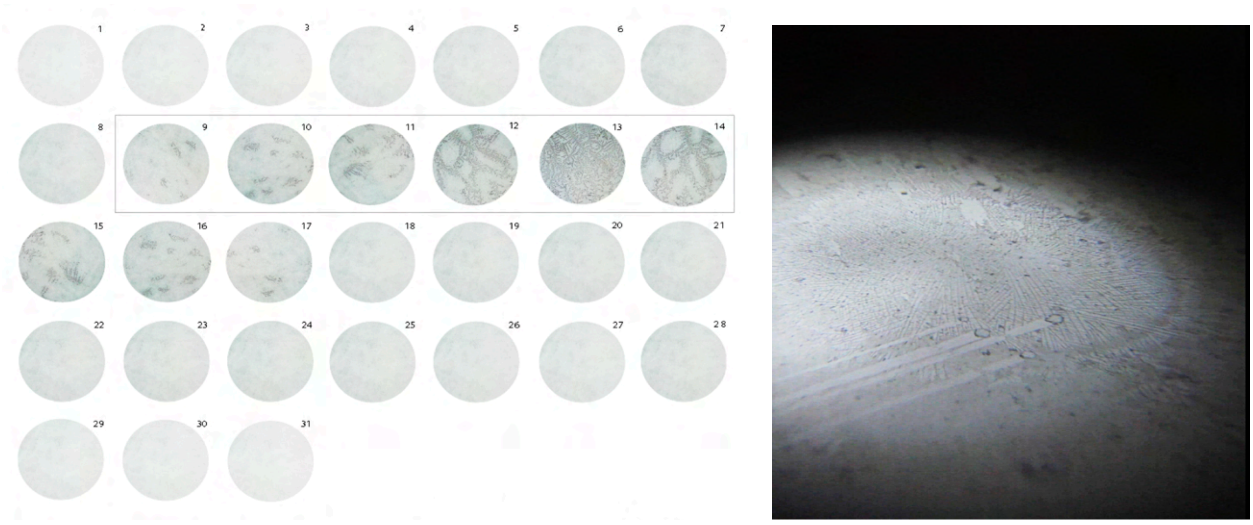

Figure 3. (Left) Saliva samples showing crystals appearing when the user becomes fertile on day 9 and increasing on day 13 when ovulation would occur. (Right) Photo of the projected silhouette of the saliva sample with crystals visible.

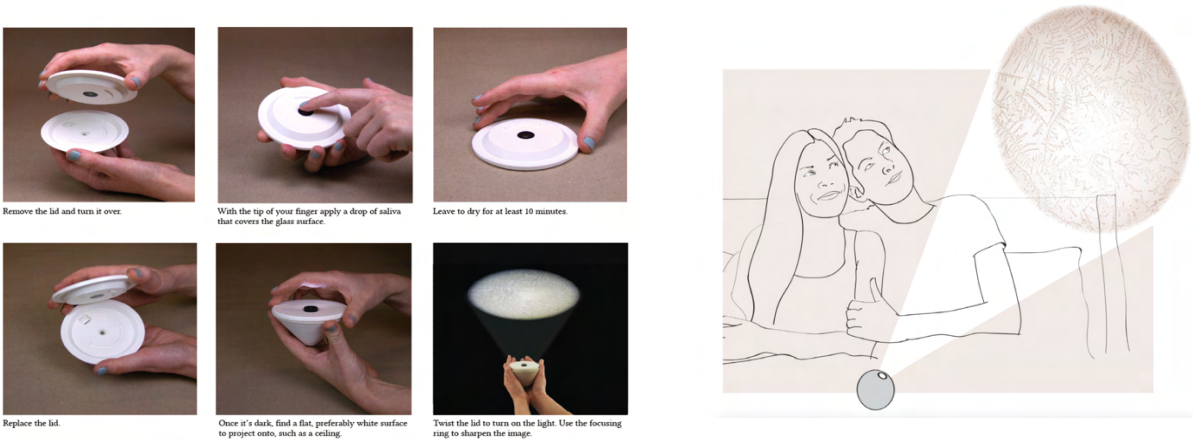


Figure 4. (Left) Step by step instructions on how to use Ovum. (Right) Ovum being used by a couple trying to conceive.

## 4 GUT FEELING

The third design example is Gut Feeling which is made up of a loupe and a lightbox, which operate to externalize gut biota for closer examination, aesthetic appreciation, and reflection on the relationship between gut and mental health as it changes over time [2]. The user is invited to leave a collection of samples of gut bacteria collected through the breath or swabbing the mouth to grow in a back-lit petri dish in a wooden lightbox. These samples continue to grow once they are outside of the body. Unlike the other two examples, Gut Feeling is a speculative design that does not offer any accurate biodata about the user, but rather prompts reflections on possibilities for the design of health tracking technologies.

Figure 5. Images of Loupe and Lightbox being used to consider gut data.

Figure 6. (Left) Loupe with a gut sample. (Right) The Lightbox that displays and back-lights the gut samples

## 5 THE TEMPORAL QUALITIES OF BIODATA AS A DESIGN MATERIAL

All three examples exemplify ways of engaging with the body as it changes over time. The fact that a different crystal structure, or bacteria growth, or mood lighting colour will be shown at different times is an integral aspect of the design of all these devices. These changing aspects represents how the body is always in a state of flux, and therefore biodata is also always in a state of flux. These three examples show how fluctuating biodata can become a resource for designers as a material. It is not that existing technologies do not reflect that the body changes over time, but rather that this aspect of the body is not centered by designers. My examples point to possible future directions and raise some interesting questions when applying this approach.

### 5.1 New (Non-Utilitarian) Experiences of Biodata

Once biodata is used as a material to reflect the changing nature of the body over time, rather than just providing diagnostic information on the state of the body, we can design for new types of experiences of data. Ambient Cycle does not only tell the user where in their menstrual cycle they are, but also considers the mood they will be in when they receive that information. Deployments of Ambient Cycle showed that users employed Ambient Cycle in a number of diverse ways [7]. This included using their choice of colours to either reflect or attempt to change the emotional mood that was caused by their menstrual cycle, e.g., choosing pink to cheer than up when they "felt blue" during PMS. They also chose colours as a way to communicate with their family, e.g., when the lamp was blue their family should know that they had PMS and "you have to be nice to me". It can be said that when each user programmed the colours they would like Ambient Cycle to show over their menstrual cycle, they themselves became designers using the representation of the data (coloured light) as a design material by each user to produce a specific emotional experience for their future self.

Similarly, we also designed Ovum and Gut Feeling to afford specific emotional reactions to biodata. Ovum is deliberately designed to offer a romantic experience of fertility tracking; thereby fitting the biodata as a material to the context in which this data will be used, i.e., to create a romantic context in which to have sex if the data shows that the user is fertile.

Although Gut Feeling is a non-functioning prototype (in that we cannot be sure that the growths in the petri dishes do in fact originate from gut bacteria), the design uses a "wizard of oz" method to offer the user a chance to reflect on the relationship between their gut health and mental health, or more broadly on the mind/body connection. The Loupe used to examine the petri dish makes a reference to jewelers peering at precious gems and diamonds. In this design, gut bacteria is allowed to live a life of its own and bloom outside of the body and then literally held up to the light. It is presented as a precious specimen that allows for a moment of intimate reflection. The multiple specimens collected over time are placed next to each other on the lightbox and tell a story to the user about their past and present mental and physical states. It is the differences between these specimens that become the biodata – is it possible to see the effects of a stressful meeting two days ago compared to a day walking in the countryside in the growth patterns of the bacteria?

### 5.2 Subjective Temporalities

A key aspect of the approach of using the temporal qualities of biodata as a design material is that these devices would produce different results for each user, and even different results for the same user over time. This approaches centers the fact that bodies differ across populations, and that bodies change over time. This means that interactions between the body and devices would also change over time. Ovum will show a different constellation of crystals (or no crystals at all) when used on different days of the menstrual cycle. Technologies that acknowledge that the body using them is in a state of flux

are in some ways alive. They react to and adapt with the body interacting with them. This represents more entangled and symbiotic understanding of the relation between people and technologies than we use today in HCI.

### 5.3 Designing with Analogue vs Digital Data

When considering data as a design material, what is classified as "data" is an interesting aspect to consider. In this paper I do not make a distinction between analogue and digital forms of biodata as a design material. This is because crystals in saliva, the shape and colour of the growth of bacteria collected from the gut via the breath, and the coloured light related to position in the menstrual cycle all provide information about the body – which I believe is the primary definition of biodata.

However, there typically are differences between the nature of analogue and digital data. Analogue forms of data have not yet been processed, and are typically "raw" – i.e. some particle of bodily fluid or material. Digital forms of data about bodily process have been through more stages of translation through quantified calculations and binary models [6].

Although the three examples given in this paper represent both digital (ambient cycle) and analogue (Ovum and Gut Feeling) forms of biodata, these examples are more related than one might think. In Ambient Cycle, a subjective experience of the menstrual cycle is translated by the user into their choice of coloured light as a data. Although analogue data (saliva and gut bacteria) is the focus of the design, Ovum and Gut feeling have also been through some aspect of translation in the process of designing with the biodata as a material. Ovum uses a lens to magnify the sample and a bright LED light to project a silhouette of the saliva sample out into the room, and Gut Feeling transforms a tiny speck of invisible gut bacteria on the breath to a living form growing and multiplying cells in the petri dish visible to the naked eye, which is then back-lit by the light box for added impact. The Loupe component also uses a lens and offers magnification of the gut bacteria sample.

Ambiguity and openness occur more readily when designing with analogue forms of biodata, since the person observing the analogue data has to denote information from the raw material they are presented. This was one of the motivations for exploring the saliva tracking fertility tracking method; that the user was positioned as an expert in their own data [3, 4]. However, Ambient Cycle was also designed with the intention of allowing the user freedom in how they translated their own data into a display which best suited their experience of their menstrual cycle, rather than fitting their menstrual cycle into pre-determined models used by conventional period tracking apps [7]. Ambiguity and openness were used to limit the stages of translation between the menstrual cycle and the data representation.

### 5.4 Implications of This Approach – Negotiating Perceptions of Accuracy and Validity

Ovum and Ambient Cycle were both deployed in user studies [3, 7]. One interesting aspect that might signal future areas of research on the temporal qualities of biodata as a design material is how this approach produced devices that were perceived as less accurate and valid than their more utilitarian counterparts.

One participant of the four month long Ambient Cycle study said "but then I actually had my period, so the lamp was more accurate than the app… But that's also a weird way of looking at it. Like the app is the correct... I mean it's my body that should be correct". She communicated surprised when Ambient Cycle ended up being more accurate than her app. Her understanding was that, because of the way in which her data was represented as changing light rather than in an app interface or through quantified data, that this would be less accurate. This is in spite of the fact that Ambient Cycle was just as accurate as any menstrual cycle tracking app (though no method will be completely accurate since the menstrual cycle is rarely completely regular). In the same was as conventional apps, Ambient Cycle made calculations based on the

average menstrual cycle length of the user and cycled through the colours chosen by the user before beginning again at the beginning of the next cycle.

This was also reflected when deploying Ovum for four months with participants trying to conceive [3]. Although Ovum works in exactly the same method as a microscope – enlarging the saliva sample so that it can be inspected for crystals, it was perceived as being compromised in terms of its effectiveness. As one participant said "It's more like a soft science project in a way… What I first like enjoyed about it was that it was like a sculpture. Now it's more like "OK, this is not so handy." … Honeymoon phase is over. Now I just want it to be like what it is supposed to be.". In both cases, the way in which the data had been used as a material had influenced the perception of trustworthiness and accuracy.

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