Airea: Arts and Interdisciplinary Research

DOI: https://doi.org/10.2218/airea.2833
www.journals.ed.ac.uk/airea

ARTICLE

Data-driven visibility: maternal bodies

Alexandra Jønsson[a] and Loes Bogers[b]

Through artistic interventions into the computational backbone of maternity services, the artists behind the Body Recovery Unit explore data production and its usages in healthcare governance. Taking their artwork *The National Catalogue Of Savings Opportunities. Maternity, Volume 1: London* (2017) as a case study, they explore how artists working with 'live' computational culture might draw from critical theory, Science and Technology Studies as well as feminist strategies within arts-led enquiry. This paper examines the mechanisms through which maternal bodies are rendered visible or invisible to managerial scrutiny, by exploring the interlocking elements of commissioning structures, nationwide information standards and databases in tandem with everyday maternity healthcare practices on the wards in the UK. The work provides a new context to understand how re-prioritisation of 'natural' and 'normal' births, breastfeeding, skin-to-skin contact, age of conception and other factors are gaining momentum in sync with cost-reduction initiatives, funding cuts and privatisation of healthcare services.

Keywords: Data, data visualisation, the body, critical inquiry, algorithmic culture, feminist art

Introduction: Living Computational Culture

This paper discusses the making of the artwork *The National Catalogue of Savings Opportunities: Maternity, Volume 1: London* (2017) (the 'savings catalogue' hereafter) by art collective the Body Recovery Unit founded in 2017[1]. It is a part of a ongoing collection of experiments exploring the rise of computational culture in the UK National Healthcare Service (the NHS hereafter). The savings catalogue specifically focuses on maternity services, where we have examined the online databases and public reports, and digital infrastructures that shape everyday processes of the maternity ward and vice versa. The savings catalogue raises new questions regarding computational vision: what does it mean to be visible or invisible to a database and what are its ways of constructing views on maternal bodies? We discuss the implications of such *data-driven visibility* in the context of maternity healthcare and explore how feminist art methodologies may carve out new positions for looking at the social and political implications of data and its increasing relevance in healthcare governance.

We will unpack the methods, concepts and materials used in our inquiry, cover the discourse and definitions of 'data', its different forms and processes, and address how artists across disciplines have used digital data in their practice. Moving beyond the idea of producing artworks - we explore how feminist art practice can be used to study the bodily and social biases emerging from computational culture, shifting the aim of the artwork towards the process, rather than the finished work.[2] This entails considering how the physical and conceptual forms of art

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[1] The Body Recovery Unit (BRU hereafter) is an artistic research unit established in 2017 as a part of a research collaboration between Alexandra Jønsson and Loes Bogers. The pair have joined their interests in feminist practice, exploring new socially and politically relevant artistic forms in their work as the Body Recovery Unit which developed as a part of Jønsson's PhD research Body Politics of Data at Westminster University and Bogers' research on visual methodologies and critical making pedagogy at the Amsterdam University of Applied Sciences.

[2] The work *The National Catalogue of Savings Opportunities: Maternity, Volume 1: London* (2017) referred to in this article is a first printed iteration from a series of experiments in using different visual typologies to explore the effects of data-driven polices on individual bodies. The current format is printed and binded in A4, however the final print is designed as smaller flipbook format

making can invite the public into the processes of researching and finding out about computational culture and consequently learn about their own data. The work is brought into contact with a growing body of theory addressing technological bias, drawing in methodologies from Science and Technology Studies, feminist theory, and critical software studies to explore how practice-led research can make use of theoretical tools and benefit from connecting with theoretical positions.

Devising ways of seeing: maternal bodies

Within the field of feminist art practice artists have refined ways of visually exploring and unpicking the ways in which the gendered body has been defined and occupied by the interests of others, such as Barbara Kruger's work *Untitled (We won't play nature to your culture)* (1983) shown in figure 1. The reproductive body in particular has always been a site of struggle. Historically, it has hosted the battles of medical practices, such as obstetrics over women-led non-medical practice of midwifery, and has been subject to decision-making hierarchies of both age, gender, and class. In Western Europe, male physicians started to move into the practice of childbirth in the early 18th century as new medical instruments such as the *forceps* were invented by families of physicians tending to child births at the English courts. The introduction of the forceps marked a series of shifts in the formation of professions around the phenomenon of childbirth, where male medical professions and the traditionally female midwives struggled over first rights and access to the pregnant body to assist in deliveries. The pregnant person's body became a central site of professional battle, while the pregnant person's agency was slowly lowered to the bottom of the hierarchy.[3]

Instruments and technologies have always played a central role in upholding such hierarchies. When the forceps became public knowledge, after having been kept secret by its wealthy inventors for more than a century, midwives were not trusted to use the potentially life saving tool (Laycock 2014, Wilson 1995). Other examples, such as the stethoscope, invented early 19th century, allowed caregivers to hear the baby's heartbeat. Later on, the technology of ultrasound imaging in the mid-20th century allowed the medical expert to "access" the womb remotely, affording physicians to surpass the expecting mother's experience of the baby, seeing directly into her body. In this way, technologies create positions of power, between who can *see* what, depending on who is handling the technology, and posit skills to read its output, introducing a lines of machine agency in the practices of birth.

The creation of such devices for clinical observation have radically changed how pregnancy and childbirth is conceptualised until today (Gammeltoft 2007). Childbirth practices and bodies are currently more affected by instruments than ever, and a large part of these processes are not only tangible medical devices, but also the mobilisation of small bits of demographic and medical data produced in and around care processes into larger policy making initiatives. In this paper we discuss a period of research in which we employed art-based methodologies and feminist strategies to specifically examine how data is captured from the pregnant body, and how it is subsequently formed into *digital corpora* or *data doubles*: the proxies by which we see bodies through the lens of a database. We trace and visualise the forming of such aggregates of digital corpora, and explore what role they play in how healthcare is organised around individual bodies, and turn, whose interests they serve.

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[3] In this article, when we talk about pregnant bodies rather than pregnant people, it is to underline the fact that such battles in fact reduce a pregnant person's lived experience to a mere site where a child can grown into being, and where struggles relating to other agendas might be played out.

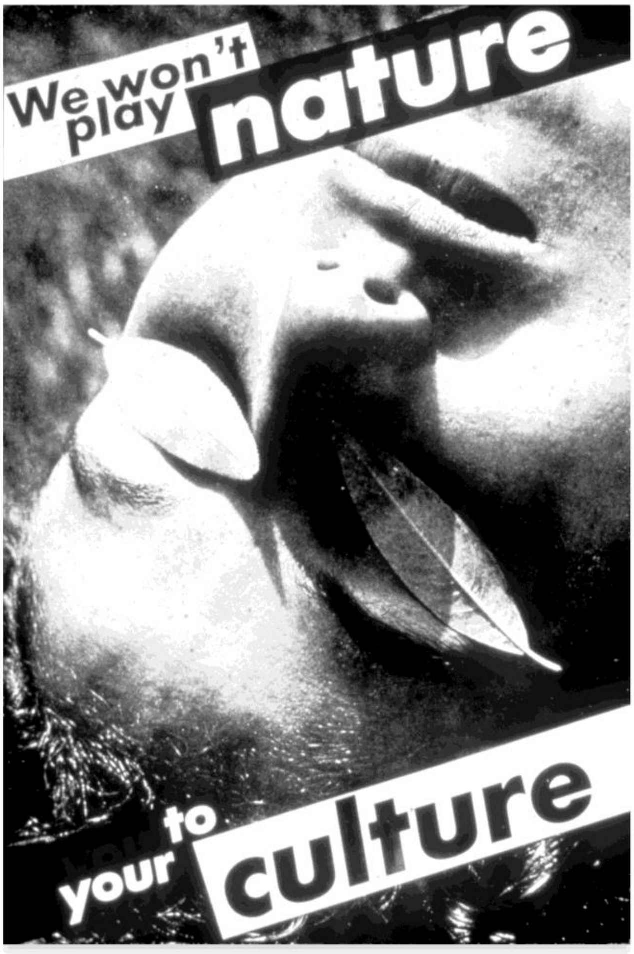

Figure 1. Untitled (We won't play nature to your culture), 1983,
Gelatin silver print, 185,4 x 124,5 cm (framed), artwork by Barbara Kruger
Source: Sprüth Magers

Artists using data

Artists have for decades developed novel ways of using data as a part of their visual practice by drawing on scientific tools and methods. Artist Tom Corby describes artistic approaches to data and information visualisation as methods that often provokes questions about the limits of representation, rather than serving analysis or clarity of interpretation (Corby 2008, 467). These questions are becoming increasingly important because data is rapidly growing in numbers and scale with about 90% of all the world's data has been created within only a few years, and by 2025 the world will be creating 163 zettabytes of digital data a year[4]. Data is often discussed in terms of its relation to rhetorics and knowledge, in terms of what it *is*. In the book *The Data Revolution*, Rob Kitchin describes data as "[...] that which exists prior to argument or interpretation that converts them to facts, evidence and information" (2014, 3). One could also say, that data is a kind of raw material, which needs processing in order to become knowledge.

The practice of visualising data is described by Stuart Card, Jock Mackinlay and Ben Shneiderman as "[...] the use of computer-supported, interactive, visual representations of abstract data to amplify cognition" (1999, 7). This

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[4] "Andrew Cave, "What Will We Do When The World's Data Hits 163 Zettabytes In 2025?," https://www.forbes.com/sites/andrewcave/2017/04/13/what-will-we-do-when-the-worlds-data-hits-163-zettabytes-in-2025/#38fa3aae349a (17 July 2017).

approach is referenced widely by artists and designers whose work generates better or more intelligible knowledge from data as raw material, such as data visualisations that reveal the complexity of datasets (Bihanic 2015; Tufte 1983; Steele & Iliinsky 2010; Segaran & Hammerbacher 2009), or the relatively recent strand of work on dataphysicalisation, a method aimed at giving data physical form (Jansen et.al. 2015; Stusak 2015). What these examples have in common is that they draw on scientific methodologies, and orient the work towards visualising or making tangible what the datasets 'hide' from the human eye.

However, as suggested by Corby (2008) artist-led explorations of data may invoke questions of the limits of such representation and the perceived knowledge that can be generated from it. In his own work *Maxima-Minima* (2015) a complete dataset for the project *The Northern Polar Studies* (2015) is printed out and piled meticulously on tables in the gallery space, revealing the sheer volume of data accumulated in the project.[5] In a similar vein, Natalie Jeremijenko's early work *Live Wire* (1990-1995) appropriates internet traffic data to reveal the 'rhythm' of the internet: a dangling wire acting as a real-time traffic indicator. More recently, artists have drawn from the increasingly popular *quantified self movement*; that is the tracking of streaming data, producing (often proprietary) metrics of life (Abreu 2014). An example of such work is Laurie Frick's *Walking* (2012-2015), created using the artist's own walking pattern over time as the basis for her large scale collages (Urist 2015). In these projects we see less emphasis on using data visualisation to support analytical tasks, and instead an increased focus on formulating conceptual forms, that reveal what the world looks like through data: its scale, rhythms and relations.

Some of these issues have been explored in a body of socially engaged practice, such as that of YoHa, The Office of Experiments, Artist Placement Group, and Deep Lab, who more explicitly explore the technoscientific forms of hierarchy including the military-industrial complex, privacy, security, surveillance, and anonymity, refocusing the debate of data on its relations to wider structures of power. YoHa's work focuses on public databases, such as the project *Expenditure Rider* (2010), a pneumatic seat controlled by mutations in the Bristol Council's expenditure data, or the reverse engineering of healthcare databases in *Database Addiction* (2015-2017). These artworks explore the socio-political role of databases in society, actively leveraging artistic methods to investigate databases collaboratively. They do so by drawing on the insights of admin workers, computer programmers, social workers, clinical personnel and members of the public in the process of making work, which in turn contributes to the context of the enquiry. It is within this model of collaborative investigation that we situate our own practice and approach to using artistic methods to examine computational culture.

The project *the National Catalogue Of Savings Opportunities. Maternity, Volume 1: London* (2017) specifically seeks to visualise the bodily effects of data-driven methods in healthcare governance. How might the increasing demand for both workers and expecting families to produce large amounts of data be impacting on daily routines and service user relationships? We use methods such as drawing, concept-making, making and collaging as practical and emotional wayfinding devices, as we trace the lands of datasets, policy reports, and technical manuals back to individual bodies. This allows us to explore which formats of 'making visible' we can use to understand the implications and reach of population metrics, and the new relationships they enable between our own bodies, other individuals, institutions, and corporations. This is explored by drawing on our own experiences, conversations with clinicians, activists, and service users to compose a thorough understanding of the subject matter. Rather than the finished work, the process of investigation is at the core of our artistic practice, with pedagogy and critical reflection as main drivers in our explorations of how computational culture affects bodies in new ways.

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[5] The *Northern Polar Studies* (2015) was made in collaboration with the British Antarctic Survey. The work animates a time-series of climate data from the arctic between 1984 – 2012 derived from drifting buoys and satellite measurements of sea ice age controlling a looped 3.12 animation of the ice retreating.

Practical and theoretical feminist strategies enable us to understand the nature of these new relationships, and challenge the discourse of the digital in which questions of *difference* including gender have systematically been erased. Constructs of gendered bodies often remain latent within technical systems, and it is necessary to examine how they structure and classify the bodies they record, and look to the agency such digital corpora have in the world. Some of these are more obvious, such as the formatting of databases according to heteronormative ideas of reproduction evident in examples such as failure to record the gender of the pregnant person (assuming they are cisgendered women), absence of partner in the maternity record (apart from one question regarding their employment status), and the binary record of the baby's sex at birth (in terms of phenotypic sex, which is determined by looking at external genitalia alone). When digging deeper however, we encounter more complex and refined systems enclosing the bodies they record in ways that are less recognisable at first glance. Data plays a central role in how bodies are able to figure in healthcare metrics, which often are taken at face value or fact. However, the idea that data represents facts or somehow can function as evidence, have been challenged by theorists who examine data as cultural matter.

How data is made: from raw to cooked

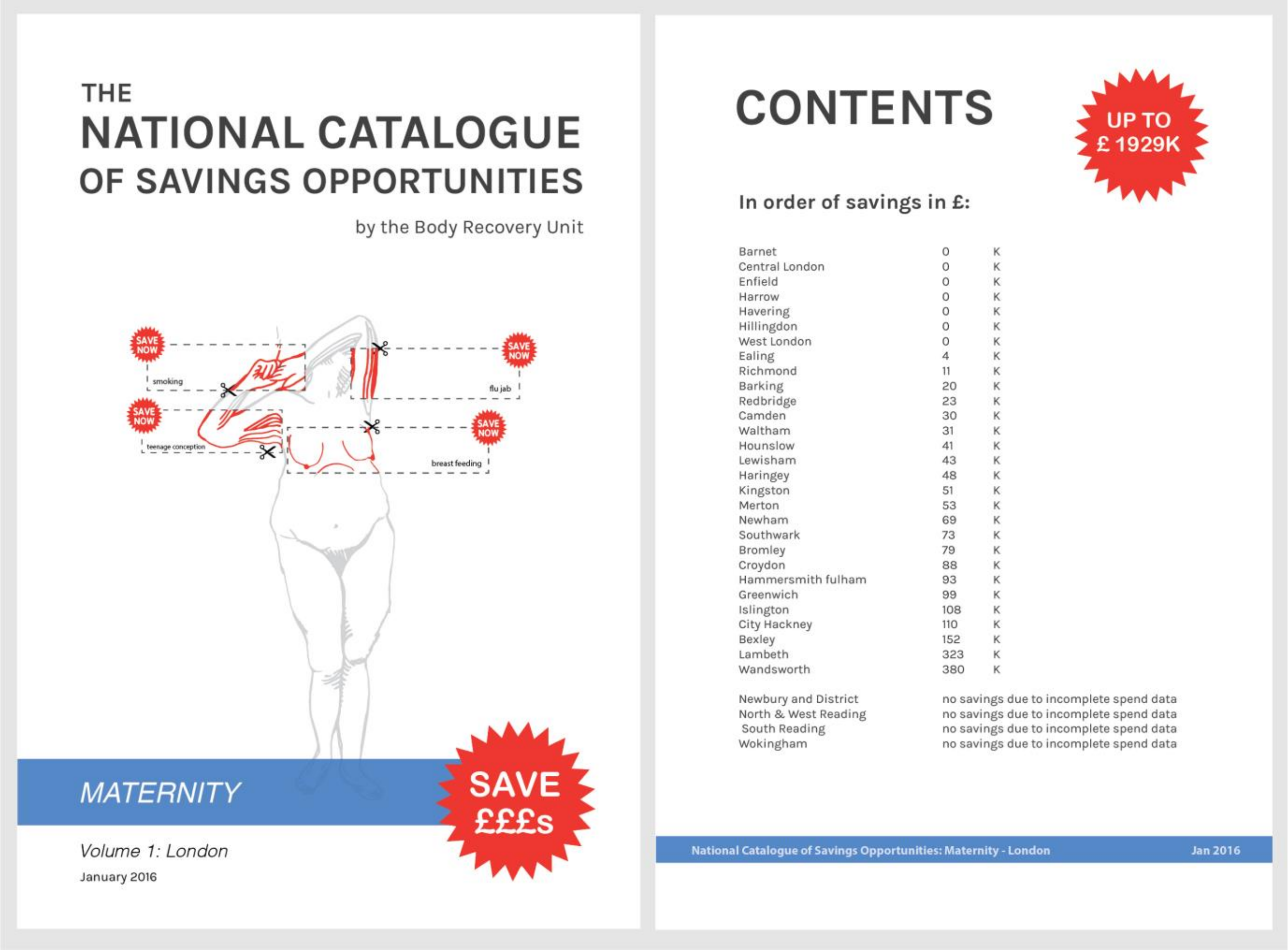
In her book *Raw Data is an Oxymoron,* Lisa Gitelman suggests to look at how data is *produced* to begin with. She argues that data must always be seen in context, and include the machines, processes, and people who have been instrumental to the making and shaping of such data (2013). For our research, this meant looking specifically at the digital data produced around pregnant people's bodies in the processes of antenatal and neonatal care and childbirth within the NHS. This data is stored centrally in a nationwide database employed by *NHS Digital*. Maternity data is conventionally produced to help manage, distribute, and organise reproductive care, and as such reflects not only the *data subjects* - the families receiving care - but also their relationship to the national institution of public health: the connected organisational bodies, and the hospitals themselves. These relationships determine the way in which digital data is used to represent reproductive bodies as *digital corpora,* also described as *data doubles* by Kevin Haggerty and Richard Ericson (2000). Kitchin describes how data can be seen as the building blocks for knowledge creation when he explains:

> Data are commonly understood to be the raw material produced by abstracting the world into categories, measures and other representational forms – numbers, characters, symbols, images, sounds, electromagnetic waves, bits – that constitute the building blocks from which information and knowledge is created (Kitchin 2014, 1).

What he describes as abstraction processes, are what enable the *digital corpora* to materialise, which provides us an understanding of what data *are.* According to Gitelman, it has become increasingly important to also understand what data *do* (2013). Most technical procedures however, are not transparent or available for public examination, which makes the means through which one comes to 'know' through data inaccessible. Taina Bucher's suggests new methods for examining what the seemingly impenetrable "black boxes" of algorithmic culture *do* in her book *If...Then: Algorithmic Power and Politics.* She argues that "[w]hile we cannot ask the algorithm in the same way we may ask humans about their beliefs and values, we may indeed attempt to find other ways of making it "speak" (2018, 100-101). In the making of the savings catalogue, we have explored what other ways we can make the algorithm behind cost-optimisation numbers 'speak'. For example, by tracing from whom and what situations the data is first produced, by connecting the managerial cost savings reports to these daily actions of data collection and administration on a national level, and in turn tracing how such big data sets connect back to the way care is structured, organised and given at maternity wards.

The National Catalogue of Savings Opportunities. Maternity, Volume 1: London

The National Catalogue of Savings. Maternity, Volume 1: London (2017) is an investigatory artwork that examines aspects of the recently introduced public healthcare model in the UK National Healthcare Service (NHS hereafter) called 'RightCare'. The artwork is a 106-page visual analysis of suggested relationships between individual body parts and their price-tag as defined by the NHS' analysis of spending patterns. The work is created for expecting families' eyes and designed to be printed and placed in the waiting room in antenatal clinic across London. It enables pregnant people to see which parts of the body have the most cost-saving potential in the context of healthcare commissioning systems such as the one propagated through NHS RightCare. It shows them that they could personally save the NHS an arm or leg, by 'simply' choosing to breastfeed, or wait a couple of years with having babies or alter their behaviour altogether. Figure 2 below shows the cover page and content pages of the catalogue, and figure three is a selection from the 106-page catalogue covering CCG Barking's data.



THE
NATIONAL CATALOGUE
OF SAVINGS OPPORTUNITIES

by the Body Recovery Unit

MATERNITY

Volume 1: London
January 2016

CONTENTS

In order of savings in £:

Barnet	0	K
Central London	0	K
Enfield	0	K
Harrow	0	K
Havering	0	K
Hillingdon	0	K
West London	0	K
Ealing	4	K
Richmond	11	K
Barking	20	K
Redbridge	23	K
Camden	30	K
Waltham	31	K
Hounslow	41	K
Lewisham	43	K
Haringey	48	K
Kingston	51	K
Merton	53	K
Newham	69	K
Southwark	73	K
Bromley	79	K
Croydon	88	K
Hammersmith fulham	93	K
Greenwich	99	K
Islington	108	K
City Hackney	110	K
Bexley	152	K
Lambeth	323	K
Wandsworth	380	K
Newbury and District	no savings due to incomplete spend data	
North & West Reading	no savings due to incomplete spend data	
South Reading	no savings due to incomplete spend data	
Wokingham	no savings due to incomplete spend data	

National Catalogue of Savings Opportunities: Maternity - London Jan 2016

Figure 2. Cover page and contents page from *The National Catalogue of Savings Opportunities. Maternity, Volume 1: London* (2017) by Alexandra Jønsson and Loes Bogers

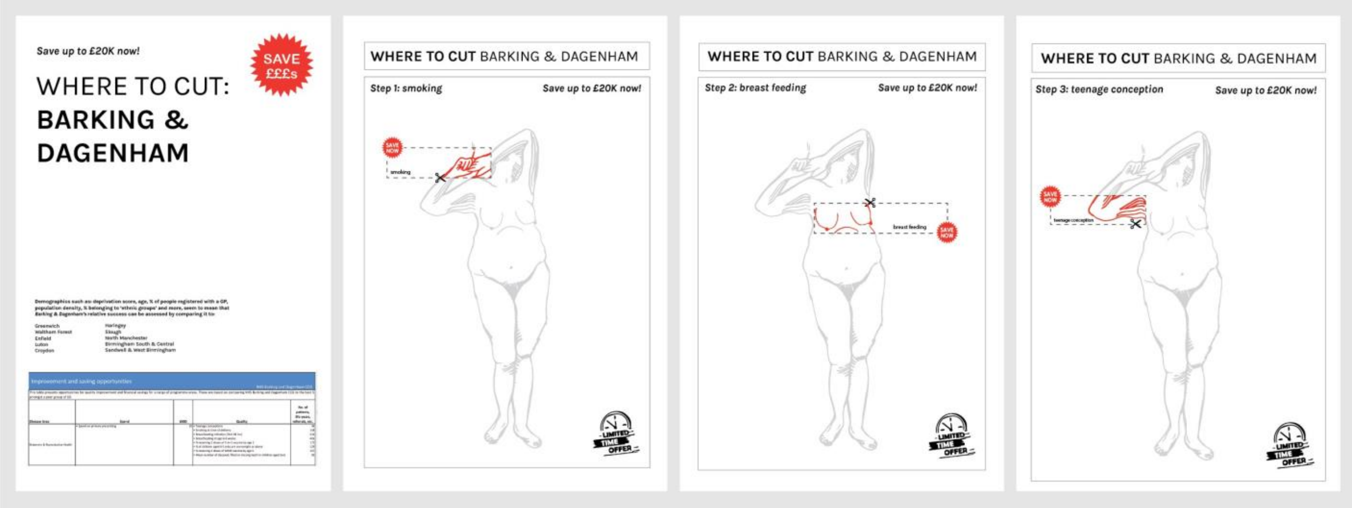


Figure 3. Excerpt from *The National Catalogue of Savings Opportunities. Maternity, Volume 1: London* (2017) by Alexandra Jønsson and Loes Bogers

The savings catalogue is made using cost-saving reports called *Where To Look Packs* from the NHS range of 'intelligent products', which are digital products, such as predictions, performance graphs, future scenarios and other data visualisations. The *Where To Look Packs* are periodically issued to regional Clinical Commissioning Groups (CCGs), or clusters of local hospitals as a managerial tool to align hospital spendings with the RightCare predictions. The RightCare programme consists of three phases to model change in the healthcare system, 1) Where to Look, 2) What to Change, 3) How to Change. Phase one - the 'diagnosis' of where hospitals can spend less money, is heavily reliant on quantifying bodies and behaviours of the population, in order to optimise spending patterns and quality of care. *Commissioning for Value* reports, the performance reports periodically distributed by NHS RightCare situate a CCG within a cluster of the ten most comparable CCGs based on the demographic composition. It also states what type of cluster a particular CCG cluster is, for example: "deprived urban areas with younger people and ethnic diversity, particularly Black." In the *Commissioning for Value* pack, you can see how the CCG in question, stacks up to CCGs in in the cluster (consisting of commissioning groups with similar demographics) on various specific indicators such as breastfeeding initiation, smoking at time of delivery, flu vaccine and <18 conceptions rate. This is one of the many graphs in the report, showing how well the CCG is performing. In addition to the Commissioning for Value Reports, another type of report is sent to hospital management, where this concrete "improvement opportunities" are expressed in terms of quality improvement as well as spend difference, expressed in 000s of pounds.

While the metrics produced in the RightCare programme are also aimed at identifying problems and opportunities for higher quality of care and eliminate care variations within the healthcare services, we have chosen to focus on connecting the predicted costs and values to the bodies that are expected to make such savings. Our work focuses on inviting the public into the debate about how new technologies are introduced, and openly discuss the biases and unintended side-effects that we will only come to know as they exist in situ, in real life environments. By using the form of a product 'savings' catalogue' we invite the viewers to see the pregnant body as a place of national economic urgency whose free-flowing data is the foundation of the metrics of cost-savings and directions for care optimisation. Visually, the body parts are marked out using cutting lines indicating the number of Great British Pounds can be saved according to the cost-saving data corresponding with a particular borough. As you flip through the book, you realise that the body remains static, while the cutting lines move rapidly across the body as you move through the different boroughs of London. This is not because people have the same body across London, but because the artwork reveals the moving eye of the cost-savings database, rather than the bodies itself. In fact, the database treats a body by proxy, according to the data it records about it, and as such produces a generic view across the unique bodies of the population: it creates an aggregate of the data double produced for each individual.

We chose to visualise these reports and their relationships to data production practices in healthcare, because they show what such data paired with algorithms are used for. Through experimentation with visual tactics, we explore which data is collected in maternity services, and the lines of actions this affords, rather than what the data can make known by itself, as artefact seemingly separated from the context of its production. The project outlined here is less about visualising individual healthcare data, and more about exploring how maternity databases are constructed to see some bodies more intensively than others. As such, the project calls for new and critical examinations of the perceived neutrality of data and visualisations thereof. The making of this artwork is highly context-dependent, as is revealed in the following discussion of the process of making the work. Exploring what data does - instead of what is - requires us to look at the context of this data and leads us to ask questions such as; where it is made? How is it processed? What it is used for? As a consequence, data is positioned as material that is continuously made, shaped and moulded, rather than any kind of 'raw' material or objective entity. The artwork in fact functions more as a connecting object, than one of revelation: it shows how administrative agendas of hospital management using the digital corpora, are fundamentally entangled with the actual bodies receiving care. The aim of the work therefore is to connect families receiving care with the ways in which their data is used, by designing the artwork for showcase at maternity departments in the London boroughs affected by the RightCare programme.

Politics of data: from raw data to predictive product

The CCG savings reports that we used for the making of the savings catalogue, are a result of complex and opaque relationships between datasets, statistical operations, and administrative and consultative processes within a larger algorithmic machinery. NHS RightCare describes their approach as "designed to help entire health economies take action to increase value in healthcare provision and to reduce unwarranted variation" (Cribbs 2017). There is however no certain way of knowing exactly how algorithmic models plough through the data to find patterns and correlations that result in information with any kind of predictive value about future spending, let alone saving suggestions.The RightCare approach has garnered critical reviews, such as from researcher Greg Dropkin, who calls the models used by NHS RightCare into question in his article *RightCare: Wrong Answers* when he writes "until public health statisticians with access to the data examine its quality and the methodology, claims by NHS RightCare to be 'a proven approach' are unsubstantiated" (Dropkin 2017).

As Dropkin suggests, the process of constructing the areas of cost optimisation is not quite transparent, so other ways have to be invented to make the algorithm "speak" and reveal itself. This led us to look at the context in which this data is produced, such as the everyday routines of consultation and care, as well as the artefacts[6] that are used in this process. A similar strategy is advocated by Taina Bucher, who recommends examining "semiotic clusters" around the data systems, such as their technical specifications, information standards, press releases, company briefs, and media reports (2018: 87). In the context of maternity healthcare, such artefacts may include forms used by midwives, questionnaires, maternity notebooks, and also digital objects like national information standards such as the *Maternity Services Data Set*[7] that hospitals must adhere to in the UK. From the perspective of a family attending antenatal care, we began to look, how is a body described in data in the first place? The story begins with a visit to the maternity ward.

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[6] We describe the digital or analogue data capturing tools, such as questionnaires, forms, dropdown menus, etcetera as artefacts.

[7] The *Maternity Services Data Set* (MSDS) specifies the data each maternity ward much capture throughout a pregnancy. This information standard was implemented nationwide in the UK as of 2014 https://digital.nhs.uk/data-and-information/data-collections-and-data-sets/data-sets/maternity-services-data-set (17 July 2017).

WELCOME TO THE
MATERNITY WARD!

Expecting a baby? Are you a budding dad? Supporting your best mate's pregnancy? Or are you someone who is just curiously pondering about family making?

We welcome you to the maternity ward!

11-07-2017, Antenatal clinic

Oh, you are 10 weeks pregnant?! Congratulations, that's really wonderful love. Ah, you would like to book an appointment, yes, just a minute love. We have about 130 questions to ask you, so I'm afraid we won't have time today. Ok…Next week, Tuesday 11:30. No, we don't have anything after 5pm, sorry love. Oh it clashes with work, yes isn't it just! Well well, you are starting a family now, you'll have it all to come, don't you worry, we look after you very well here. Alright then, please fill out this form, yes also telephone number. Lovely, all booked!

28-07-2017 - 11:25 Antenatal clinic

Welcome love, here is a little plastic container for you, just pee in this pot for me, yes please, just a bit, yes pee for a second, then collect the middle pee. Don't worry we only need a small amount love. If you want to have a confidential chat with me in private, just put a dot on your urine test, we will do it discretely. Thank you love, that marvelous, take a seat, the midwife will call you when she is ready for you. [...] Come in! Please take a seat, and who do we have with you today? Nice to meet you Selma, are you the other parent to the child? Lovely, sit down. Let me just make a note of your relationship somewhere in the margin here to make sure the midwives you will meet know you are the parents and don't assume anything wrong. Well, I have some questions, let's begin: address, religion, occupation; is that part time or full time? GP number [...] yes let's list them all. What shall I write down under ethnicity for you? Alright, let's see that one is not listed here… okay we'll tick the 'other' box for that . How long have you been in the UK for? Ok, lovely. [...] Now, let's move right on through, yes it's quite a lot isn't it. Let's try to make this as painless as possible, just to get down the details to make sure you will get just the right care along the way. Are you a smoker? We can refer you to our smoking clinic, anyone at homes smokes? [...] About the living situation: are you a homeowner? Private renting? Or still living with the folks perhaps? Ah I see, yes yes being on the job hunt is hard on the savings. [...] Do you need any assistance with benefits forms? I can write it down right here so we can have someone call you to work that out, ok? [...] Alright, let me just record your urine test, that looks lovely. Very good, you did well love. I only have a few questions left. Let's see the next question, yes medical history of the family… So with that we mean things like diabetes, depression perhaps, or other mental illness or other conditions running in the family that you know of? [...] Thank you love, yes please go to reception and book your next appointment. No worries love, bye bye.

11-08-2017 - 10:34 Antenatal clinic

Yes, come in! Oh you are back, is everything alright love? No you are not disturbing me, I'm just finalising all your data, so we can put you on a cost pathway, yes, pregnancies costs different amounts, depending on what type of care is needed, what kinds of perceived risks are present. But there's no need for you to worry about that, they won't bother you with that, it's all just internal administration. Let's do the regular check-ups today, did you bring another urine sample? [...] Lovely, I'll send all of this information off by the end of your birth. It's funny you should ask, yes some of it are in paper form, only certain parts of your data gets sent to the government, actually, now that you are asking, your data will travel a very particular route. After your birth, i will send all the paperwork to Annie, she works over at admin, and she codes all the paperwork so the computer can read it. Yes, she is called a coder. Yes they collect it from all the hospitals it's all the same everywhere nowadays. The local commissioning groups use it to see how much money the different types of births costs, how they can save money and improve services, and they also look at if everyone is receiving equally good care, making sure you get just the right care no matter what NHS branch you step into… Yes, its clever, very clever. But also a lot of work for us to be honest, dealing with all these notes…. Yes love, I do apologise, what did you want, ohhhh, yes, you sure did leave your scarf over here. Ok then, you take care love, bye bye.

Figure 4. *Welcome to the maternity ward!* Graphic fiction
Source: Alexandra Jønsson and Loes Bogers, 2017

To describe this process we created the graphic fiction *Welcome to the Maternity Ward!* (Figure 4). It is created from collaging together our personal experience of producing such data during pregnancy, conversations with midwives, and maternity groups, and examining the questionnaires used during the first meeting with maternity care. The first meeting is a registration meeting with a midwife who creates an analog *data file* or *data double* for the pregnant person, which enables access to care during pregnancy. At a later stage, the clients' responses and the midwife's handwritten notes are manually encoded into a computer-readable format using a standardised transcoding procedure (SNOMED CT, see below). The data is captured by following a very specific protocol for maternity care that starts with an extensive set of questions built directly upon the Maternity Services Data Set information standard mentioned above. The pregnant person is provided with a pregnancy journal, in which information from tests and screenings, such as blood tests, urine samples, blood pressure, ultrasounds and all the medical procedures executed around the delivery, are recorded and stored. All the data captured throughout the pregnancy follow the Maternity Services Data Set: the *information standard* or classification system developed by the NHS that prescribes in detail *which* information about each pregnancy should be submitted to a central, nationwide system by each NHS maternity ward.

The MSDS information standard builds on yet another digital artefact: clinical vocabulary SNOMED Clinical Terms, an international computer-processable collection of medical terms[8]. SNOMED CT is a classification system that defines hierarchies and categories of medical information, and prescribes *how* medical information ought to be transcoded from the handwritten notes into standardised numerical codes so they can be stored in an electronic format and appended to the nationwide NHS health database. In theory these formats make all the data entries concerning pregnant bodies uniform, and therefore *comparable*. They define with great precision what information can be put into the machine - which questions must be asked and which answers are possible (and which are not) - and in exactly what form (yes/no, a number or value, limited multiple choice options). Each question or data point encountered throughout antenatal and postnatal care corresponds with a number or code, and each question comes with a number of predefined answers, that each have their own code as well.

Besides the handwritten notes, most of the artefacts *resulting* from and used to act upon data are not used for direct care at the maternity ward, but for hospital management. At the end of the first registration appointment the data of the expecting person is analysed to calculate how much a hospital gets paid for providing antenatal care for that particular pregnancy. Based on the information in the maternity notebook, the NHS makes a prediction in the early stages of the pregnancy that puts a particular pregnancy on one of three cost pathways, depending on whether the pregnancy is considered low, medium or high risk.[9] Perhaps surprisingly, the hospital gets paid, not based on the actual care provided, but on a *cost prediction* made in direct relation with the *risk assessment* in week 10-14 of the pregnancy.

New administrative processes are thus created from the data produced: such as the hospital bills, and the NHS commissioning structure including the payment system. This shows how data produced around a pregnant person's body directly links to the creation of new managerial and economic processes in healthcare governance, which we will see are not based on actual costs, but on predictions. Because all NHS maternity wards follow the same information standard and submit their pregnancy data to the nationwide database, all pregnancies (and by extension maternity wards) can theoretically be measured up against one another, allowing algorithms to find patterns and correlations between them. The NHS RightCare *Commissioning for Value* and *Focus Packs* we appropriated to create the catalogue do just that: the reports are issued to each clinical commissioning group (CCG), in which hospitals *performance data* is made comparable, while also making suggestions for quality improvement and cost reduction based on the data.[10] The reporting happens to a level of detail where recommendations are made for each department of each CCG, one of them being the maternity services department. The information provided in such reports is reflected in the catalogue.

Looking at the practices behind data collection and processing in the context of maternity, we begin to see that data is a highly constructed material, increasingly in demand as patients and healthcare workers face administrative

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[8] NHS publishes details on the implementation of classification systems and standards through the NHS Digital Website: https://digital.nhs.uk/services/terminology-and-classifications/snomed-ct, see also: https://nhs-digital.citizenspace.com/data-set-development-service/msdsv2/ for the relationship between the Maternity Services Dataset (MSDS) information standard and SNOMED CT (27 July 2017).

[9] In a European policy study on the reform of the Maternity Pathway Bundled Payments introduced by the UK government in 2013, John Henderson describes the current factors for risk assessment in antenatal care, such as: complex social factors, obesity or underweight, physical disabilities and substance abuse, medical conditions and previous obstetric history (Henderson 2016, 9-11). A hospital gets paid less for a low risk pregnancy (one that is expected to require less resources) and more for a high risk one.

[10] These documents are publicly available via NHS Digital and are used by hospitals to understand how they can improve their services and reduce spending by looking at the data. More general reports that are issued are used to identify and address health inequalities, to warrant quality of care across the UK.

tasks of producing data for programmes such as RightCare: the body that is that is instrumental in the restructuring of the NHS. In "Sustainable Health Systems" a report from the World Economic Forum prepared in collaboration with McKinsey & Company, NHS's future investments and decisions are described as "driven by value and data" enabling a new care model which

> […] shift[s] healthcare out of hospitals into communities, spurring innovation through greater competition in delivery, introducing more humanized care into healthcare, and investing in behavioural change and prevention to diminish demand (2013, 9).

From this we see some of the objectives that go hand in hand with data-driven governance, such as competition, prediction and behavioral change in the population. All of the above can and should be rendered in a transparent manner for the public to gain insight, and critically considered in a time of drastic national healthcare restructuring.

Breast is best: bodies and decision-making

The data collage template that is repeated throughout the savings catalogue, renders visible the relationship between 'spend reduction' numbers in the reports and individual bodies and behaviours. By visualising these, we begin to see how data can be an economic resource or "agent of capital interests" as described by Kitchin (2014: 16). In the process of making the savings catalogue, we visually mapped the 'savings data' back into the body, attempting to figure out, which part of the body, and which of its actions were marked out in the dataset as 'cost-saving', or in what seems now to be rather euphemistic terminology: a site of value that needs to be made visible.

Looking at the body in the savings catalogue, some body parts can be seen to act as indicators of broader health measures, and in the context of cost optimisation policies, these can be targeted for financial gain. For example, the body parts occurring most often in the savings catalogue, are a pregnant person's breasts, because they hold the key to saving money, which is also reflected in an independent study revealing that breastfeeding could save the NHS up to 40 million pounds a year because it is known to reduce other complications, such as bowel infection, lower respiratory tract infection, middle ear infection and necrotising enterocolitis, and breast cancer (Pokhrel et. al. 2014). With this example we reach the point where we see that the small bits of information shared in a first meeting with a midwife to receive appropriate care play a role in larger economical and political questions such as the restructuring of the national healthcare service. What the savings catalogue expresses, is that these entangled interests are inevitably also felt at the level of the individual carrying a child. The materials we used to create the catalogue were the reports carrying savings suggestions - based on maternity data - that boil all this nationwide complexity down to a particular behaviors such as smoking, breastfeeding, flu jab uptake and the age of the person carrying the child. This implies a perspective on the pregnant individual that heavily foregrounds certain bodies, body parts and behaviors, making other aspects of the individual's lived experience less visible and therefore less important to evaluate or take into consideration. Philosopher Ian Hacking is describing the history of probability when he argues that the systematic collection of data collection has severe impacts on how we see our (pregnant) selves and others:

> [it] has affected not only the way in which we conceive of a society, but also the ways in which we describe our neighbour. It has profoundly transformed what we choose to do, who we try to be, and what we think of ourselves (Hacking 1990, 3)

Such framing of healthcare efficiency in terms of individual's behavior affords maternity data to be used as justification for attempts to influence, control or even discipline behaviors. The shadow side to this is that we might start to think that a healthy pregnancy is primarily a choice, open to each individual (that also will save everyone a lot of money), while overshadowing the fact that some of these practices, such as breastfeeding are heavily context dependent, and both practically, physically and emotionally demanding. It puts forward such simple indicators that there is a risk of foreclosing other ways to rethink healthcare efficiency in tandem with healthcare quality on a managerial level. Dropkin formulates such conclusions in different words, by describing the RightCare approach as "a type of benchmarking, a business concept", which has so far lacked extensive peer reviewing and transparency, and ultimately, he writes; "if RightCare is used to justify savings in NHS budgets, it is acting as a cover for cuts" (2017).

Kitchin describes how big data enables new forms of decision-making that are *data-driven*; where management models heavily rely on algorithms ploughing through big data to make predictions and inform decision making. He describes how the mode of production in the knowledge economy becomes increasingly data-driven, a development that turns data into an *economic* resource:

> [...] the production and analysis of data enables companies to be run more intelligently with respect to how they are organised and operate, promoting flexibility and innovation, reducing risks, costs, and operational losses, improving customer experience, and maximising return on investment and profits. [...] Data can thus be understood as an agent of capital interests (Kitchin 2014, 16).

Theorists such as Kate Crawford as well as Catherine D'Ignazio suggest that the starting point for critically examining the socio-political motivations of data means looking *beyond* the dataset itself. Crawford describes how big data often comes with "hidden biases" (2013) that mimic existing structures of economic and cultural privilege, visibility and space-taking, reminding us to not only look at what is *in* the big data, small data, but also at what is altogether left out. This is termed the *missing data* by D'Ignazio in her account of how data is represented, and she argues how we largely "accept charts as facts because they are generalised, scientific and seem to present an expert, neutral point of view", a fact she questions, because "[…] the perspectives of oppressed groups including women, minorities and others are systematically excluded from 'general' knowledge" (2015). Missing data could also be understood as the erasure of identities and bodies that are not recognisable by databases, such as experienced by the American transgender dad Evan Hempel, who had to change his healthcare ID to female in order to receive care during his pregnancy (McCormick 2016), having no recourse to public funds, or being undocumented[11]. What the savings catalogue attempts to render visible, are those very *particular* machine visions of the pregnant body and their processes of construction - rather than assuming that the data will allow us to see a neutral or general one. This in turn prompts questions of what might be left out or rendered irrelevant in the context of the system's intended use. What other agendas might it serve to present pregnant bodies in this way? Could it be that the pregnant body become a battleground for other competing interests once more?

Data-driven visibilities

Flipping through *The National Catalogue Of Savings Opportunities. Maternity, Volume 1: London* (2017) one gets a view of the differences between the different borough's projected savings potential were huge, ranging from 0 in Barnet to 380.000(!) pounds in Wandsworth's maternity departments alone. Why might the differences for savings potential be so big? When appearing side by side, the comparison between two London Boroughs, Croydon and Central London Westminster, a savings disparity becomes clear. In other words there is much more to save in Croydon, and perhaps therefore also much more reason, to monitor more intensely (Figure 5)?

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[11] Such issues are specifically addressed in the context of biometrics by Shoshana Amielle Magnet as the *biometric failure*, that affects women, people with disabilities and people of colour to a disportionate extent because the science behind the vast majority of biometric products "rely upon erroneous and outdated assumptions about the biological nature of identity" (2011, 20).

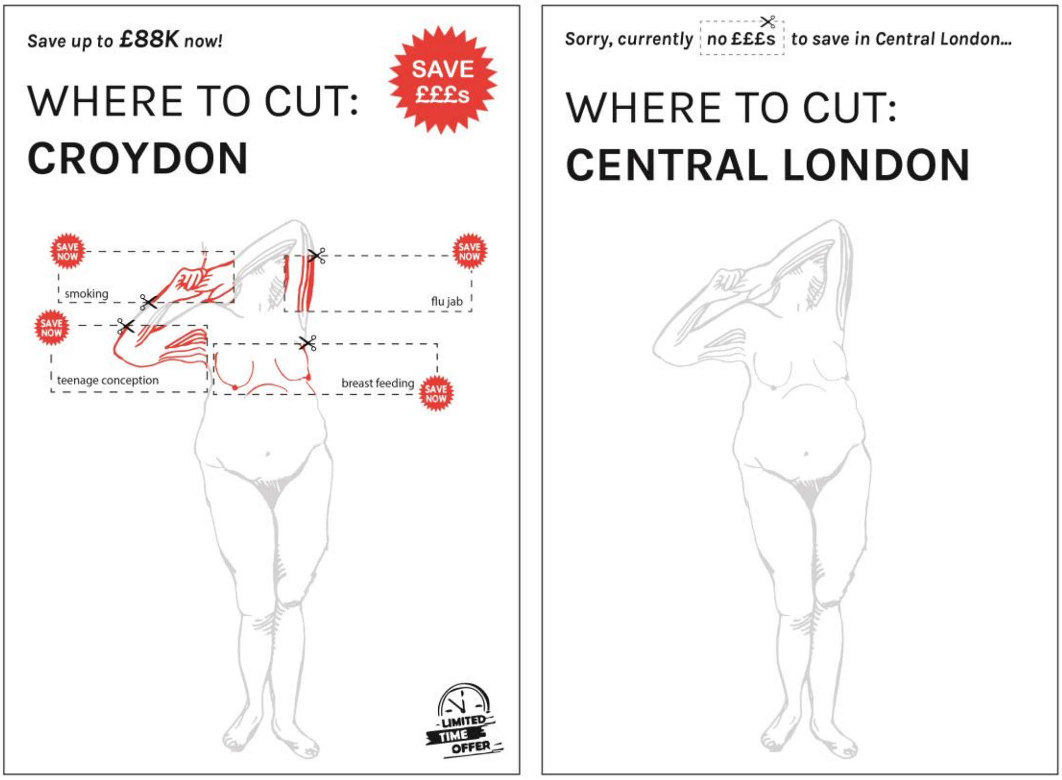

Figure 5. Savings catalogue pages from Central London and Croydon compared.
Source: The National Catalogue of Savings Opportunities. Maternity, Volume 1: London (2017) by Alexandra Jønsson and Loes Bogers

An interesting feature of developing alternative visual expressions of digital products such as the savings reports, rather than visualising the data itself, is that it can start to show how the data is used. Doing so brings into view the intention behind the production and cooking of the data, and draws attention to the fact that data-driven health optimisation inevitably happens along lines of geographical location due to the fact that maternity wards by necessity serve people in their surroundings. This prompts questions about who might benefit more than others, depending on their geographical location and its inevitable relationship to socio-economic status of the people involved. For maternity, most of the savings opportunities suggested by the database were related to behaviours, lifestyles and body practices of women, such as teenage pregnancies, weight, and smoking: aspects of life and social reality that are riddled with class, race and ability.

Through the making of the savings catalogue, a new concept of 'data-driven visibility' emerged as the artwork lets you in on which bodies and body parts are in the spotlight for financial reasons. By looking in the savings catalogue, we can see that the people who have bodies that can save the government the most money, are more visible. This insight allow us raise new questions about who stays *invisible* and therefore less affected by any cost-saving activities necessary to provide a buffer for potential and actual budget cuts and its problematic effects on the daily reality of healthcare professionals as well as the individuals receiving care.

Critical practice: the role of arts in computational culture

While numbers, datasets, and policies are generally intended for healthcare professionals and managers, the artwork reverses *who* is looking. The people whose data is being used to support and implement such policies, are now invited to see how they themselves are being looked upon through their data doubles. As such, the role of the artwork is to bridge the investigation we are carrying out into physical and tangible form of a printed book, to the people whose data the artwork is made from. The savings catalogue offers an opportunity for people to see one iteration of how their body is represented in data (in aggregate form), and the recurring cutting lines invites the person looking at the savings catalogue to critically think about the role of their data in larger context of the healthcare economy.

In the contextualisation of the project, it has been important to draw attention to the position of the work, which has emerged from researching the protocols, standards and transcoding processes, forms and other artefacts involved in the production of data. The resulting work is not a data visualisation in the traditional sense, but draws our attention to the backland of decisions made before any information is collected and can be seen as a way of pre-structuring, and pre-defining what can be seen, discovered, or known from the data after its collection. The artwork connects people to the uses and outcomes of their own data through a printed savings catalogue that was designed to exist in the daily spaces of antenatal clinics, rather than the gallery context. The work poses a question to the public: how might abstract algorithmic interactions allow the body to become indexed in new ways, so that the body's parts, behaviours and properties can be profiled and used in certain ways? While data-driven processes can have great impact in reducing care inequalities and variations, should people not be made more aware how their data is used to control or predict the future of their healthcare? Is it ethical to profile people based on their expensive smoking habit and/or cost-efficient breastfeeding? Is data being used to instigate behavioral changes, and what consequences might such initiatives have for public trust?

Artist methodologies can play a central role in giving tactile and visual form to such questions. If data are not a natural resource, but a *cultural* one, there is a need for developing visual strategies to examine the ways data is *cooked* in the process of collection and use, and shift the focus of visualisation to reveal how it is an expression of a structure that does not represent but rather shapes reality through its functions. Joanna Boehnert argues in her article *Data Visualisation Does Political Things:* "[d]ata reflects power relations, special interests and ideologies in terms of which data is collected, what data is used and how it is used" (2016, 2). The current discourse of big data introduces a set of debates that can help consider what kinds of changes could be on the drawing board for public healthcare as data management is increasingly taking a central role in the current changes in healthcare governance. It is within the scope of these definitions, that we can begin to contextualise our artistic experiments - developing an understanding of the processes behind the digitalisation of bodies, and their relationship to social and economic structures of domination.

Conclusion: Data-driven visibility

Looking at the role of art methodologies in exploring algorithmic and computational culture, the savings catalogue comes to serve as bridge between the complex and opaque processes of public health, and the public perception of data. At the moment, this relationship is impaired by quite a gap. The savings catalogue shows that very particular data-driven visibilities are constructed in such a way that certain bodies are targeted for cost-saving while others stay out of view. Equally, questions about the experience of such visibilities emerged, such as how do families experience such visibilities, assumptions or expectations? While some bodies and families appear to be targeted for cost-saving, others remain unseen and therefor untargeted, such as "standard" reproductive cis women with a UK or EU passport, living in a areas largely populated by people higher on the socio-economic scale. Moreover it is imaginable that a third group is inadequately accounted for in underlying classification systems (if at all), such as people who do not fit the gender binary and differently abled people, or people with multiple partners. Can we assume that the maternity databases are constructed in a way that can also guarantee to help provide fitting care for these people who might fall outside the parameters made measurable by design?

The artistic research has evidently produced more questions than answers, while at the same time carving out a place from where to begin to understand the kind of vision of the reproductive body that is constructed in data-driven healthcare governance. The use of investigatory methods to gain an understanding of how databases are constructed, where the data comes from, and what it is used for, has been crucial for situating the research and artistic response not on perceived values of the role of big data in healthcare, but amongst the actual agents, material processes, and policies influencing the directions of maternity care. *The National Catalogue Of Savings Opportunities. Maternity, Volume 1: London* (2017) is our response to the necessity of developing reflective artistic practices of visualising that do not represent data themselves alone, but also the context of their production. It is an example of our quest to find means and methods to make visible how seemingly neutral and abstract data in fact always remain highly contextual, ever-entangled with healthcare politics and pregnant individuals, their interactions with healthcare staff, the artefacts used in these interactions and how such data lives beyond the maternity ward and back.

In the midst of universalising claims of big data, maternity metrics turned out to be produced through messy processes of urine and blood tests, belly measures, handwritten journals, costing pathways, care predictions, proxies, coding processes, and policies webbed together in a complex network of actors around the pregnant body. Data captures play a central role in the construction of new managerial processes and economic models used to cost behaviours, lifestyles, and body types and according care based on speculative predictions, rather than actual price following the conclusion of care. The theoretical work outlined above has been instrumental in developing feminist methods of visualising that reveal ways in which maternity healthcare is increasingly affected by data-driven processes and logics, while at the same time allowing the producers of such data to reflect on the kind of decision-making their data affords. By bringing our art-based research into the maternity clinic, we want to connect people with the outcome of their data, and encourage a broader public debate about their usages. On a more personal level, we explored the technical processes of ‘othering’ which are happening during pregnancy, and question how and why these data-based telescopes are used to look into the reproductive body or structure its environment. It is a call for the laying out of what these machineries are doing - and who are making use of them.

Acknowledgements

Thank you to the kind midwives, consultants, and managers that took time to speak with us, and the mums and healthcare activists that have discussed this subject matter with us and shared their ideas and thoughts. Thank you to Saskia for support and for letting us know about Kruger’s work *Untitled (We Won’t Play Nature to Your Culture)* (1983). We also want to thank The Common House for hosting our workshop and all the participants for their willingness to go along with our ideas, and for their input and thoughts. And lastly, a big thank you to all colleagues and peers who gave us valuable feedback on our work.

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