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MATERIALISING DATA: GETTING TO GRIPS WITH SLIPPERY CONCEPTS.

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ABSTRACT | Data is ubiquitous in the 21st century, we voraciously create and consume it, and it can be the driver of innovation and the lens through which we view the world. But data is a slippery, shapeshifting material that can take a myriad of forms which makes it challenging to engage with in a critical manner. This paper explores how design can address the challenge of revealing complex and sometimes hidden relationships with data from the perspective of six individual pieces that have been created as part of two exhibitions. The first project entitled *There Be Dragons* commissioned five pieces from artists/designers that challenged them to represent data in a way that was meaningful to their lived experience of being a creative practitioner. The five responses sought to untangle personal relationships with data through the application of techniques such as interaction, storytelling, and wayfinding. The *Picture Your Poisons* piece was created by two of the authors and related to the previous work as it gave form to highly personalised data about cancer treatments through the medium of glass. The paper will reflect on the body of work from the perspectives of the authors as both active agents in shaping the first project and as creators of the second piece. The combination afforded insight into the production of creative work for public exhibition together with the requirements that exhibition places on this process. The subsequent interpretation has identified three emergent themes: performance and participation; rethinking value and representation – making data physical and explicit.

1. Introduction

In 2017 the Economist published an article claiming that, “The world’s most valuable resource is no longer oil, but data” (The Economist, 2017). In the years since then, a great deal has been written about the role that data is playing in shaping the world. In this paper, we look at this often daunting and intractable global topic on a smaller scale, through the lens of the lived experience of the creative practitioner. In this paper, we present reflections on two examples of creative projects that dealt with this topic, and the process of producing them. The first was an exhibition presenting five works; *There be Dragons: Navigating the uncharted data territories of creative practice*. The second is a work titled *Picture Your Poisons*, an artistic project that aims to make scientific and medical data more accessible and impactful to the public. This work was exhibited as part of a larger exhibition. The paper considers themes emerging from these creative works, and we reflect on the development and curation of creative exhibitions as a research method.

2. The Exhibition Contexts

2.1 The Backdrop of Creative Informatics

Creative Informatics was an ambitious research and development programme based in Edinburgh, aiming to bring the city’s world-class creative industries and technology sector together, providing funding and development opportunities that enabled creative individuals and organisations to explore how data can be used to drive ground-breaking new products, businesses and experiences. Creative Informatics nurtured local talent through five key funding programmes and regular events that supported Edinburgh’s creative industries to do inspiring things with data. One of these funding programmes had the aim of bringing academics and industry together in order to break new ground and establish how technology could benefit the creative industries in the future. It was under this initiative that the *There be Dragons* work was produced. The other project discussed was a collaboration between two of the researchers working on the Creative Informatics programme.

Whether implicit or explicit, data plays a role in the work of creative practitioners and artists. From a commercial perspective, even the smallest creative enterprise can benefit from knowing more about their customers, stakeholders and audiences and about wider trends that could influence their future planning. Data comes in many forms, whether it is generated from within the creative practice itself or alternatively whether it comes from an external source. For example, data is collected about creative practices and individuals for use by other agencies, such as to inform government policy and to develop strategies to support creative practice at a wider level. In considering the value produced by data, Speed & Oberlander (2016) assert that creative practitioners can design from, with and by data. For example, design *from* data might use measurable data that can be processed to make it useful; *with* data could involve making use of live data streams or feedback to create interactive designs; and *by* data involves a situation where data itself, supported by an algorithm, will become a designer. Bound up in such an entanglement of the uses of data and the value it may or may not generate, is the question of how data impacts on the lived experience, and the identity, of being a creative practitioner. The mechanism of exhibition was chosen as a catalyst for exploring these issues, foregrounding the experience of being a working practitioner.

2.2 Exhibition as Research Method

As researchers, we had three main aims with the development of these exhibition works. Firstly we wanted to investigate how creative and artistic practitioners understand and articulate the role that data – a complex and multi-faceted concept – plays in their working lives. Secondly, we were interested in design methods and approaches around co-creation, curation and collaborative exhibition design. Thirdly, the projects acted as public engagement activities, aimed at both the general public, and also a particular set of stakeholders. In this latter case, the works acted as stimulation and provocation to inform further

research investigations into the role of data-driven technologies and the challenges of accessing and using data for creative industry participants of all scales, especially small businesses, freelancers and individual practitioners. In this paper we mainly focus on reflections on the first two of these aims.

There Be Dragons: Navigating the uncharted data territories of creative practice was funded directly by the Creative Informatics project. It focused on the form and nature of data and specifically addressed the question of how data might best represent the lived experience of creative practitioners. A brief was set by the authors, and five creative practices were selected after a review process to develop their submitted concepts to be part of the final exhibition. The brief was intentionally open and encouraged respondents to

imagine future possibilities for data as well as considering how it exists today. To support this approach practitioners took part in a series of workshops, run by the authors over the six-month development period. To further coordinate the development of the individual pieces and to ensure the overall coherence of the exhibition, a curator from New Media Scotland, an agency fostering artist and audience engagement with all forms of new media practice, was appointed. The curator provided an important point of contact for the practitioners and – critically – was independent of the authors.

The second event was the centenary exhibition of Visual Arts Scotland at the Royal Scottish Academy in Edinburgh. As part of the larger exhibition, the work entitled *Picture Your Poisons* was created by two of the authors and sought to make visible the normally hidden data associated with a medical procedure.

All six pieces created an opportunity to both engage with and reflect on the nature of data through the creation of physical artefacts and the process of making (Huron et al, 2023). In the first instance, the authors were engaged throughout the production process and worked with the individual creatives as they developed their ideas from initial concepts to a final exhibition piece. In the second instance, it was two of the authors who produced the work for the exhibition. These roles provided a unique insight into the role and representation of data during the production process and how audiences responded to the final exhibition pieces.

3. There Be Dragons: Navigating the Uncharted Data Territories of Creative Practice

The motivation of the *There Be Dragons* project was to critically reflect on the types of data that practitioners considered to best represent their experiences of producing creative output. These individuals and groups were attempting to wrangle the disruption of the digital shift, with its increased pressure to continuously acquire new technical skills, and to build upon existing proficiencies for creative production, collaboration, innovation and dissemination (Helgason et al, 2023).

Up to this point much of the data used to describe what is referred to as the creative industries has been at a systemic level. For example, in the Spring budget of 2023, the UK Chancellor declared that the creative industries were a growth industry. This served as recognition that the sector had generated over £100 billion in revenue, representing over 10% of the UK economy and providing 2.29 million creative industry jobs. But behind these statistics lie real people, producing creative output in times of undoubted challenge. The aim of the *There Be Dragons* project was to explore how creative practitioners saw themselves and what data they considered to best reflect their own lived experience. The approach complemented the human-centred approach of the Coast to Coast project (Smyth & Delaney, 2023), also undertaken as part of Creative Informatics which conducted a visual and textual study of creative practice that focused on individual practitioners in Scotland and Northern Ireland.

The work reported in this paper contributes to the overarching goal of giving a voice to practitioners in terms of how they identify as creatives while acknowledging that it is a very personal and contextual endeavour that is set against a backdrop of the seemingly continuous shifting sands of economic and social change.

The *There Be Dragons* project started from the premise that data can empower creative businesses to do more and to do it better. Data can be used *for* creative practice, *with* creative practice, and to tell us *about* creative practice. However, coping with data is not a simple or straightforward activity. It has to be collected, analysed, visualised, understood and communicated (Sanches et al 2022). There are ethical and privacy issues to consider. The project aimed to investigate and untangle some of these messy issues in order to build a more representative picture of the role that data plays in the life of the creative practitioner. A key objective was that the project should speak to and for the creative community, so it was critical to harness the creative and artistic skills of the community itself in a collaborative design and exploration process.

As a source of inspiration, the artists were encouraged to consider future scenarios or “imaginaries” as a method to speculate about data. This technique gave permission to decouple from many of the practical issues associated with data and to give a freedom to their imagination as they explored the relationship between data and creative practice. It was hoped that this approach could reveal insights for further discourse and create outputs that would engage a wider public audience in an accessible way. The result was that each of the artists’ responses provided an insight to their complex and sometimes very personal relationships with data and how it was seen to reflect their practice.

3.1 The Exhibition Pieces

The five works that comprised the *There Be Dragons* exhibition are described in the following section.

When Do You Give Yourself Away? by Theodore Koterwas

The motivation of this work was to examine aspects of daily experience that often go unnoticed, with a particular focus on data as it relates to the body. The installation took the form of a large screen that displayed coloured patterns and shapes that responded to the pulse and galvanic skin response of people who placed their hands on two pads of medical gel that were attached to the screen (Figure 1).

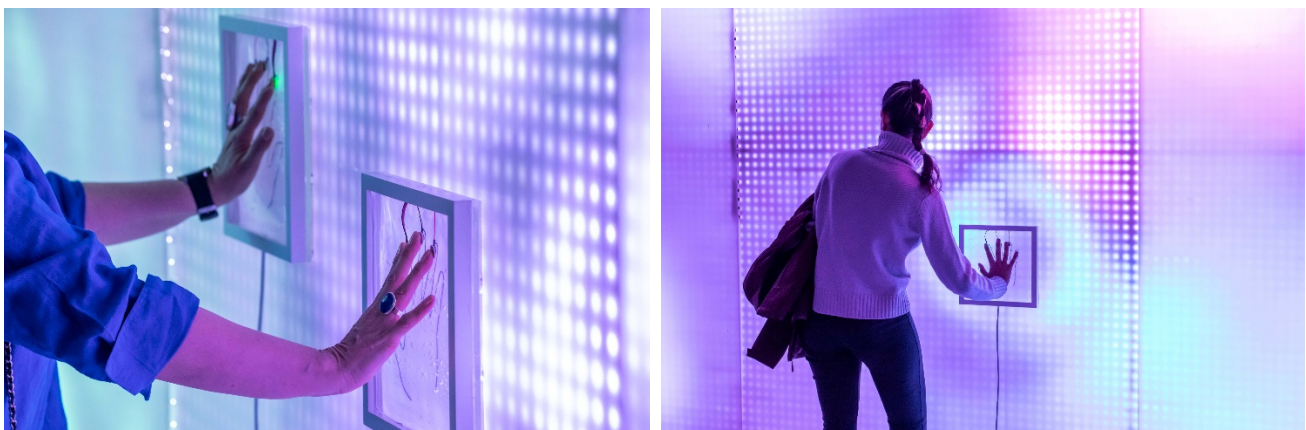


Figure 1. When Do You Give Yourself Away?

By physically engaging with the work, the artist wanted to explore the idea of “giving away” data and how the normally hidden physiological data could be reimagined as a public performance. The experience was further enhanced through floor-based speakers that literally shook the ground beneath the feet of participants.

The overall effect was that intimate personal data coming from the body was being magnified and displayed in full view. The piece sought to explore how personal data might be externalised and, if personally identifiable, what this might mean for data that is more intimate and internal.

Doing Data by Elke Finkenaue

This response took the form of experimental sculptures that used strategies inspired by data analysis to create physical forms that explored parallels between the worlds of making and data (Figure 2). In essence, the work was a metaphor for data gaps and ways to handle what slips between the cracks of data analysis.



Figure 2. Doing Data sculptures.

Inspired by the idea of data that gets left out or ignored, the practitioner created a database of materials from her studio. One of the categories was “material scraps,” from which items were selected to create a series of configurable sculptures. The processes and materials were documented in infographic sheets as part of the exhibit (Figure 3). At the core of the work was an exploration of tension between data-driven systems and structures, and things that don’t fit.

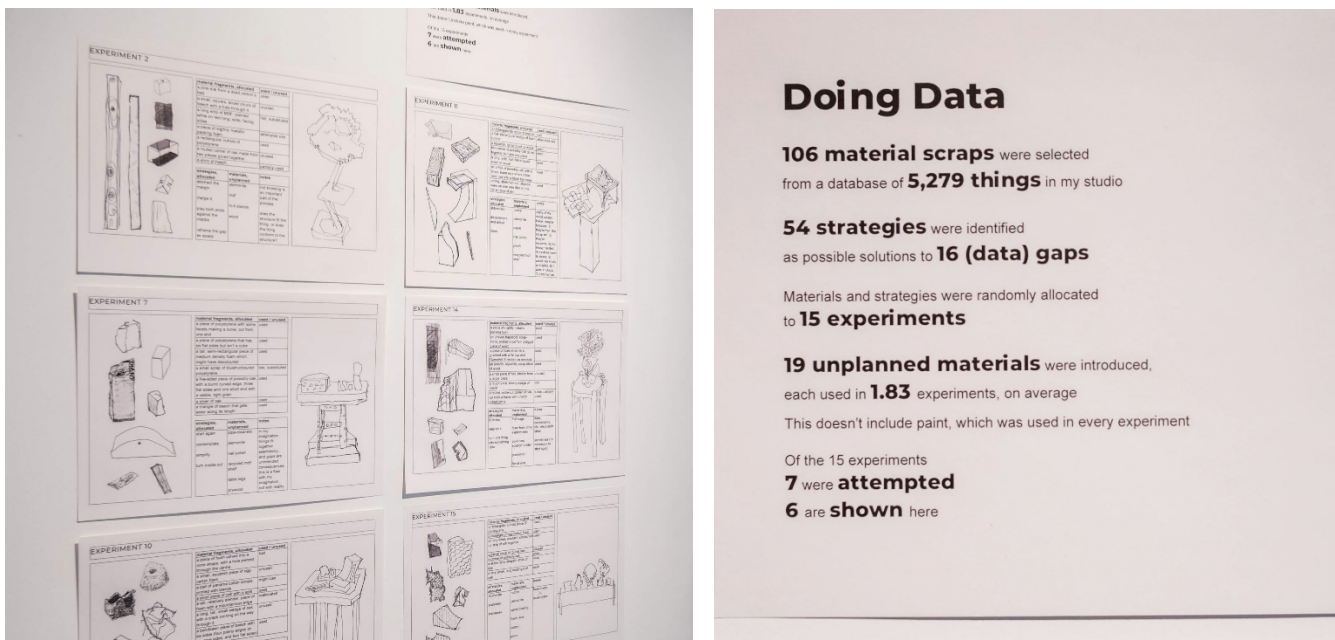


Figure 3. Doing Data Infographic sheet.

Privacy Wizards or Data Thieves? by More Fun With Games, in partnership with Ray Interactive, Cameron Hall and Two Rats Press

Through the use of an interactive walking adventure, this piece explored the idea of personal data and how much participants were willing to reveal of themselves to discover new information. Based on the premise of a “shadow self” that was created by a person’s online presence, the setup of the game assigned participants to a character class, either Privacy Wizards – people with relatively data-secure habits – Everyday Rangers in the middle, or Data Thieves – people using services that might detect a lot of their data.

The set-up process engaged participants in a playful dialogue that encouraged them to provide personal information in order to take part in the walking game. This formed the basis of a later conversation about the unknown nature of data that is revealed during the typical sign-up process to a mobile app.



Figure 4. The walking game; Unveiled Edinburgh, part of Privacy Wizards or Data Thieves?

The walking game was called Unveiled Edinburgh (Figure 4) and required the players to engage with the local area, and discovering something, or see something familiar in a new way. Through participation, the piece sought to highlight how people use data to “feed” their digital shadow self, and through the provision of alternatives, the work encouraged discussion of data, privacy and manipulation, together with face-to-face social connection.

Enough is Enough by Amy Dunnachie, Lorna Brown, Lynne Hocking – on behalf of Applied Arts Scotland

This piece was a collaborative, participatory installation laid out on a tabletop grid of tasks and accompanying tactile tokens that were used to indicate specific activities and tasks that reflected the daily work of creative practitioners. The tasks were categories of creative work and revealed the broad range of possibilities associated with creative production. For example, research new materials, share skills, go for a walk, read for fun, do the tax return, meet clients or research exhibition venues (Figure 5).

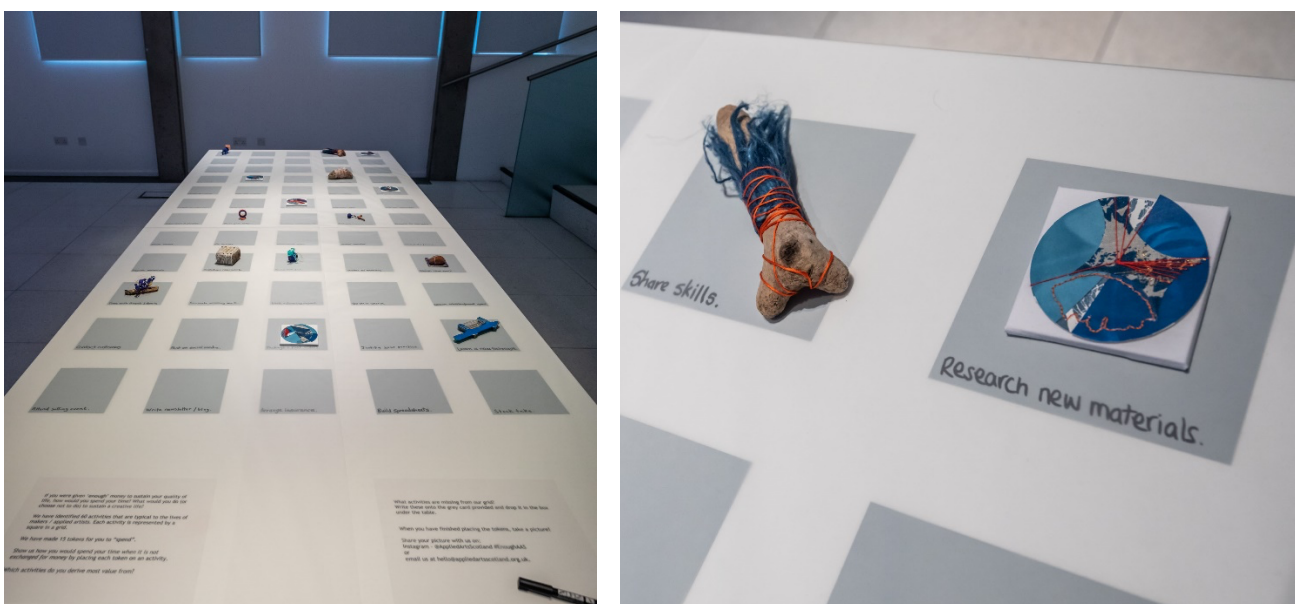


Figure 5. Enough is Enough.

Visitors could place the tokens on the grid of tasks, signalling their affinities and priorities, and creating a shifting picture of contemporary creative practice. The act of selecting categories also acted as an opening of discussion about creative work and livelihoods.

As well as giving a current snapshot of making practice, the installation invited people to think about how creative practice might be different. For example, if you didn't have to think about financial values or income streams, how would your creative choices change? What would be made? How would the values change?

People could add their own tasks and ideas to the grid, so it was also a way to gather data on other people's value systems around being a creative practitioner or running a creative business."

Cloud by Melanie Frances

The piece (Figure 6) was more abstract and consisted of a series of data fragments that revealed multiple narrative threads centering on the operation of a fictitious data cloud. The format acted as both a provocation and a metaphor for how data can mean different things to different people and can be read in different ways by different people. The work sought to find ways of exploring that diversity of viewpoint and the plural nature of data.



Figure 6. Cloud.

4. Picture Your Poisons by Inge Panneels and Caitlin McDonald

This work is distinguished from the previous exhibition pieces in that it was created by two of the authors blending their unique artistic backgrounds as a glassmaker and a mixed-media memoirist to represent unique, highly personalised data about one of the author/artist's cancer treatments. Their prior collaborations on *There Be Dragons* and its sister research project about data used in creative industries policymaking, *Detecting Dark Matter Data*, informed the artists' intentions to use historical medical data in the creation of *Picture Your Poisons*, as well as the subjective, experiential lens that naturally infuses all self-portraiture. The artwork was selected for display as part of a retrospective exhibition organised by Visual Arts Scotland, as well as displayed among works bridging the artificial divides between the arts and sciences in the Edinburgh Science Festival, the UK's largest science festival (Figure 7).

Picture Your Poisons presents an intimate portrait of a cancer treatment journey as experienced by one of the artists. Nearly 1 in 2 people born in the UK in 1961 will be diagnosed with some form of cancer during their lifetime (Cancer Research UK, n.d. a), including one in seven women with breast cancer (Cancer Research UK, n.d. b). The glass casts featured in *Picture Your Poisons* ground viewers in the real-world material origins of systemic anti-cancer treatments through the specific lens of one patient's course of treatment. Each of the six glass casts and one wax mould constituting the artwork represents the substance from which a type of cancer treatment was originally derived in nature, including mouse-derived immune

proteins, yew tree bark, soil bacteria discovered in Tuscany, the elements carbon and platinum, and radioactive energy. These treatments are usually discussed in a clinical context with reference to their bodily effects on the patient, leaving out the rich history of their discovery and development. By materialising each treatment, the casts allow viewers to explore data which is more usually presented in an abstract, clinical context through a striking visual medium that elicits an emotional as well as a cognitive response (Figure 7). The artwork encourages the viewer to explore aspects of the patient experience relating to bodily autonomy, selfhood, and dis/empowerment in medical contexts by confronting them with the disembodied partial body casts of the affected breast.

The difference between medicine and poison is largely one of dosage (Grandjean, 2016). Substances which in one context are deadly (and indeed, used as weapons, such as the mustard gas from which the chemotherapy cyclophosphamide is derived) are also life-saving. *Picture Your Poisons* explores this relationship using glass, a substance of many dualities: brittle yet strong, transparent or opaque, malleable yet firm. Glass is forged in a transformative process of great stresses on the raw materials, and similarly, cancer survivors endure treatments which radically transform their bodies in order to survive.



Figure 7. *Picture Your Poisons* (Photo by Caitlin McDonald).

5. Discussion and Reflection

5.1 The Question of Data

Data is ubiquitous in the 21st century, we voraciously create and consume it, it can be the driver of innovation and it can replicate the world through digital twinning (Ganguly & Venkatasubramanian, 2022). Data has become a lens through which we view and seek to understand reality. But data is a slippery, shapeshifting material that can take a myriad of forms which makes it challenging to engage with in a critical manner. It hides in plain sight but remains resistant to classification. The reality is that data is never neutral, it is always gathered by stakeholders, for a given purpose using specific tools. This illusion

regarding the neutrality of data has been referred to as the “commodity fiction” of data by Gitelman et al (2013). This idea has been further developed by Sanches et al (2022) who report on the growing body of design research that shows that data is neither immaterial, nor finished but is instead co-produced by many entangled factors including people, context and the sensors, analysis and display techniques employed. It was against this backdrop that the work reported here sought to shed light different forms of data and how that data might best reflect the eclectic nature of creative practice.

6. Emergent Themes

The *There Be Dragons* project offered the authors a particular insight into the production of creative work for public exhibition. The authors set the brief and selected the creative practitioners and while not producing the work themselves, the authors were at the centre of the process and were undoubtedly active agents in shaping the project. The introduction of a curator contributed to the overall coherence of the exhibition and alleviated some of the tensions over adherence to the brief that emerged during the various workshops. An independent writer was also employed in the second half of the production phase to interview each of the creatives in order to better understand their experience of being part of the project. The resulting publication was available during the exhibition (Horne et al, 2023).

While it is acknowledged that this does not constitute an exhaustive or indeed controlled environment, the insights gained from the *There Be Dragons* exhibition, in particular the representation of hidden data, went some way to informing the approach of the authors who created the *Picture Your Poisons* work.

Based on the authors’ interpretation, three main themes emerged from the work:

6.1 Theme: Performance and Participation

All of the work described previously was designed to be experienced in a public gallery or exhibition setting. As a way of attracting people, some of the pieces employed an explicitly performative style in terms of how they either represented data or encouraged people to interact with the data, or as a means to reveal hidden data and provoke further discussion.

For example, *When Do You Give Yourself Away?* used abstract colours and sound to represent physiological data that was harvested through physical gel pads which people touched. The abstract nature of the representation actively encouraged exploration through movement as people tried to apply meaning to the data. The performative nature of the work was a natural draw to visitors at the exhibition.

A different perspective on performance was provided by the *Enough is Enough* work. This piece was explicitly designed to be performative where individuals moved counters on a tabletop grid to prioritise the daily work of creative practitioners. The act of making these choices visible acted as a catalyst for discussion and encouraged participation.

Finally, the work entitled *Privacy Wizards or Data Thieves?* adopted a deliberately performative style by incorporating an interactive walking adventure to highlight issues around data privacy. Through the use of a facilitator/guide participants in the adventure were encouraged to discuss how much data about themselves they were willing to provide in order to discover something new by participating in the walk.

6.2 Theme: Rethinking Value

Data is about choices; making selections about what data is gathered and for what purpose, how, where and when it is gathered and by whom. The work of Sanches et al (2022) emphasises these complex entanglements around the gathering of data and builds on the growing body of design research that shows that data is neither immaterial, nor finished but is instead co-produced by many entangled factors

including people, context, and the particular sensors, analysis and display techniques employed. Each of these factors contributes to the value placed on data. This view of data draws from the concept of diffraction as presented by Barad (2007) which prioritises what is referred to as the “entanglement of the apparatus of production”.

The work entitled *Doing Data* explicitly interrogated the notion of value attributed to data by focusing on gaps in data, the forgotten or hard to reach data that becomes somehow devalued because of its inaccessibility. By explicitly documenting what was referred to as material scraps, the piece presented five configurable sculptures representing data that would have otherwise been lost. By reasserting the value of these materials, the work sought to demonstrate how the production of data is both a complex and multi-stakeholder endeavour.

6.3 Theme: Representation – making data physical and explicit

The ubiquitous nature of data makes it challenging to pin down and engage with in a critical manner. The approach taken in this paper has been to employ exhibition as a research method from which to explore methods of representing data and in particular how design can address the challenge of revealing the complex and sometimes hidden relationships with data through the making of physical artefacts.

For example, the piece entitled *When do you give yourself away?* translated normally hidden physiological data into abstract colours and sounds that created a performative experience in the exhibition setting. The *Enough is Enough* work encouraged the audience to engage in conversations as they prioritised a series of activities that reflected the daily work of creative practitioners, through locating tokens on a tabletop grid.

Cloud explored the multifaceted nature of data through the use of interconnected narrative fragments that revealed how different people might respond to the ever present nature of data in an imagined future. By exploring that diversity of viewpoint and the plural nature of data the work interrogated how data can mean different things to different people.

The most explicit representation of data that is normally hidden was illustrated in the *Picture Your Poisons* work which used the medium of glass to represent and make visible the treatment of breast cancer. The visualisation of a series of anti-cancer treatments through a series of glass casts and their concomitant labels which mimicked the safety data sheet enclosed in drug packaging, attempted to reveal data that more normally resides in a clinical context and thereby provoke both an emotional and cognitive response in the viewer.

7. Conclusion

This paper presents a description and discussion of two related exhibition projects, together comprising of six individual creative artworks, that addressed the relationship between data and creative practice. The authors’ roles in this process were varied; as instigators, curators, researchers, and as creative artists. From this range of perspectives the paper presents our interpretation of the themes that emerged from the exhibited works. It also argues that exhibition production can be a valid and fruitful design research method for interrogating intangible concepts that impact on lived experience. In this case, the act of creative making, and the demands of public exhibition, supported deep reflection on the meaning of data and how it relates to life as a creative practitioner.

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